# Lab 05

## Phase 1 — Enterprise Foundation

## Lab 05 — Layer 2 EtherChannel Deployment

## Section A — Enterprise Build Scenario

## Lab Type

Enterprise Foundation Build Lab

## Difficulty

Intermediate

## Estimated Time

120–150 Minutes

## Lab Objective

In this lab, you will deploy Layer 2 EtherChannel technology within an enterprise switching environment.

You will learn how to:

- configure EtherChannel bundles,
- deploy LACP negotiation,
- build redundant enterprise uplinks,

- validate logical port-channel operation,
- verify Layer 2 forwarding consistency,
- troubleshoot EtherChannel mismatches,
- and improve enterprise switching resiliency.

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# Why This Lab Matters

Enterprise networks require redundant links to maintain high availability.

Without EtherChannel:

- spanning-tree blocks redundant paths,
- bandwidth remains underutilized,
- failover becomes slower,
- and operational scalability decreases.

EtherChannel allows multiple physical interfaces to operate as a single logical link.

Modern enterprise infrastructures rely heavily on EtherChannel for:

- switch uplinks,
- server connectivity,
- data center aggregation,
- and campus core redundancy.

This lab introduces real-world enterprise EtherChannel deployment operations.

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# Enterprise Scenario

Your enterprise campus is experiencing increasing bandwidth utilization between distribution and access switches.

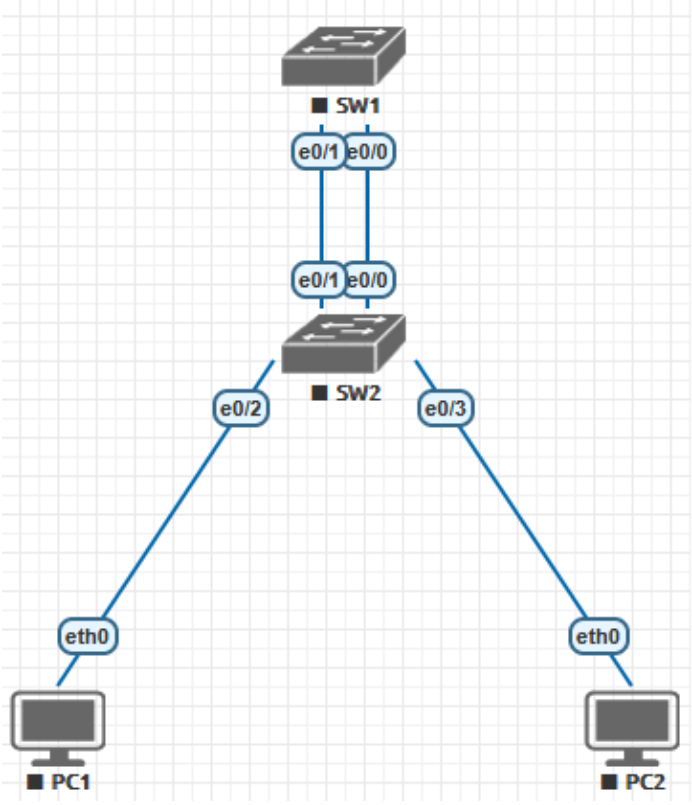
Management requires:

- redundant uplinks,
- higher throughput,

- faster failover,
- and simplified Layer 2 operations.

You are assigned to deploy enterprise EtherChannel bundles using LACP between enterprise switches.

# Topology for EVE-NG & GNS3




# Connection Table

| Device | Interface | Connected To | Interface |
|---|---|---|---|
| SW1 | Ethernet0/0 | SW2 | Ethernet0/0 |
| SW1 | Ethernet0/1 | SW2 | Ethernet0/1 |
| SW2 | Ethernet0/2 | PC1 | eth0 |
| SW2 | Ethernet0/3 | PC2 | eth0 |

# VLAN Design Table

| VLAN ID | VLAN Name |
|---|---|
| 10 | SALES |
| 20 | ENGINEERING |
| 99 | MANAGEMENT |

# IP Addressing Table

| Device | Interface | IP Address | VLAN |
|---|---|---|---|
| PC1 | eth0 | 10.10.10.10/24 | VLAN 10 |
| PC2 | eth0 | 10.20.20.10/24 | VLAN 20 |

# Enterprise Naming Standards

| Device Type | Naming Convention |
|---|---|
| Distribution Switch | SW1 |
| Access Switch | SW2 |
| Sales Endpoint | PC1 |
| Engineering Endpoint | PC2 |

# Required Images

| Device | Purpose |
|---|---|
| Cisco IOLL2 | Enterprise Layer 2 switching |
| VPCS | Endpoint validation |

# Step 1 — Deploy Nodes in EVE-NGGoal

Deploy the enterprise EtherChannel topology.

# Add The Following Nodes

| Node | Quantity |
| --- | --- |
| IOLL2 Switch | 2 |
| VPCS Host | 2 |

# Step 2 — Connect The Enterprise Topology

# Goal

Create all physical enterprise uplinks.

Use the Connection Table above.

# Step 3 — Configure VPCS HostsPC1

```
ip 10.10.10.10/24
set pcname PC1
save
```

# PC2

```
ip 10.20.20.10/24
set pcname PC2
save
```

# Verification

```
show ip
```

```
PC2> show ip

NAME        : PC2[1]
IP/MASK     : 10.20.20.10/24
GATEWAY     : 0.0.0.0
DNS         :
MAC         : 00:50:79:66:68:04
LPORT       : 20000
RHOST:PORT  : 127.0.0.1:30000
MTU         : 1500

PC2>
```

# Expected Result

Both VPCS hosts should display correct enterprise endpoint addressing.

# Step 4 — Configure SW1Goal

Deploy enterprise VLANs and EtherChannel aggregation.

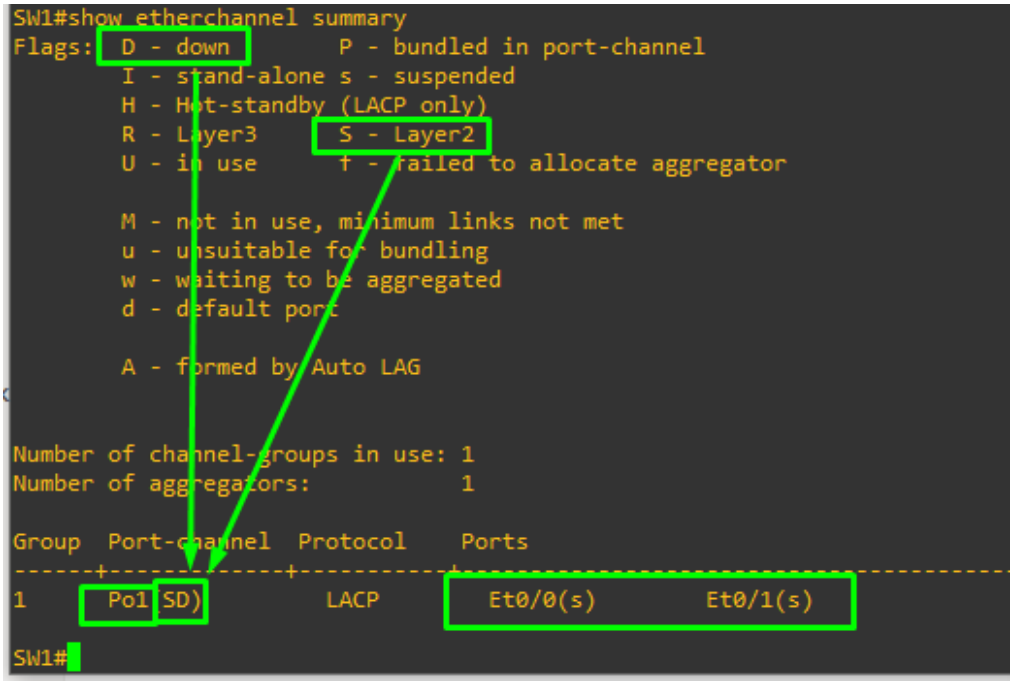
# Commands

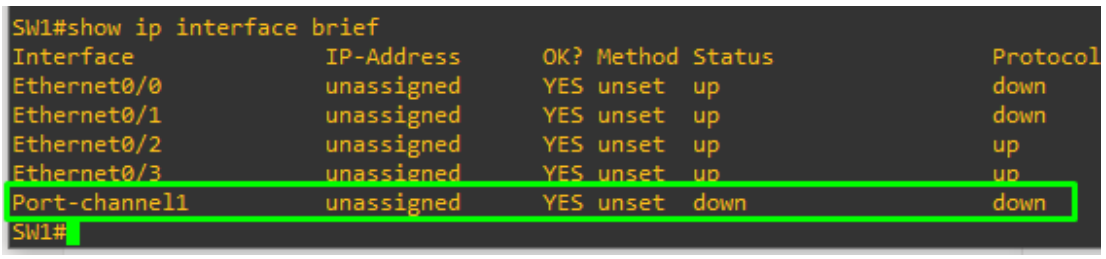
```
enable
conf t

hostname SW1

vlan 10
 name SALES

vlan 20
 name ENGINEERING

vlan 99
 name MANAGEMENT

interface range Ethernet0/0 - 1
 switchport trunk encapsulation dot1q
 switchport mode trunk
 switchport trunk native vlan 99
```

```
 switchport trunk allowed vlan 10,20,99
 channel-group 1 mode active
 no shutdown

interface Port-channel1
 switchport trunk encapsulation dot1q
 switchport mode trunk
 switchport trunk native vlan 99
 switchport trunk allowed vlan 10,20,99
 no shutdown

end
write memory
```

# Verification

```
show etherchannel summary
show ip interface brief
```



**Note:** Port-channel 1 will remain in a down state until the corresponding port-channel configuration is completed on the remote device.

# Expected Result

- Port-channel1 should be operational
- LACP negotiation should succeed
- Physical interfaces should appear bundled

# Step 5 — Configure SW2Goal

Deploy enterprise EtherChannel access switch operations.

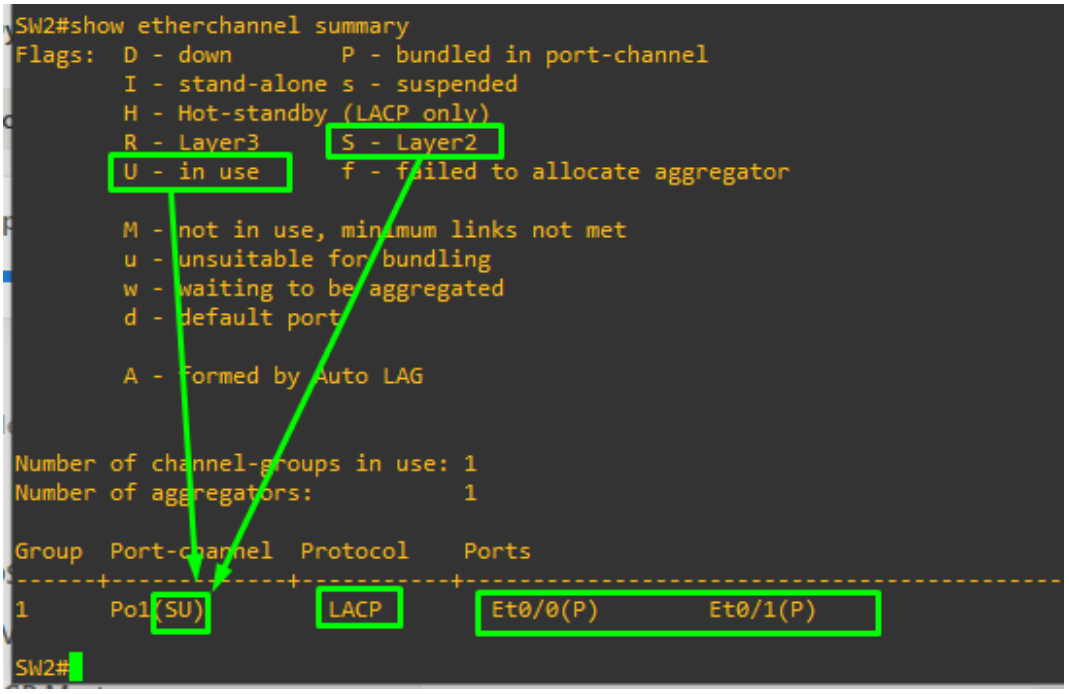
# Commands

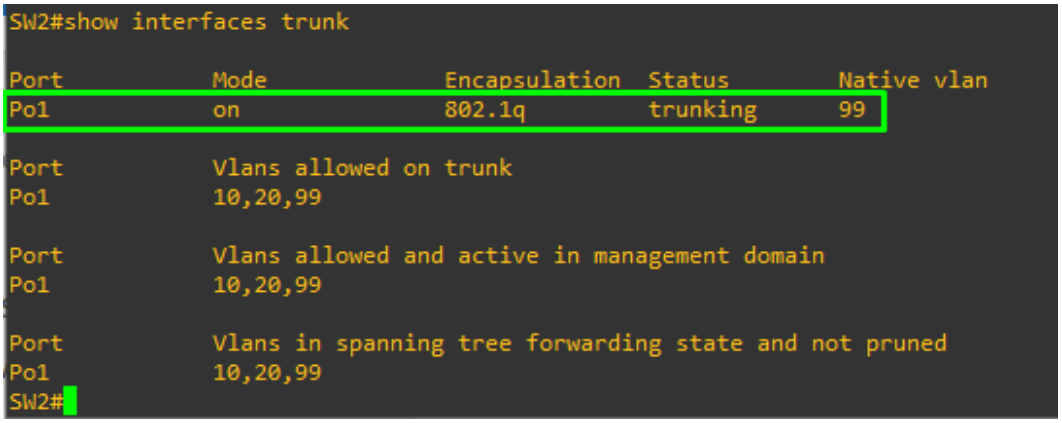
```
enable
conf t

hostname SW2

vlan 10
 name SALES

vlan 20
 name ENGINEERING

vlan 99
 name MANAGEMENT

interface range Ethernet0/0 - 1
 switchport trunk encapsulation dot1q
 switchport mode trunk
 switchport trunk native vlan 99
 switchport trunk allowed vlan 10,20,99
 channel-group 1 mode active
 no shutdown

interface Port-channel1
 switchport trunk encapsulation dot1q
 switchport mode trunk
 switchport trunk native vlan 99
 switchport trunk allowed vlan 10,20,99
 no shutdown
```

```
interface Ethernet0/2
 switchport mode access
 switchport access vlan 10
 spanning-tree portfast
 no shutdown

interface Ethernet0/3
 switchport mode access
 switchport access vlan 20
 spanning-tree portfast
 no shutdown

end
write memory
```

# Verification

```
show etherchannel summary
show interfaces trunk
show spanning-tree
```




SW2#show interfaces trunk
Port Mode Encapsulation Status Native vlan
Po1 on 802.1q trunking 99
Port Vlans allowed on trunk
Po1 10,20,99
Port Vlans allowed and active in management domain
Po1 10,20,99
Port Vlans in spanning tree forwarding state and not pruned
Po1 10,20,99
SW2#

```
SW2#show spanning-tree

VLAN0010
  Spanning tree enabled protocol rstp
  Root ID     Priority    32778
              Address     aabb.cc00.1000
              Cost        56
              Port        65 (Port-channel1)
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    32778  (priority 32768 sys-id-ext 10)
              Address     aabb.cc00.2000
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  300 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Et0/2               Desg FWD 100       128.3    P2p Edge
Po1                 Root FWD 56        128.65   P2p


VLAN0020
  Spanning tree enabled protocol rstp
  Root ID     Priority    32788
              Address     aabb.cc00.1000
              Cost        56
              Port        65 (Port-channel1)
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    32788  (priority 32768 sys-id-ext 20)
              Address     aabb.cc00.2000
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  300 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Et0/3               Desg FWD 100       128.4    P2p Edge
Po1                 Root FWD 56        128.65   P2p


VLAN0099
  Spanning tree enabled protocol rstp
  Root ID     Priority    32867
              Address     aabb.cc00.1000
              Cost        56
              Port        65 (Port-channel1)
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID   Priority    32867  (priority 32768 sys-id-ext 99)
              Address     aabb.cc00.2000
              Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
              Aging Time  300 sec

Interface           Role Sts Cost      Prio.Nbr Type
------------------- ---- --- --------- -------- --------------------------------
Po1                 Root FWD 56        128.65   P2p


SW2#
```

## Expected Result

- EtherChannel should form successfully
- Port-channel1 should operate as trunk
- STP should treat the bundle as a single logical interface

---

# Step 6 — Validate EtherChannel Operations

## Goal

Validate enterprise EtherChannel functionality.

---

## Verification Commands

```
show etherchannel summary
show lacp neighbor
show interfaces port-channel 1
```

---

## Expected Result

- LACP neighbors should appear
- Port-channel operational state should be UP
- Member interfaces should appear synchronized

```
SW1#show etherchannel summary
Flags:  D - down        P - bundled in port-channel
        I - stand-alone s - suspended
        H - Hot-standby (LACP only)
        R - Layer3      S - Layer2
        U - in use      f - failed to allocate aggregator

        M - not in use, minimum links not met
        u - unsuitable for bundling
        w - waiting to be aggregated
        d - default port

        A - formed by Auto LAG


Number of channel-groups in use: 1
Number of aggregators:           1

Group  Port-channel  Protocol    Ports
------+-------------+-----------+-----------------------------------------------

1      Po1(SU)         LACP        Et0/0(P)        Et0/1(P)

SW1#
```

```
SW1#show lacp neighbor
Flags:  S - Device is requesting Slow LACPDUs
        F - Device is requesting Fast LACPDUs
        A - Device is in Active mode       P - Device is in Passive mode

Channel group 1 neighbors

                  LACP port                     Admin  Oper   Port    Port
Port          Flags  Priority  Dev ID          Age  key    Key    Number  State
Et0/0         SA     32768     aabb.cc80.2000   6s  0x0    0x1    0x1     0x3D
Et0/1         SA     32768     aabb.cc80.2000  25s  0x0    0x1    0x2     0x3D
SW1#
```

```
SW1#show interfaces port-channel 1
Port-channel1 is up, line protocol is up (connected)
  Hardware is EtherChannel, address is aabb.cc00.1010 (bia aabb.cc00.1010)
  MTU 1500 bytes, BW 20000 Kbit/sec, DLY 1000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Full-duplex, Auto-speed, media type is 10/100/1000BaseTX
  input flow-control is off, output flow-control is unsupported
  Members in this channel: Et0/0 Et0/1
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input 00:12:22, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/2000/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 1000 bits/sec, 2 packets/sec
     12 packets input, 800 bytes, 0 no buffer
     Received 12 broadcasts (0 multicasts)
     0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
     0 input packets with dribble condition detected
 --More--
```

# Step 7 — Validate VLAN ConnectivityGoal

Validate enterprise Layer 2 forwarding across EtherChannel.

# From PC1

```
ping 10.10.10.10
```

# Expected Result

Local connectivity should succeed.

# Step 8 — Validate STP BehaviorGoal

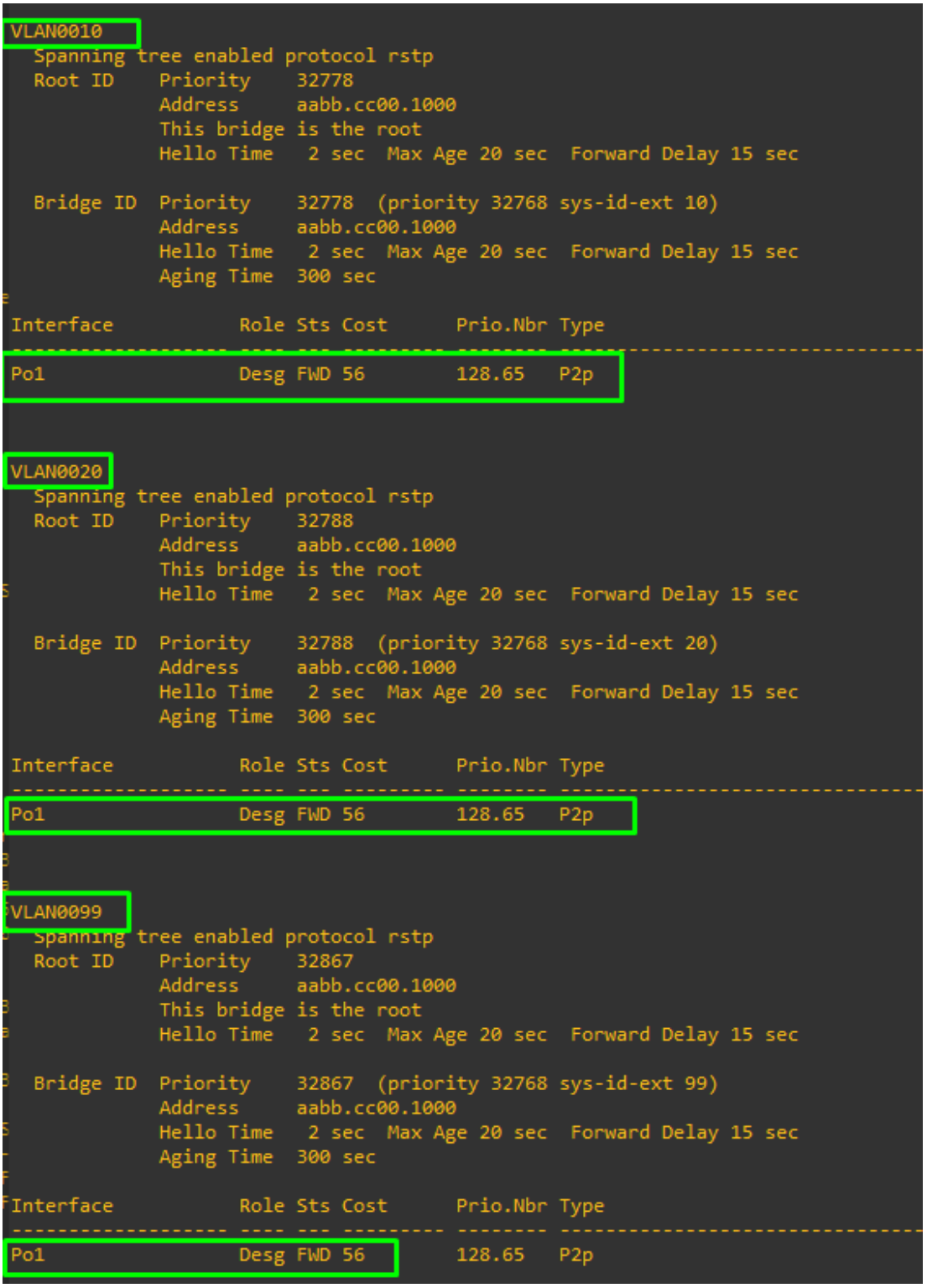
Verify spanning-tree interaction with EtherChannel.

# Verification Commands

```
show spanning-tree
```

# Expected Result

- STP should recognize Port-channel1 as single logical path
- Member interfaces should not individually block


VLAN0010
Spanning tree enabled protocol rstp
Root ID Priority 32778
Address aabb.cc00.1000
This bridge is the root
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Bridge ID Priority 32778 (priority 32768 sys-id-ext 10)
Address aabb.cc00.1000
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Aging Time 300 sec
Interface Role Sts Cost Prio.Nbr Type
Po1 Desg FWD 56 128.65 P2p
VLAN0020
Spanning tree enabled protocol rstp
Root ID Priority 32788
Address aabb.cc00.1000
This bridge is the root
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Bridge ID Priority 32788 (priority 32768 sys-id-ext 20)
Address aabb.cc00.1000
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Aging Time 300 sec
Interface Role Sts Cost Prio.Nbr Type
Po1 Desg FWD 56 128.65 P2p
VLAN0099
Spanning tree enabled protocol rstp
Root ID Priority 32867
Address aabb.cc00.1000
This bridge is the root
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Bridge ID Priority 32867 (priority 32768 sys-id-ext 99)
Address aabb.cc00.1000
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
Aging Time 300 sec
Interface Role Sts Cost Prio.Nbr Type
Po1 Desg FWD 56 128.65 P2p

# Step 9 — Enterprise Operational Verification

## SW1 Verification

```
show etherchannel summary
show lacp neighbor
show interfaces trunk
show spanning-tree
```

---

## SW2 Verification

```
show etherchannel summary
show interfaces trunk
show mac address-table
```

---

## Common Mistakes

| Problem | Cause |
|---|---|
| EtherChannel not forming | Mismatched channel-group mode |
| Interfaces suspended | VLAN mismatch |
| Port-channel down | Trunk inconsistency |
| STP instability | Different EtherChannel settings |
| Traffic loss | Native VLAN mismatch |

---

## Enterprise Engineering Notes

- EtherChannel increases redundancy and throughput simultaneously.
- LACP is preferred in enterprise environments due to negotiation safety.

- All member interfaces must share identical configurations.
- STP views EtherChannel as one logical interface.
- EtherChannel simplifies large-scale Layer 2 operations.

---

# Step 10 — Save ConfigurationsSW1

```
write memory
```

---

# SW2

```
write memory
```

---

# Step 11 — Backup EtherChannel Documentation

# Goal

Document enterprise EtherChannel deployment.

---

# Suggested Documentation

```
Port-channel1
 Members:
  - Ethernet0/0
  - Ethernet0/1

 Allowed VLANs:
  - 10
  - 20
  - 99
```

---

# What You Learned

In this lab you learned:

- enterprise EtherChannel deployment,
- LACP negotiation,
- logical interface aggregation,
- trunk redundancy operations,
- spanning-tree integration,
- EtherChannel verification workflows,
- and enterprise uplink resiliency design.

---

# Verification Score

| Task | Status |
| --- | --- |
| EtherChannel configured | ☐ |
| LACP operational | ☐ |
| Trunks operational | ☐ |
| VLAN propagation verified | ☐ |
| STP validated | ☐ |
| Configurations saved | ☐ |

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# Section B — Enterprise Troubleshooting Scenario

# Incident Scenario

Users report intermittent connectivity issues between enterprise switches.

Your task:

- investigate the EtherChannel failure,

- identify the root cause,
- and restore enterprise uplink stability.

---

# Step 1 — Introduce FailureOn SW2

```
enable
conf t

interface Ethernet0/1
 switchport trunk allowed vlan 10,99

end
```

---

# Step 2 — Verify Failure Symptoms

# Verification Commands

```
show etherchannel summary
```

---

# Expected Result

One EtherChannel member should become suspended or inconsistent.

---

# Step 3 — Begin Investigation

# Verification Commands

```
show run interface Ethernet0/0
show run interface Ethernet0/1
show etherchannel summary
```

---

# Expected Result

Trunk settings should appear inconsistent between member interfaces.

# Root Cause Analysis

EtherChannel member interfaces must have identical configurations.

A VLAN mismatch caused the logical bundle to become unstable.

Without consistency:

- interfaces suspend,
- traffic forwarding becomes unreliable,
- and enterprise redundancy fails.

# Step 4 — Restore Enterprise Stability

# Commands

```
enable
conf t

interface Ethernet0/1
 switchport trunk allowed vlan 10,20,99

end
```

# Step 5 — Validate Recovery

# Verification Commands

```
show etherchannel summary
```

## Expected Result

All EtherChannel member interfaces should return to bundled operational state.

## Final Enterprise ValidationSW1

```
show etherchannel summary
```

## SW2

```
show interfaces trunk
```

## Final Engineering Note

Enterprise EtherChannel troubleshooting should always follow a structured workflow:

1. Verify physical connectivity
2. Verify interface consistency
3. Verify trunk settings
4. Verify LACP negotiation
5. Verify Port-channel operational state
6. Restore configuration consistency
7. Validate end-to-end recovery

## End of Lab 05 — Layer 2 EtherChannel Deployment