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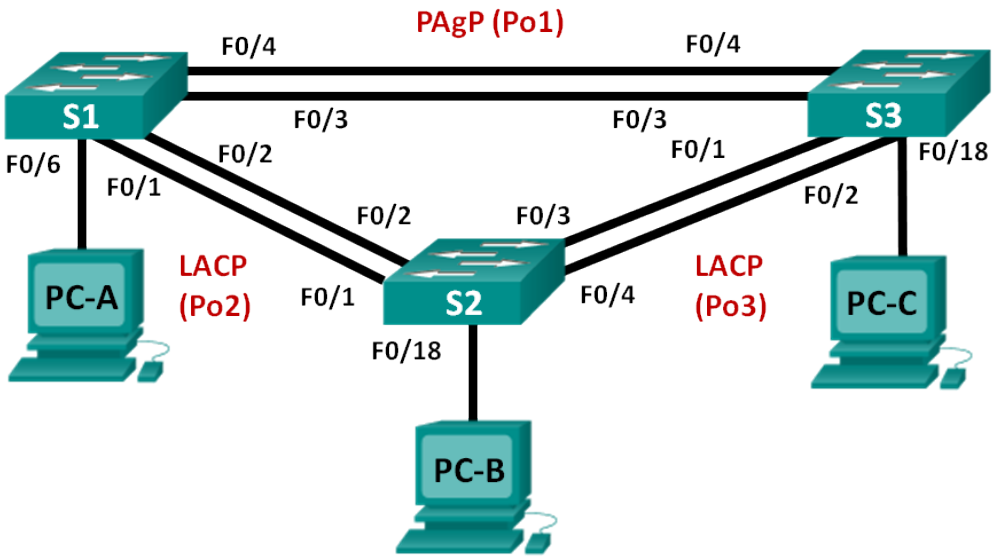
Lab 3.1 – Configuring Etherchannels



Addressing Table

Device	Interface	IP Address	Subnet Mask
S1	VLAN 99	192.168.99.11	255.255.255.0
S2	VLAN 99	192.168.99.12	255.255.255.0
S3	VLAN 99	192.168.99.13	255.255.255.0
PC-A	NIC	192.168.10.1	255.255.255.0
PC-B	NIC	192.168.10.2	255.255.255.0
PC-C	NIC	192.168.10.3	255.255.255.0

Objectives

Part 1: Configure Basic Switch Settings

Part 2: Configure Port Aggregation Protocol

Part 3: Configure Link Aggregation Control Protocol

Part 4: Observe Common Etherchannel Configuration Issues

Background / Scenario

forwarding state using PortFast and prevent the edge ports from forwarding BDPUs using BDPU guard.

Link aggregation allows the creation of logical links that are comprised of two or more physical links. This provides increased throughput beyond using only one physical link. Link aggregation also provides redundancy if one of the links fails.

In this lab, you will configure EtherChannel, a form of link aggregation used in switched networks. You will configure EtherChannel using Port Aggregation Protocol (PAgP) and Link Aggregation Control Protocol (LACP).

Part 1: Build the Network and Configure Basic Device Settings

Step 1: Cable the network as shown in the topology.

Step 2: Configure PC hosts.

Assign PC IP addresses and subnet according to the addressing table.

Step 3: Configure basic and VLAN settings for each switch.

a. Configure switch host names.

b. Configure VLANs and trunks on switches.

1) Create VLAN 10 on all switches and name it **Staff.** Configure all witch ports with connected hosts as static access and assign to VLAN 10.

2) Create VLAN 99 and name it **Management.** Assign switch IP addresses to the VLAN 99 interface according to the addressing table

Part 2: Configure Port Aggregation Protocol (PAgP)

PAgP is a Cisco proprietary protocol for link aggregation. In Part 2, a link between S1 and S3 will be configured using PAgP.

Note: When configuring EtherChannels, it is recommended to shut down the physical ports being grouped on both devices before configuring them into channel groups. Otherwise, EtherChannel Misconfig Guard may place these ports into err-disabled state. The ports and port channels can be re-enabled after EtherChannel is configured.

Step 1: Configure Port Channel 1 with PAgP.

a. On S1 and S3, add ports F0/3 and F0/4 to Port Channel 1. S1 port will be set to desirable mode to enable the switch to actively negotiate to form a PAgP link; while S3 ports will be set to auto mode.

Note: It is recommended that interfaces are **shutdown** before adding them to the channel group.

```
S1(config)# interface range f0/3 – 4
S1(config-if-range)# shutdown
S1(config-if-range)# channel-group 1 mode desirable
S1(config-if-range)# no shutdown

S3(config)# interface range f0/3 - 4
S3(config-if-range)# shutdown
```

```
S3(config-if-range)# channel-group 1 mode auto
S3(config-if-range)# no shutdown
```

The message “Creating a port-channel interface Port-channel 1” should appear on both switches when the channel-group is configured. This interface designation will appear as Po1 in command output

b. Currently the F0/3, F0/4, and Po1 (Port-channel1) interfaces on both S1 and S3 are in access operational mode with the administrative mode in dynamic auto. Verify the configuration using the **show interfaces** *interface-id* **switchport** command.

```
S1# show interfaces f0/3 switchport
Name: Fa0/3
Switchport: Enabled
Administrative Mode: dynamic auto
Operational Mode: static access
Administrative Trunking Encapsulation: dot1q
Operational Trunking Encapsulation: native
Negotiation of Trunking: On
Access Mode VLAN: 1 (default)
Trunking Native Mode VLAN: 1 (default)
Administrative Native VLAN tagging: enabled
Voice VLAN: none
Administrative private-vlan host-association: none
Administrative private-vlan mapping: none
Administrative private-vlan trunk native VLAN: none
Administrative private-vlan trunk Native VLAN tagging: enabled
Administrative private-vlan trunk encapsulation: dot1q
Administrative private-vlan trunk normal VLANs: none
Administrative private-vlan trunk associations: none
Administrative private-vlan trunk mappings: none
Operational private-vlan: none
Trunking VLANs Enabled: ALL
Pruning VLANs Enabled: 2-1001
Capture Mode Disabled
Capture VLANs Allowed: ALL

Protected: false
Unknown unicast blocked: disabled
Unknown multicast blocked: disabled
Appliance trust: none
```

Step 2: Verify that the ports have been aggregated.

Issue the show etherchannel summary command on S1 and S3 to verify that EtherChannel is working on both switches. This command displays the type of EtherChannel, the ports utilized, and the port states. Command output is shown for S1

```
S1# 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


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

Group  Port-channel  Protocol    Ports
------+-------------+-----------+-----------------------------------------------
1      Po1(SU)          PAgP      Fa0/3(P)    Fa0/4(P)
```

If the EtherChannel does not come up, shut down the physical interfaces on both ends of the EtherChannel and then bring them back up again.

What do the flags SU and P in the command output indicate about the newly created port-channel Po1?

The flags SU and P in the command output indicate the status of the newly created port-channel Po1 and its member ports. The SU flag indicates that the port-channel is at Layer 2 and is in use. The P flag indicates that the corresponding interface is bundled in the port-channel. Therefore, Po1(SU) means that the port-channel Po1 is operational, and Fa0/3(P) and Fa0/4(P) mean that interfaces Fa0/3 and Fa0/4 are part of the port-channel.

Step 3: Configure trunk ports.

After the ports have been aggregated, commands applied at the port channel interface affect all the links that were bundled together. Manually configure the Po1 ports on S1 and S3 as trunk ports.

```
S1(config)# interface port-channel 1
S1(config-if)# switchport mode trunk

S3(config)# interface port-channel 1
S3(config-if)# switchport mode trunk
```

Step 4: Verify that the ports are configured as trunk ports.

a. Issue the **show run** commands on S1 and S3.

Compare the commands listed under F0/3 and F0/3 and Po1. What can you observe?

After manually configuring the Po1 ports on S1 and S3 as trunk ports and issuing the show run command on S1 and S3, the commands listed under F0/3, F0/4, and Po1 are now in trunk mode, whilst S1 and S3 are in desirable mode and auto respectively.

b. Issue the **show interfaces trunk** and **show spanning-tree** commands on S1 and S3.

What interface is listed under the operational trunks of the switches?	Po1, Fa0/1, and Fa0/2

What is the STP port cost associated with the aggregated link?	The port cost is now 12
What is the port priority associated with the aggregated link?	The port priority is 128.28

Why do you think are F0/3 and F0/4 of both switches not listed under the outputs of these 2 'show' commands despite being active and configured with the 'switchport mode trunk'?

The interfaces F0/3 and F0/4 are not listed under the outputs of the show interfaces trunk and show spanning-tree commands because they have been bundled into the port-channel Po1. When interfaces are bundled into a port-channel, they are treated as a single, logical interface.

Part 3: Configure Link Aggregation Control Protocol (LACP)

In 2000, the IEEE released 802.3ad, which is an open standard version of EtherChannel. It is commonly referred to as LACP. In Part 3, the link between S1 and S2, and the link between S2 and S3 will be configured using LACP. Also, the individual links will be configured as trunks before they are bundled together as EtherChannels.

Step 1: Configure Port Channel 2 with LACP.

a. On S1 add ports F0/1 and F0/2 to Port Channel 2. S1 ports will be set to active mode to enable the switch to actively negotiate to form a LACP link. Set the newly created port channel to trunk mode

```
S1(config)# interface range f0/1 – 2
S1(config-if-range)# shutdown
S1(config-if-range)# channel-group 2 mode active
S1(config-if-range)# no shutdown
S1(config-if-range)# interface port-channel 2
S1(config-if)# switchport mode trunk
```

b. On S2, add F0/1 and F0/2 to port channel 2, set them to LACP passive mode and enable trunking.

What commands are needed to accomplish this?

interface range Fa0/1-2
shutdown
channel-group 2 mode passive
no shutdown
interface port-channel 2
switchport mode trunk

Step 2: Verify that the Etherchannel was formed.

Issue the **show etherchannel summary** command on S1 and S2.

From the resulting output, how can you tell that the Etherchannel was successfully formed and that all member links are operational?

After using the show etherchannel summary command, I can verify all the member links are operational since the SU flag was next to the Port-channel Po2. The S means Layer 2 EtherChannel, and U means it's in use. The member interfaces were also listed under the Ports in the group section. Finally, since the member interfaces were flagged as P, the EtherChannel was properly formed.

Part 4: Observe Common Etherchannel Configuration Issues

Several misconfigurations can cause issues with Etherchannel. It is essential to be aware of these and know how to diagnose these issues. In Part 4, you will purposely misconfigure switch ports in order to observe their effect on Etherchannel operations.

Step 1: Configure Port Channel 3 with LACP.

On S3 add ports F0/1 and F0/2 to Port Channel 2. S3 ports will be set to active mode to enable the switch to actively negotiate to form a LACP link.

```
S3(config)# interface range f0/1 – 2
S3(config-if-range)# shutdown
S3(config-if-range)# channel-group 3 mode active
S3(config-if-range)# no shutdown
S3(config-if-range)# interface port-channel 3
S3(config-if)# switchport mode trunk
```

Step 2: Create and observe incompatibility errors.

a. Configure S2 with the following commands.

```
S2(config)# interface range f0/3 – 4
S2(config-if-range)# shutdown
S2(config-if-range)# channel-group 3 mode auto
S2(config-if-range)# no shutdown
S2(config-if-range)# interface port-channel 3
S2(config-if)# switchport mode trunk
```

b. Check the status of the Etherchannel Po3 on S2 and S3 using the command **show etherchannel summary** command.

Describe the status of Po3 and its ports based on what you see from the command output:

After running the show etherchannel summary command on both S2 and S3, the port-channel Po3 is down and not in use, which is indicated by the SD flag. The S means Layer 2 EtherChannel, and D means it's down. Furthermore, the member ports Fa0/3 and Fa0/4 were flagged as standalone, which was indicated by the flag I.

What Etherchannel management protocol is used on **S2** Po3?	PAgP
What Etherchannel management protocol is used on **S3** Po3?	LACP

What do you think is the cause of the issue in this scenario?

The reason S2 Po3 is running the PAgP protocol is because it was configured with the mode active, which is one of the PagP modes. Similarly, S3 Po3 is running the LACP protocol because it was configured with the mode auto, which is one of the LACP modes. The cause of the issue in this scenario is due to a mismatch in the EtherChannel management protocol used on S2 Po3 and S3 Po3. Since S2 Po3 is using the the PAgP protocol, while S3 Po3 is using the LACP protocol, these two protocols are not compatible with each other. EtherChannel can be formed using either PAgP or LACP, but the protocol should be consistent on both ends of the EtherChannel for it to function properly. If one end is configured with PAgP and the other end with LACP, the EtherChannel will not form, resulting in the interfaces being in the standalone state.

Step 3: Create and observe configuration inconsistency errors.

a. Configure S2 with the following commands.

```
S2(config)# no interface Po3
S2(config)# interface range f0/3 – 4
S2(config-if-range)# shutdown
S2(config-if-range)# channel-group 3 mode active
S2(config-if-range)# no shutdown
S2(config-if)# interface fa0/4
S2(config-if)# switchport mode access
```

b. Check the status of the Etherchannel Po3 on S2 using the command **show etherchannel summary** command.

Describe the status of Po3 and its ports based on what you see from the command output:

After running the show etherchannel summary command, the status of Po3 is SU, which means it's a Layer 2 EtherChannel and it's currently in use. The port Fa0/3 is in P state, which means it's bundled in the port-channel and the port Fa0/4 is in s state, which means it's suspended.

What do you think is the cause of the issue in this scenario?

The issue in this scenario is with port Fa0/4, where it's in a suspended state. This is because Fa0/4 was not configured as a trunk. As a result, there was a mismatch, causing it to be suspended.

Step 4: Restore Etherchannel operations.

a. Configure S2 with the following commands

```
S2(config)# interface Po3
S2(config-if)# switchport mode trunk
```

b. Perform connectivity test between hosts using ping:

- PC1 to PC2
- PC2 to PC3
- S1 to S2
- S2 to S3

If any of these do not work, perform the necessary troubleshooting to correct errors

Reflection

1. What advantages does link aggregation provide to a network?

Link aggregation, also known as link bundling or port aggregation, is a method of combining multiple individual Ethernet connections into one logical link. There are several advantages in using link aggregation. Firstly, link aggregation provides additional bandwidth between connected devices. By bonding two or more network connections together, it can significantly boost throughput, making data transmission more efficient. Secondly, it offers redundancy, increasing the resilience of the network. If one of the physical links in the Link Aggregation Group fails, traffic is dynamically and transparently reassigned to one of the other physical links. This ensures a reliable and high-performance network even in the event of a cable failure. Thirdly, link aggregation allows for load balancing of the connections. This means that the total network load can be distributed evenly across all available ports, optimizing network efficiency. This feature is particularly beneficial when multiple clients are accessing the network simultaneously.

2. As demonstrated in the lab activity, port configuration inconsistencies can easily cause issues in Etherchannel operation. What good configuration practice/s can you employ to avoid such errors when working with Etherchannels in a network?

When working with EtherChannels in a network, it's crucial to follow good configuration practices to avoid errors and ensure smooth operation. The first practice is to ensure that all physical interfaces within an EtherChannel have the same configuration. This includes settings like port type, speed, duplex, DTP mode, and VLAN membership settings. Furthermore, it is important to use the same protocol on your network and make sure it's consistently configured across all devices in the EtherChannel. The second practice is to shut down the interfaces before making changes, and then to reactivate the interfaces. The third practice is to use descriptive names for your EtherChannels. This can make the configurations easier to understand and troubleshoot.