



Chapter 3: Link Aggregation



Scaling Networks

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Chapter 3

3.1 Link Aggregation Concepts

3.2 Link Aggregation Configuration

3.3 Summary



Chapter 3: 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.



3.1 Link Aggregation Concepts



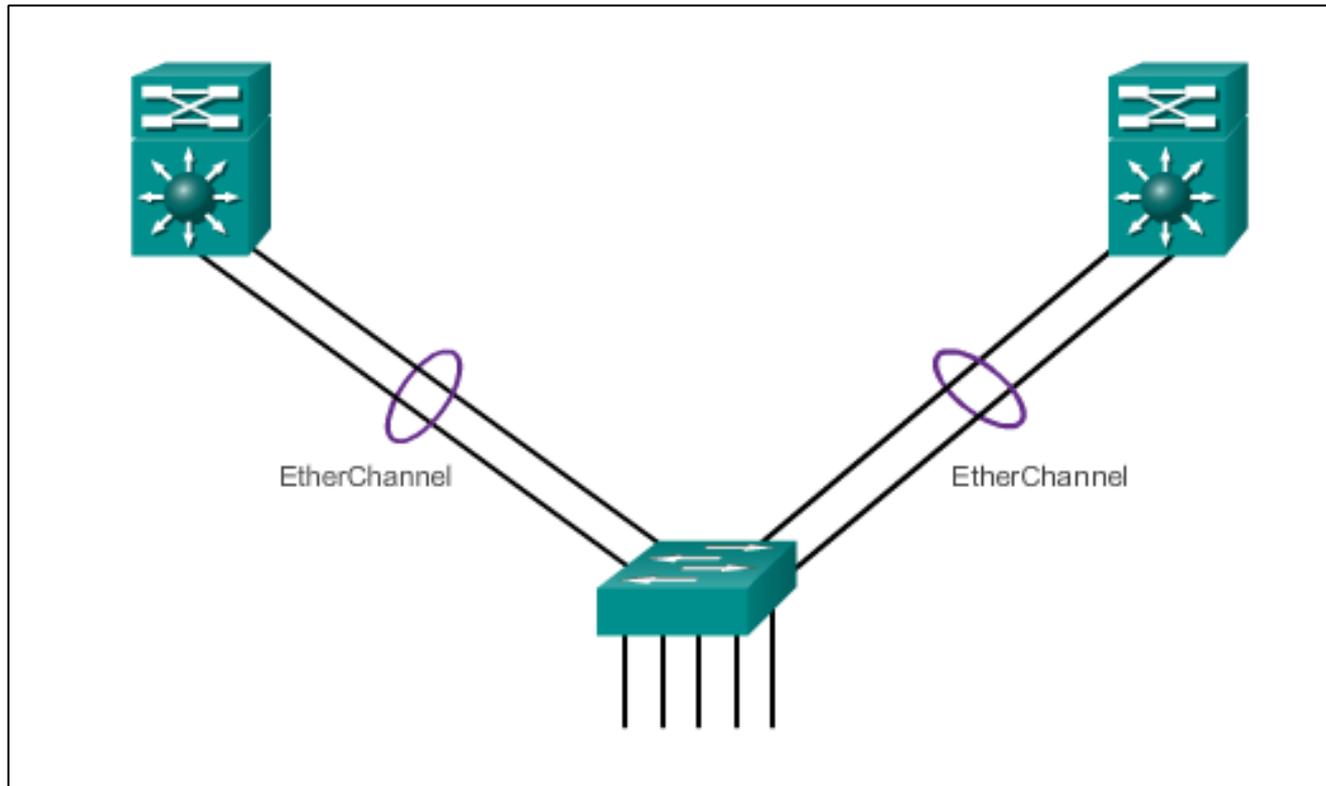
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Link Aggregation

Introduction to Link Aggregation

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





Link Aggregation

Advantages of EtherChannel

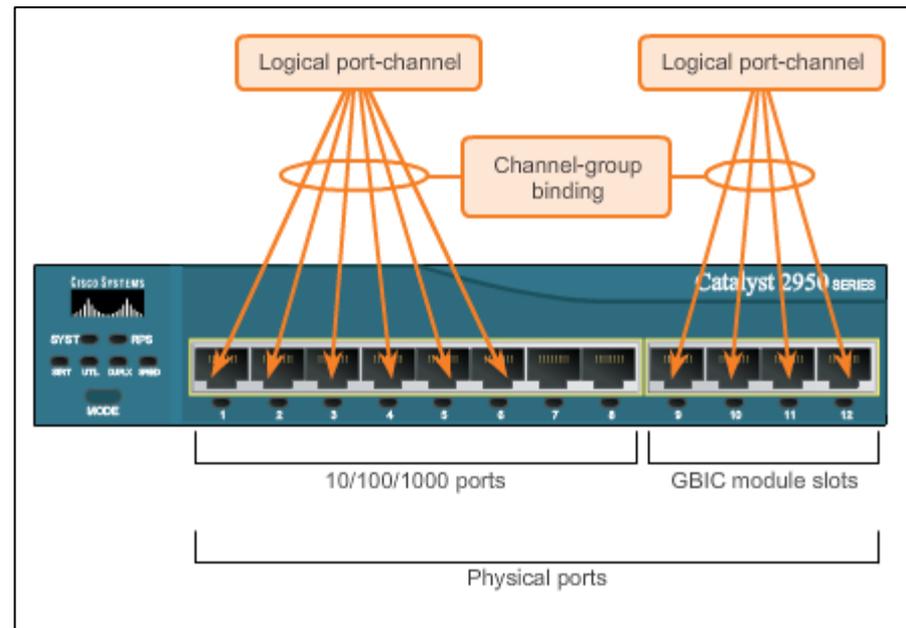
- Most configurations are done on the EtherChannel interface ensuring consistency throughout links.
- Relies on existing switch ports – no need for upgrades.
- Load-balances between links on the same EtherChannel.
- Creates an aggregation viewed as one logical link by STP.
- Provides redundancy because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



EtherChannel Operation

Implementation Restrictions

- EtherChannel 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.



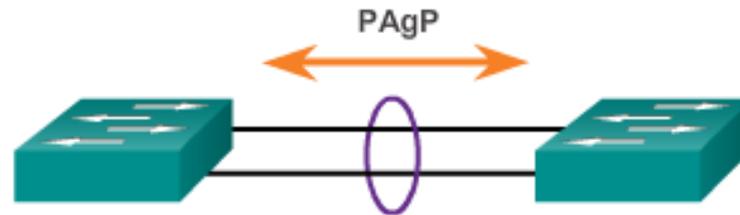


EtherChannel Operation

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

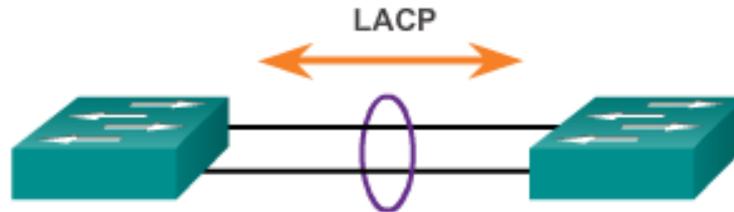


EtherChannel Operation

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



3.2 Link Aggregation Configuration



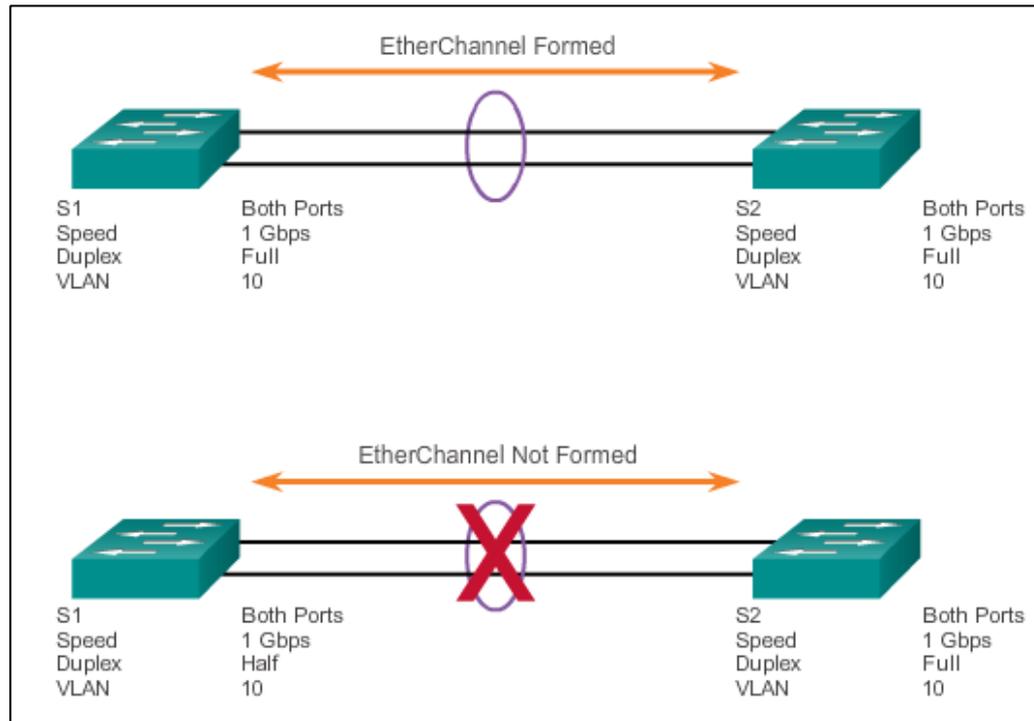
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Configuring EtherChannel

Configuration Guidelines

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





Configuring EtherChannel

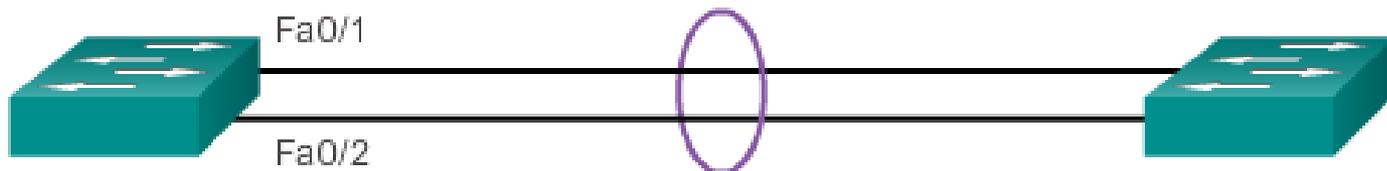
Configuring Interfaces

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 and Troubleshooting EtherChannel

Verifying EtherChannel

- **show interface Port-channel** – Displays the general status of the EtherChannel interface.
- **show etherchannel summary** – Displays one line of information per port channel.
- **show etherchannel port-channel** – Displays information about a specific port channel interface.
- **show interfaces etherchannel** – 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.



Verifying and Troubleshooting EtherChannel

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 3: Summary

This chapter described:

- EtherChannel and how to encompass both the PAgP-based and the LACP-based link aggregation methods
- EtherChannel technologies and the various means available to implement them
- The configuration, verification, and troubleshooting of EtherChannel

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