Spanning Tree Protocol (STP) Workbook

A Hands-On Guide to PVST+, RSTP, and MSTP

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Contents

Chapter 1

VTP (VLAN Trunking Protocol) Tutorial

1.1 Introduction to VTP

1.1.1 What is VTP?

VTP (VLAN Trunking Protocol) is a Cisco proprietary protocol that manages VLAN configurations across multiple switches in a network. It allows for:

- **Centralized VLAN Management** – VLANs created on one switch (VTP Server) propagate to other switches (VTP Clients).

- **Consistency** – Ensures VLAN information remains synchronized across switches.

- **Reduced Configuration Errors** – Prevents VLAN mismatches.

- **Efficient VLAN Management** – Reduces administrative overhead.

1.1.2 Network Topology Overview

This tutorial follows the given network topology:

- **Three Switches**: Switch 1, Switch 2, Switch 3

- **Nine PCs connected to VLANs**:
    - VLAN 10: PC1 (Switch 1), PC2 (Switch 2), PC3 (Switch 3)
    - VLAN 20: PC4 (Switch 1), PC5 (Switch 2), PC6 (Switch 3)
    - VLAN 30: PC7 (Switch 1), PC8 (Switch 2), PC9 (Switch 3)

- **Switch Connections**:
    - Switch 1 connected to Switch 2
    - Switch 2 connected to Switch 3

1.2 VTP Modes

Cisco switches support three VTP modes:
For our topology:

- **Switch 1 is the VTP Server**.
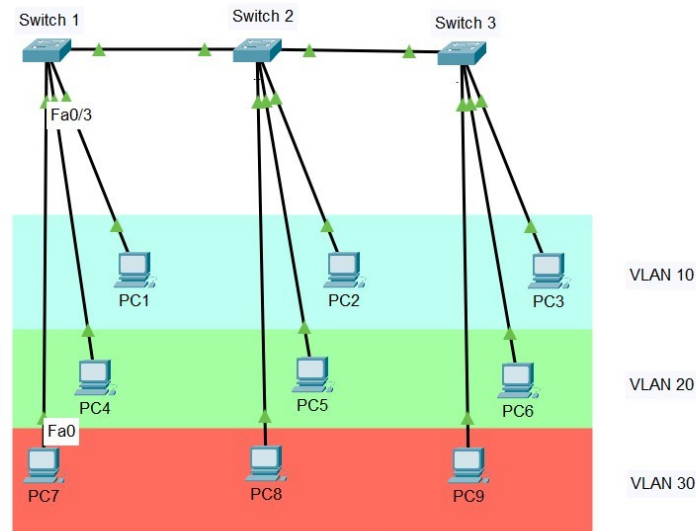
- **Switch 2 and Switch 3 are VTP Clients**.

Figure 1.1: *Network topology created using the Packet Tracer Simulator.*

Mode	Description
Server	Creates, modifies, and deletes VLANs. Sends VTP updates.
Client	Receives and synchronizes VLANs from the VTP server. Cannot create VLANs.
Transparent	Does not participate in VTP updates but forwards them. Can create local VLANs.

Table 1.1: VTP Modes in Cisco Switches

1.3 Configuring VTP

1.3.1 Step 1: Configure VTP on Switch 1 (Server Mode)

Set the VTP domain name, enable server mode, set a password, and enable version 2.

```
Switch1(config)# vtp domain NetworkingLab
Switch1(config)# vtp mode server
Switch1(config)# vtp password cisco123
Switch1(config)# vtp version 2
```

1.3.2 Step 2: Configure VTP on Switch 2 and Switch 3 (Client Mode)

```
Switch2(config)# vtp domain NetworkingLab
Switch2(config)# vtp mode client
Switch2(config)# vtp password cisco123
Switch2(config)# vtp version 2

Switch3(config)# vtp domain NetworkingLab
Switch3(config)# vtp mode client
Switch3(config)# vtp password cisco123
Switch3(config)# vtp version 2
```

1.3.3 Step 3: Verify VTP Configuration

```
Switch1# show vtp status
Switch2# show vtp status
Switch3# show vtp status
```

1.4 VTP VLAN Management

1.4.1 Step 4: Create VLANs on Switch 1 (VTP Server Mode)

```
Switch1(config)# vlan 10
Switch1(config-vlan)# name VLAN10
Switch1(config)# vlan 20
Switch1(config-vlan)# name VLAN20
Switch1(config)# vlan 30
Switch1(config-vlan)# name VLAN30
```

1.4.2 Step 5: Verify VLAN Propagation

```
Switch2# show vlan brief
Switch3# show vlan brief
```

1.5 Assigning VLANs to Interfaces

1.5.1 Step 6: Assign VLANs to PCs

```
Switch1(config)# interface fa0/3
Switch1(config-if)# switchport mode access
Switch1(config-if)# switchport access vlan 10

Switch2(config)# interface fa0/3
Switch2(config-if)# switchport mode access
Switch2(config-if)# switchport access vlan 10

Switch3(config)# interface fa0/3
Switch3(config-if)# switchport mode access
Switch3(config-if)# switchport access vlan 10
```

1.6 VTP Troubleshooting

1.6.1 Checking and Resetting VTP

```
Switch1# show vtp status
Switch3# vtp mode transparent
Switch3# vtp mode client
Switch2(config)# debug sw-vlan vtp events
```

1.7   VTP Pruning

1.7.1   Enabling VTP Pruning

```
Switch1(config)# vtp pruning
```

Verify pruning:

```
Switch1# show vtp status
```

1.8   Summary

- VTP allows automatic VLAN propagation in a network.

- Switch 1 (VTP Server) manages VLANs, while Switch 2 and 3 (Clients) receive updates.

- VLANs should be created on the VTP Server.

- Use trunk links between switches for VLAN traffic.

- VTP Pruning helps optimize VLAN traffic.

Chapter 2

Exercises (Practice Section)

2.1　Basic VTP Configuration Exercises

1. Configure **Switch 1** as the **VTP server** for the domain "`NetworkingLab`" with password "`cisco123`".

2. Configure **Switch 2** and **Switch 3** as **VTP clients** in the "`NetworkingLab`" domain with password "`cisco123`".

3. Change **Switch 3** to **VTP transparent mode** while keeping it in the "`NetworkingLab`" domain.

4. Set **VTP version 2** on all switches.

5. Configure **Switch 2** with a **VTP pruning feature enabled**.

6. Reset the **VTP configuration** on **Switch 1** to default.

7. Change the **VTP domain name** from "`NetworkingLab`" to "`CiscoNet`" on **Switch 1**.

8. Verify the **VTP configuration** on **Switch 3**.

9. Disable **VTP pruning** on **Switch 2**.

10. Check the **VTP mode** of **Switch 3**.

2.2 VTP and VLAN Management Exercises

1. Create VLAN 10, VLAN 20, and VLAN 30 on **Switch 1** in **VTP Server mode**.

2. Assign **PC1, PC2, and PC3** to **VLAN 10** on their respective switches.

3. Assign **PC4, PC5, and PC6** to **VLAN 20** on their respective switches.

4. Assign **PC7, PC8, and PC9** to **VLAN 30** on their respective switches.

5. Verify if **VLAN 10, VLAN 20, and VLAN 30** are properly propagated to **Switch 2** and **Switch 3**.

6. Remove **VLAN 30** from **Switch 1** and observe if the deletion propagates to other switches.

7. Add a new **VLAN 40** to **Switch 1** and check if it appears in **Switch 2 and Switch 3**.

8. Change the name of **VLAN 20** to "StudentNetwork" on **Switch 1** and verify if it propagates.

9. Delete **VLAN 10** on **Switch 1** and check if it is removed from **Switch 2 and Switch 3**.

10. On **Switch 2**, verify if **VTP pruning** is active.

2.3 Troubleshooting and Debugging VTP Exercises

1. The VLANs are not propagating to **Switch 3**. Verify the **VTP domain name**.

2. **Switch 3** is in **transparent mode**, but VLANs are not being updated. Change it to **client mode**.

3. Verify the **VTP revision number** on **Switch 2**.

4. Check the **VTP configuration revision number** mismatch issue on **Switch 1**.

5. Show the **VTP password** on **Switch 3**.

6. The **VLAN database is not updating** on **Switch 2**. Check and reset the VTP configuration.

7. Debug and display **VTP updates** on **Switch 1**.

8. Restore the default **VTP mode** on **Switch 3**.

9. Force **Switch 1** to send **VTP updates** manually.

10. Change **Switch 2** to **VTP off mode** to prevent VLAN propagation.

Chapter 3

Answer Key (Solutions Section)

3.1   Basic VTP Configuration Answers

1. **Configure Switch 1 as the VTP server:**

```
Switch1(config)# vtp domain NetworkingLab
Switch1(config)# vtp mode server
Switch1(config)# vtp password cisco123
```

2. **Configure Switch 2 and Switch 3 as VTP clients:**

```
Switch2(config)# vtp domain NetworkingLab
Switch2(config)# vtp mode client
Switch2(config)# vtp password cisco123

Switch3(config)# vtp domain NetworkingLab
Switch3(config)# vtp mode client
Switch3(config)# vtp password cisco123
```

3. **Change Switch 3 to VTP Transparent mode:**

```
Switch3(config)# vtp mode transparent
```

4. **Set VTP version 2 on all switches:**

```
Switch1(config)# vtp version 2
Switch2(config)# vtp version 2
Switch3(config)# vtp version 2
```

5. **Enable VTP pruning on Switch 2:**

```
Switch2(config)# vtp pruning
```

6. **Reset VTP configuration on Switch 1:**

```
Switch1(config)# vtp mode transparent
Switch1(config)# vtp mode server
```

7. **Change the VTP domain name from "NetworkingLab" to "CiscoNet" on Switch 1:**

```
Switch1(config)# vtp domain CiscoNet
```

8. **Verify VTP configuration on Switch 3:**

```
Switch3# show vtp status
```

9. **Disable VTP pruning on Switch 2:**

```
Switch2(config)# no vtp pruning
```

10. **Check VTP mode of Switch 3:**

```
Switch3# show vtp status
```

3.2   VTP and VLAN Management Answers

1. **Create VLAN 10, VLAN 20, and VLAN 30 on Switch 1 (VTP Server Mode):**

```
Switch1(config)# vlan 10
Switch1(config-vlan)# name VLAN10
Switch1(config)# vlan 20
Switch1(config-vlan)# name VLAN20
Switch1(config)# vlan 30
Switch1(config-vlan)# name VLAN30
```

2. **Assign PC1, PC2, and PC3 to VLAN 10 on their respective switches:**

```
Switch1(config)# interface fa0/3
Switch1(config-if)# switchport mode access
Switch1(config-if)# switchport access vlan 10

Switch2(config)# interface fa0/3
Switch2(config-if)# switchport mode access
Switch2(config-if)# switchport access vlan 10

Switch3(config)# interface fa0/3
Switch3(config-if)# switchport mode access
Switch3(config-if)# switchport access vlan 10
```

3. **Assign PC4, PC5, and PC6 to VLAN 20 on their respective switches:**

```
Switch1(config)# interface fa0/4
Switch1(config-if)# switchport mode access
Switch1(config-if)# switchport access vlan 20

Switch2(config)# interface fa0/4
Switch2(config-if)# switchport mode access
Switch2(config-if)# switchport access vlan 20

Switch3(config)# interface fa0/4
Switch3(config-if)# switchport mode access
Switch3(config-if)# switchport access vlan 20
```

4. **Assign PC7, PC8, and PC9 to VLAN 30 on their respective switches:**

```
      Switch1(config)# interface fa0/5
      Switch1(config-if)# switchport mode access
      Switch1(config-if)# switchport access vlan 30

      Switch2(config)# interface fa0/5
      Switch2(config-if)# switchport mode access
      Switch2(config-if)# switchport access vlan 30

      Switch3(config)# interface fa0/5
      Switch3(config-if)# switchport mode access
      Switch3(config-if)# switchport access vlan 30
```

5. **Verify if VLAN 10, 20, and 30 are properly propagated to Switch 2 and Switch 3:**

```
      Switch2# show vlan brief
      Switch3# show vlan brief
```

6. **Remove VLAN 30 from Switch 1 and verify propagation:**

```
      Switch1(config)# no vlan 30
```

7. **Add VLAN 40 to Switch 1 and verify propagation:**

```
      Switch1(config)# vlan 40
      Switch1(config-vlan)# name VLAN40
```

8. **Change the name of VLAN 20 to "StudentNetwork" on Switch 1 and verify propagation:**

```
      Switch1(config)# vlan 20
      Switch1(config-vlan)# name StudentNetwork
```

9. **Delete VLAN 10 from Switch 1 and check if it is removed from Switch 2 and Switch 3:**

```
      Switch1(config)# no vlan 10
```

10. **On Switch 2, verify if VTP pruning is active:**

```
      Switch2# show vtp status
```

3.3 Troubleshooting and Debugging VTP Answers

1. **The VLANs are not propagating to Switch 3. Verify the VTP domain name:**

```
      Switch3# show vtp status
```

2. **Switch 3 is in transparent mode, but VLANs are not being updated. Change it to client mode:**

```
      Switch3(config)# vtp mode client
```

3. **Verify the VTP revision number on Switch 2:**

```
Switch2# show vtp status
```

4. **Check for VTP configuration revision number mismatch on Switch 1:**

```
Switch1# show vtp status
```

5. **Show the VTP password on Switch 3:**

```
Switch3# show vtp password
```

6. **The VLAN database is not updating on Switch 2. Check and reset the VTP configuration:**

```
Switch2(config)# vtp mode transparent
Switch2(config)# vtp mode client
```

7. **Debug and display VTP updates on Switch 1:**

```
Switch1# debug sw-vlan vtp events
```

8. **Restore the default VTP mode on Switch 3:**

```
Switch3(config)# vtp mode server
```

9. **Force Switch 1 to send VTP updates manually:**

```
Switch1(config)# vtp mode transparent
Switch1(config)# vtp mode server
```

10. **Change Switch 2 to VTP off mode to prevent VLAN propagation:**

```
Switch2(config)# vtp mode off
```