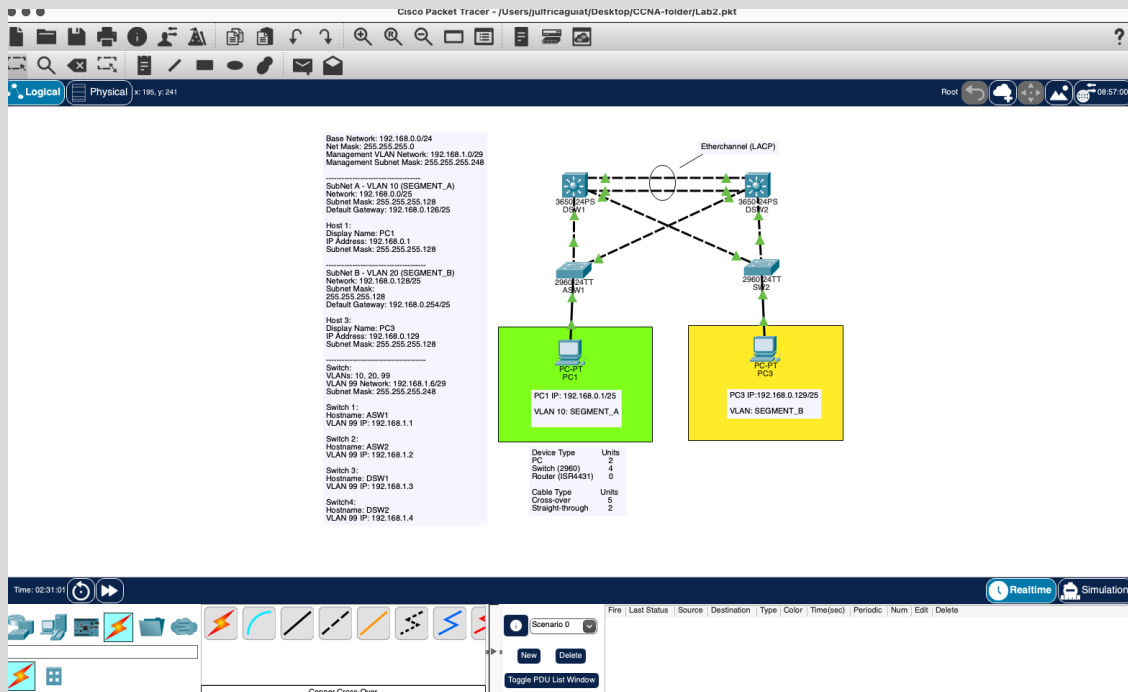


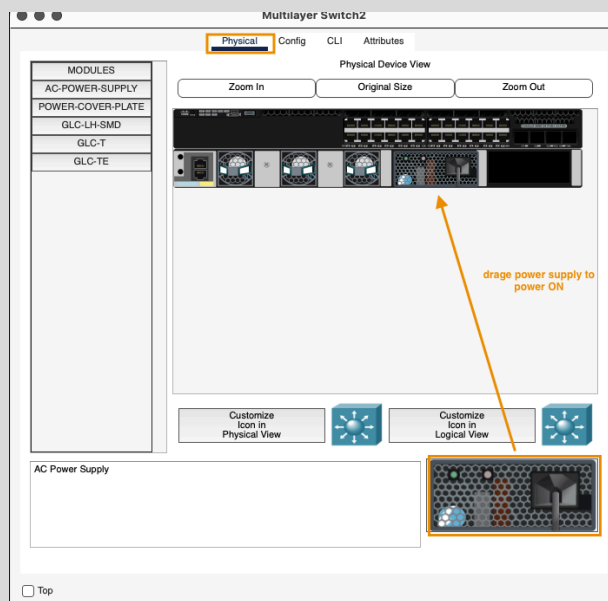
Lab 2: EtherChannel, VTP, and Spanning Tree Protocol (STP) Implementation

This lab focuses on implementing **EtherChannel (LACP)** for link aggregation and redundancy, centralizing VLAN management using **VTP**, and controlling Layer 2 loop prevention with **Rapid PVST+ Spanning Tree Protocol**. This lab builds on the previous VLAN and trunking setup by introducing switch hierarchy (Distribution and Access layers), **STP root bridge tuning**, and edge-port protections such as **PortFast**, **BPDU Guard**, and **disabling unused ports** to improve stability, resilience, and security.

Network Topology:



Powering On Devices: Multi-Layer Switch



Network Addressing Plan (Subnetting):

Overall Network:

<u>Parameter</u>	<u>Value</u>
Base Network	192.168.0.0/24
Subnet Mask	255.255.255.0
Management VLAN Network	192.168.1.0/29
Management Subnet Mask	255.255.255.248

Subnet A – VLAN 10 (SEGMENT_A)

<u>Parameter</u>	<u>Host 1 (PC1)</u>
IP Address	192.168.0.1
Subnet Mask	255.255.255.128
Default Gateway	192.168.0.126
VLAN	10
Network	192.168.0.0/25

Subnet B – VLAN 20 (SEGMENT_B)

<u>Parameter</u>	<u>Host 3 (PC3)</u>
IP Address	192.168.0.129
Subnet Mask	255.255.255.128
Default Gateway	192.168.0.254
VLAN	20
Network	192.168.0.128/25

Switch 1 – ASW1

<u>Parameter</u>	<u>Value</u>
Hostname	ASW1
VLANs	10, 20, 99
SVI VLAN 99 IP Address	192.168.1.1 /29
Default Gateway	192.168.1.6

Switch 2 – ASW2

<u>Parameter</u>	<u>Value</u>
Hostname	ASW2
VLANs	10, 20, 99
SVI VLAN 99 IP	192.168.1.2 /29
Default Gateway	192.168.1.6

Switch 3 – DSW1

<u>Parameter</u>	<u>Value</u>
Hostname	DSW1
VLANs	10, 20, 99
SVI VLAN 99 IP	192.168.1.3 /29
Default Gateway	192.168.1.6

Switch 4 – DSW2

<u>Parameter</u>	<u>Value</u>
Hostname	DSW2
VLANs	10, 20, 99
SVI VLAN 99 IP	192.168.1.4 /29
Default Gateway	192.168.1.6

Initial Switch Setup (refer to Lab1): Optional

- Configure hostnames
- Set system clock
- Configure NTP for time synchronization
- Secure device access (console & VTY)
- Save configurations

VLAN Creation (Centralized on DSW1 – VTP Server)

- Create user VLANs and management VLAN
- Assign VLAN names

on DSW1:

! Configure VTP Server

```
vtp mode server
vtp domain jcagLab
vtp version 2
```

! Create VLANs

```
vlan 10
    name SEGMENT_A
    exit
vlan 20
    name SEGMENT_B
    exit
vlan 99
    name MGMT
    exit
```

! Configure DSW2, ASW1, ASW2 to operate as VTP clients

```
vtp mode client
```

EtherChannel Configuration (DSW1 and DSW2 port-channel link)

- Bundle parallel trunk links
- Use LACP (mode active)
- Configure Port-Channel as trunk

on DSW1 & DSW2:

! Configure physical interfaces for DSW channel

```
interface range gigabitEthernet1/0/3 - 4
    channel-group 1 mode active
    exit
```

! Configure Port-Channel interface for DSW channel

```
interface po1
    sw trunk encapsulation dot1q
    sw mode trunk
    sw trunk native vlan 1000
    sw trunk allowed vlan 10,20,99
    exit
```

Manual Trunking + DTP Disabled (DSWs and trunk links)

- Configure trunk links between switches
- Set non-default native VLAN
- Disable DTP negotiation

On DSW1 & DSW2:

! Configure physical interface

```
int range g1/0/1-2
  sw mode trunk
  sw nonegotiate
  sw trunk native vlan 1000
  sw trunk allowed vlan 10,20,99
exit
```

on ASW1 & ASW2:

! Configure physical interfaces

```
int range g0/1 - 2
  switchport mode trunk
  switchport nonegotiate
  switchport trunk native vlan 1000
  switchport trunk allowed vlan 10,20,99
exit
```

Spanning Tree Protocol (Rapid PVST+)

- Enable Rapid PVST+
- Manually define root bridge roles per VLAN

! Enable Rapid PVST+

```
spanning-tree mode rapid-pvst
```

! Root bridge configuration (DSW1)

```
spanning-tree vlan 10,99 root primary
spanning-tree vlan 20 root secondary
```

! Root bridge configuration (DSW2)

```
spanning-tree vlan 20 root primary
spanning-tree vlan 10,99 root secondary
```

Management VLAN (SVI Configuration)

- Configure management SVI on each switch
- Assign IP addresses from VLAN 99 subnet
- Set default gateway

on DSW1:

! Configure management SVI

```
interface vlan 99
  ip address 192.168.1.1 255.255.255.248
  no shutdown
exit
```

! Set default gateway

```
ip default-gateway 192.168.1.6
```

! Configure DSW2, ASW1, ASW2 - Increment IP addresses on ASW2, DSW1, DSW2:

ASW2 = ip address 192.168.1.2 255.255.255.248

DSW1 = ip address 192.168.1.3 255.255.255.248

DSW2 = ip address 192.168.1.4 255.255.255.248

Access Port Configuration (End Devices)

- Assign access ports to VLANs
- Enable PortFast and BPDU Guard! Configure access port

on ASW1 & ASW2:

! Configure access port

```
interface f0/1
```

```
    switchport mode access
```

```
    switchport access vlan 10    → change to switchport access vlan 20 on ASW2
```

```
    spanning-tree portfast
```

```
    spanning-tree bpduguard enable
```

! Shutdown unused ports

```
int range f0/1
```

```
    shutdown
```

!Repeat configuration on ASW2 - change command line to: switchport access vlan 20

Verification & Testing

Command

```
show vlan brief
```

```
show interfaces trunk
```

```
show etherchannel summary
```

```
show spanning-tree vlan 10
```

```
show spanning-tree vlan 20
```

```
show ip interface brief
```

```
show vtp status
```

What It Shows

VLAN IDs, names, status, and access ports per VLAN

Trunk ports, native VLAN, allowed and active VLANs

Port-channel status, protocol (LACP/PAGP), member ports

STP role, root bridge, port states for VLAN 10

STP role, root bridge, port states for VLAN 20

Interface IPs, admin status, and line protocol state

VTP mode, domain name, version, and revision number

! Successful Pings from PC1 : VLAN 10:

ping 192.168.0.129 (PC_3 : VLAN 20)

The screenshot shows a Windows Command Prompt window titled 'PC1'. The window has tabs for 'Physical', 'Config', 'Desktop', 'Programming', and 'Attributes', with 'Desktop' selected. The command prompt shows the following output:

```
IPv4 Address..... 0.0.0.0
Subnet Mask..... 0.0.0.0
Default Gateway..... 0.0.0.0

C:\>ping 192.168.0.129

Pinging 192.168.0.129 with 32 bytes of data:

Request timed out.
Reply from 192.168.0.129: bytes=32 time=1ms TTL=127
Reply from 192.168.0.129: bytes=32 time=1ms TTL=127
Reply from 192.168.0.129: bytes=32 time=1ms TTL=127

Ping statistics for 192.168.0.129:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping 192.168.0.129

Pinging 192.168.0.129 with 32 bytes of data:

Reply from 192.168.0.129: bytes=32 time=12ms TTL=127
Reply from 192.168.0.129: bytes=32 time=12ms TTL=127
Reply from 192.168.0.129: bytes=32 time=20ms TTL=127
Reply from 192.168.0.129: bytes=32 time=1ms TTL=127

Ping statistics for 192.168.0.129:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 220ms, Average = 61ms

C:\>
```

DSW1 Running Configuration

DSW1

Physical Config CLI Attributes

IOS Command Line Interface

```
spanning-tree mode rapid-pvst
spanning-tree vlan 10,99 priority 24576
spanning-tree vlan 20 priority 28672
!
!
!
!
!
!
interface Port-channel1
switchport trunk native vlan 1000
switchport trunk allowed vlan 10,20,99
switchport mode trunk
switchport nonegotiate
!
interface GigabitEthernet1/0/1
switchport trunk native vlan 1000
switchport trunk allowed vlan 10,20,99
switchport mode trunk
switchport nonegotiate
!
interface GigabitEthernet1/0/2
switchport trunk native vlan 1000
switchport trunk allowed vlan 10,20,99
switchport mode trunk
switchport nonegotiate
!
interface GigabitEthernet1/0/3
switchport trunk native vlan 1000
switchport trunk allowed vlan 10,20,99
switchport mode trunk
switchport nonegotiate
channel-group 1 mode active
!
interface GigabitEthernet1/0/4
switchport trunk native vlan 1000
switchport trunk allowed vlan 10,20,99
switchport mode trunk
switchport nonegotiate
channel-group 1 mode active
!
interface GigabitEthernet1/0/5
!
DSW1#
```

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Top

DSW1

Physical Config CLI Attributes

IOS Command Line Interface

```
!
interface GigabitEthernet1/1/4
!
interface Vlan1
no ip address
shutdown
!
interface Vlan10
mac-address 0090.0cc3.9101
ip address 192.168.0.126 255.255.255.128
!
interface Vlan20
mac-address 0090.0cc3.9102
ip address 192.168.0.254 255.255.255.128
!
interface Vlan99
mac-address 0090.0cc3.9103
ip address 192.168.1.6 255.255.255.248
!
ip classless
!
ip flow-export version 9
!
!
!
```

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