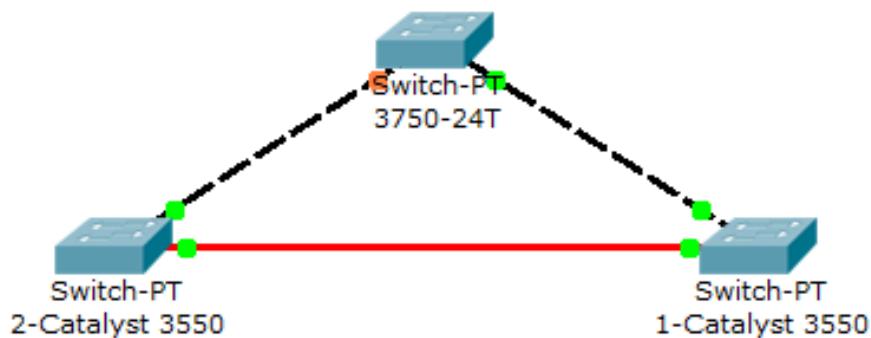


## Packet Tracer Hands-On Lab: Spanning Tree Protocol (STP)

### Objective:

- Understand what happens in a Layer 2 switching network without STP
- Observe issues such as loops, broadcast storms, and MAC flapping
- Enable STP (PVST+) and verify stable Layer 2 paths



### Devices Needed:

- 3 × Cisco 2960 Switches (S1, S2, S3)
- 2 × PCs (PC0, PC1)

### Connections:

PC0 → S1  
PC1 → S2  
S1 → S2  
S2 → S3  
S3 → S1

This forms a **Layer 2 loop (triangle topology)**.

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## ◆ PART 2 — Verify Behaviour WITHOUT STP

### STEP 1: Disable STP on All Switches

PVST+ runs automatically in Packet Tracer, so we must turn it off manually.

Run the following on **S1, S2, S3**:

```
S1(config)# no spanning-tree vlan 1  
S2(config)# no spanning-tree vlan 1  
S3(config)# no spanning-tree vlan 1
```

### STEP 2: Generate Traffic

1. Ping from **PC0 → PC1**
2. Try again after a few seconds

### EXPECTED BEHAVIOUR WITHOUT STP

- Broadcast Storm starts
- MAC addresses keep flapping
- PC0 and PC1 may not ping
- Switch CPU usage increases

### STEP 3: Observe MAC Table Instability

On any switch (example S1):

```
S1# show mac address-table
```

You will notice:

- Same MAC address appearing on **different ports repeatedly**
- The table rapidly updating — **MAC flapping**

This shows why STP is needed.

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## ◆ PART 3 — Enable STP & Observe Recovery

### STEP 1: Re-enable STP on All Switches

```
S1(config)# spanning-tree vlan 1  
S2(config)# spanning-tree vlan 1  
S3(config)# spanning-tree vlan 1
```

Packet Tracer defaults to **PVST+**.

#### STEP 2: Verify STP is Running

```
show spanning-tree
```

Check for:

- **Root Bridge**
- **Root Port**
- **Designated Ports**
- **Blocking/Alternate Ports**

The switch with the **lowest MAC address** becomes the **Root Bridge**.

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## ◆ PART 4 — Observe Loop Prevention

After 30–50 seconds (STP convergence):

- One of the redundant links will move to **blocking** state
- Broadcast storm will stop
- MAC table will stabilize
- Pings succeed normally

#### Verify Blocked Ports

Use:

```
show spanning-tree interface
```

Or:

```
show spanning-tree vlan 1
```

Look for:

- **Forwarding ports**
  - **Blocking ports**
-

## PART 5 — Optional Enhancement: Manipulate Root Bridge

You can make **S1 the Root Bridge**:

```
S1(config)# spanning-tree vlan 1 priority 4096
```

Verify:

```
show spanning-tree
```

Expected:

- S1 becomes the root
  - Other switches choose their Root Ports correctly
- 

## PART 6 — Optional: Fast-STP (RSTP)

Enable Rapid Spanning Tree:

```
S1(config)# spanning-tree mode rapid-pvst
S2(config)# spanning-tree mode rapid-pvst
S3(config)# spanning-tree mode rapid-pvst
```

Observe **faster convergence** (< 5 seconds).

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## ✓ END RESULTS

Scenario	Expected Outcome
<b>Without STP</b>	Broadcast storm, MAC flapping, pings fail
<b>With STP (PVST+)</b>	One port blocks, network becomes stable
<b>With RSTP</b>	Even faster convergence