Chapter 5: Link Aggregation

Switched Networks

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Chapter 5

5.1 Link Aggregation Concepts

5.2 Link Aggregation Configuration

5.3 Summary

Chapter 5: Objectives

- Explain the operation of link aggregation in a switched LAN environment.
- Describe EtherChannel technology.
- Configure link aggregation to improve performance on high-traffic switch links.
- Configure link aggregation with EtherChannel.
- Verify and troubleshoot link aggregation with EtherChannel.

5.1 Link Aggregation Concepts

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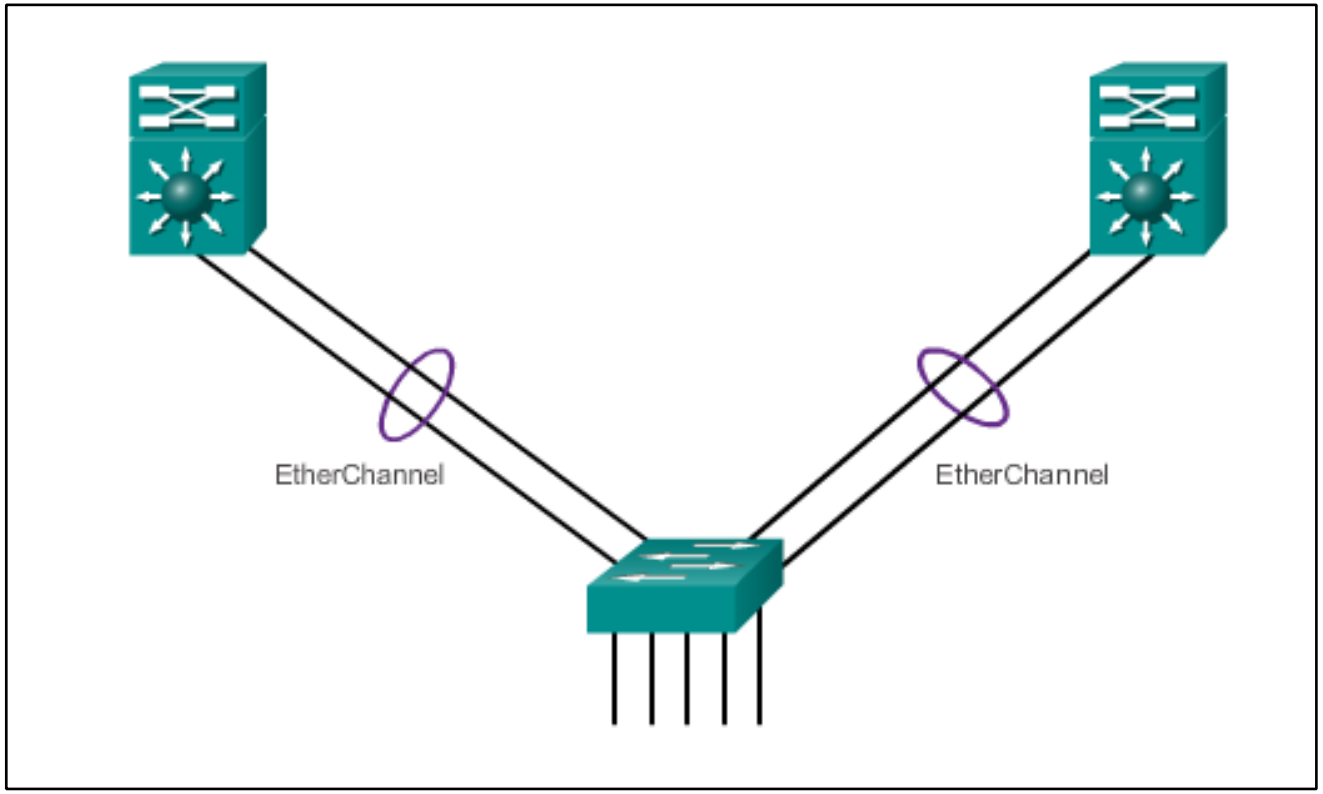
Introduction to Link Aggregation

- Link aggregation allows the creation of logical links comprised of several physical links.
- EtherChannel is a form of link aggregation used in switched networks.

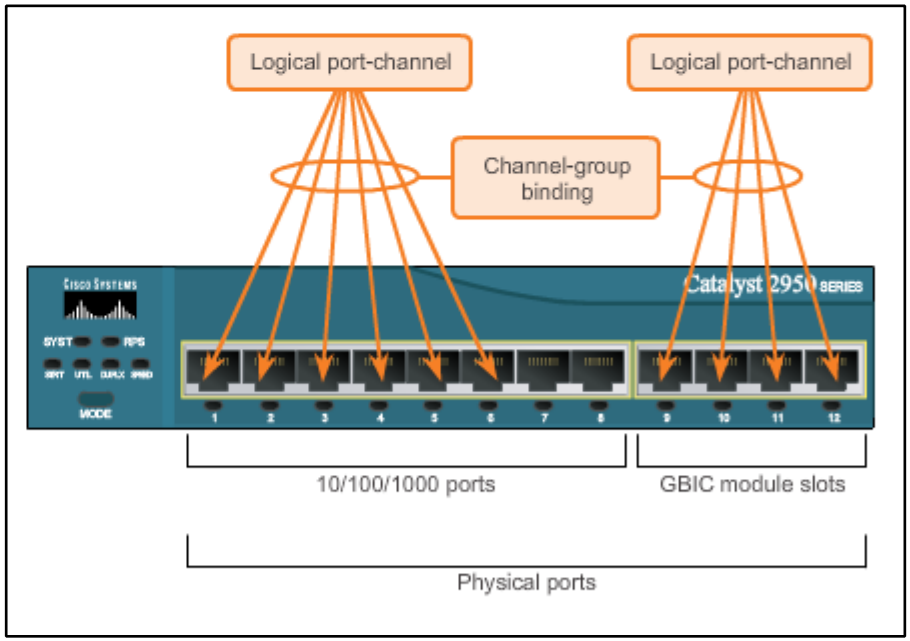


Advantages of EtherChannel

- Most configurations performed on EtherChannel interface, ensuring consistency throughout links.
- Relies on existing switch ports—no need for upgrades.
- Load balances between links on the same EtherChannnel.
- Creates an aggregation viewed as one logical link by STP.
- Provides redundancy because overall link is viewed as one logical connection. If one physical link within a channel goes down, this does not cause a change in the topology and does not require STP recalculation.

Implementation Restrictions

- EtherChannel is implemented by grouping multiple physical ports into one or more logical EtherChannel links.
- Interface types cannot be mixed.
- EtherChannel provides full-duplex bandwidth up to 800 Mb/s (Fast EtherChannel) or 8 Gb/s (Gigabit EtherChannel).
- EtherChannel can consist of up to 16 compatibly configured Ethernet ports.
- The Cisco IOS switch currently supports six EtherChannels.

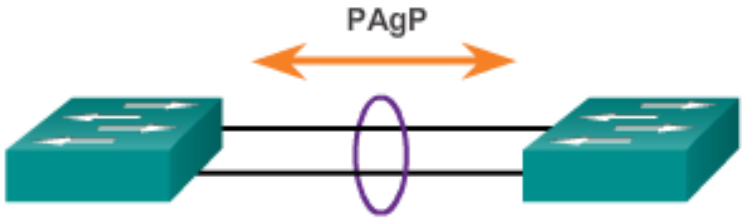


EtherChannel Operation

Port Aggregation Protocol (PAgP)

PAgP modes:

- **On:** Channel member without negotiation (no protocol).
- **Desirable:** Actively asking if the other side can or will participate.
- **Auto:** Passively waiting for the other side.



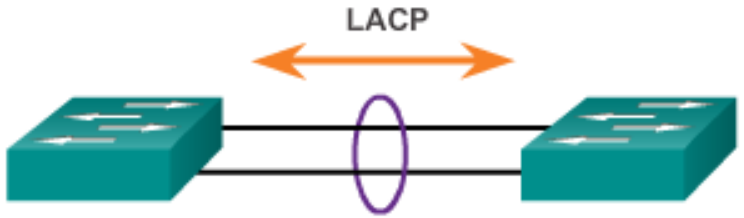
Switch 1	Switch 2	Channel Establishment
On	On	Yes
Auto/Desirable	Desirable	Yes
On/Auto/Desirable	Not Configured	No
On	Desirable	No
Auto/On	Auto	No

EtherChannel Operation

Link Aggregation Control Protocol (LACP)

LACP modes:

- **On:** Channel member without negotiation (no protocol).
- **Active:** Actively asking if the other side can or will participate.
- **Passive:** Passively waiting for the other side.



Switch 1	Switch 2	Channel Establishment
On	On	Yes
Active/Passive	Active	Yes
On/Active/Passive	Not Configured	No
On	Active	No
Passive/On	Passive	No

5.2 Link Aggregation Configuration

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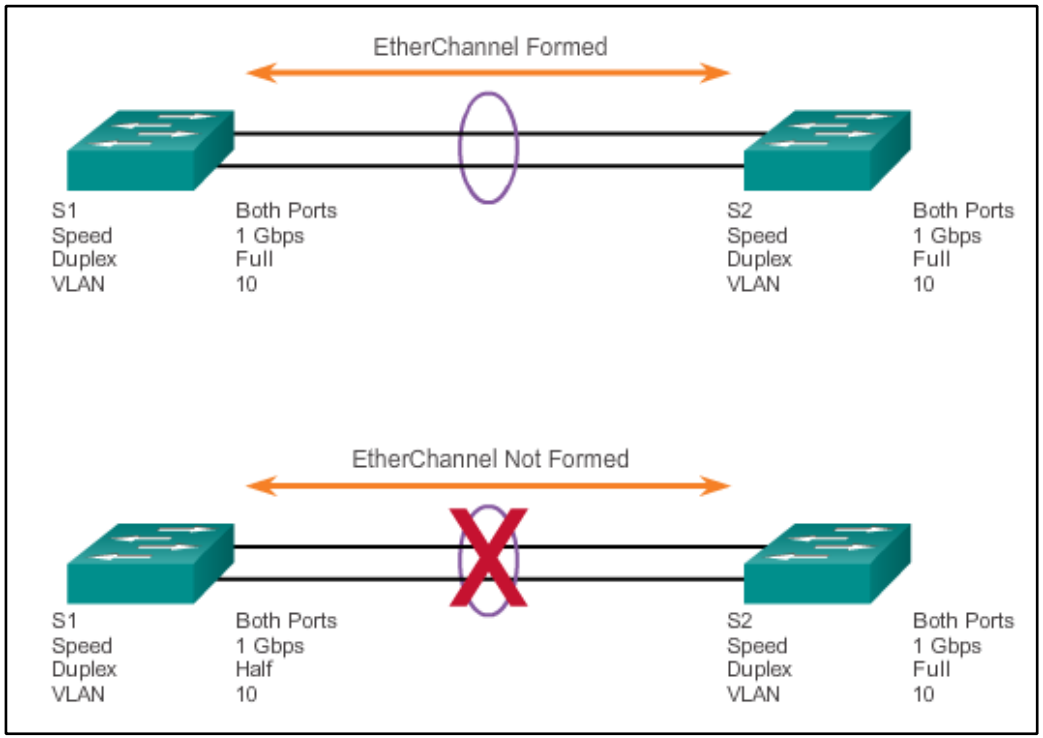
Configuration Guidelines

- **EtherChannel must be supported.**
- **Speed and duplex must match.**
- **VLAN match—**All interfaces in same VLAN.
- **Range of VLAN—**Same range on all interfaces.

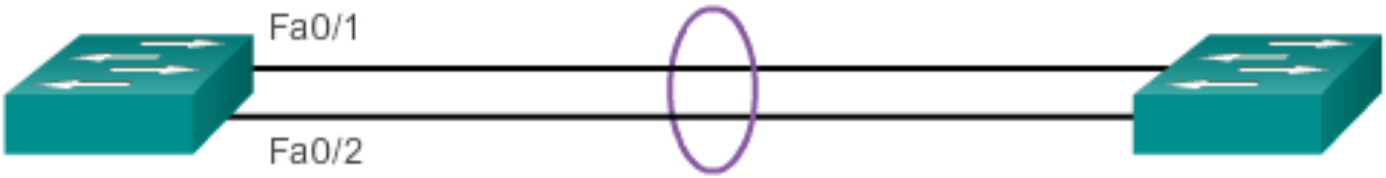


Configuring Interfaces

Configuring EtherChannel with LACP

```
S1(config)# interface range FastEthernet0/1 - 2
S1(config-if-range)# channel-group 1 mode active
Creating a port-channel interface Port-channel 1
S1(config-if-range)# interface port-channel 1
S1(config-if)# switchport mode trunk
S1(config-if)# switchport trunk allowed vlan 1,2,20
```

Creates EtherChannel and configures trunk.



Verifying EtherChannel

- The **show interface port-channel** command displays the general status of the EtherChannel interface.
- The **show etherchannel summary** command displays one line of information per port channel.
- The **show etherchannel port-channel** command displays information about a specific port channel interface.
- The **show interfaces etherchannel** command provides information about the role of the interface in the EtherChannel.

```
S1# show interface port-channel1
Port-channel1 is up, line protocol is up (connected)
  Hardware is EtherChannel, address is 0cd9.96e8.8a02 (bia
0cd9.96e8.8a02)
  MTU 1500 bytes, BW 200000 Kbit/sec, DLY 100 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
<Output omitted>
```

Verifies the interface status.

Troubleshooting EtherChannel

```
S1# show run | begin interface Port-channel
interface Port-channel1
 switchport mode trunk
!
interface FastEthernet0/1
 switchport mode trunk
 channel-group 1 mode on
!
interface FastEthernet0/2
 switchport mode trunk
 channel-group 1 mode on
!
<Output omitted>

S2# show run | begin interface Port-channel
interface Port-channel1
 switchport mode trunk
!
interface FastEthernet0/1
 switchport mode trunk
 channel-group 1 mode desirable
!
interface FastEthernet0/2
 switchport mode trunk
 channel-group 1 mode desirable
```

```
S1(config)# no interface Port-channel 1
S1(config)# interface range f0/1 - 2
S1(config-if-range)# channel-group 1 mode desirable
Creating a port-channel interface Port-channel 1

S1(config-if-range)# no shutdown
S1(config-if-range)# interface Port-channel 1
S1(config-if)# switchport mode trunk
S1(config-if)# end
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
```

Chapter 5: Summary

This chapter describes:

- How Cisco uses the term, EtherChannel, to encompass both the PAgP-based and the LACP-based link aggregation methods.
- EtherChannel technologies and the various means available to implement them.
- EtherChannel configurations, verifications, and troubleshooting.
- Load balancing takes place between links that are part of the same EtherChannel, depending on the hardware platform.
- Several **show** commands for verifying and troubleshooting an EtherChannel implementation.