

EtherChannel

SDC CNW (CSE 4541)

CSE, FET, ITER
SOA University, BBSR-30



Glen E. Clarke & Richard Deal

CCT/CCNA

Routing & Switching Exam Guide

McGrawHill

Discussion Flow

- Introduction
- Layer 2 EtherChannel Configuration
- Manual & Dynamic Configuration
- Layer 2 EtherChannel Load Balancing
- Layer 3 EtherChannel Configuration & Verification

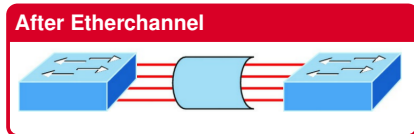
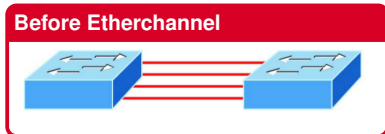
Review Questions

Introduction

- EtherChannel combines multiple parallel segments of equal speed (up to eight) between the same pair of switches.
- It bundles together multiple Ethernet ports between devices to provide a single logical interface.
- It provides a way to prevent STP convergence from being needed when only a single port or cable failure occurs.
- The switches treat the EtherChannel as a single interface with regard to STP. As a result, if one of the links fails, but at least one of the links is up, STP convergence does not have to occur.
- EtherChannels provide these advantages:
 - **Redundancy:** If one connection in the channel fails, other connections can be used in the channel.
 - **More bandwidth:** Each connection can be used simultaneously to send frames.
 - **Simplified management:** Configuration is done on the logical interface, not on each individual connection in the channel.
- EtherChannel is a **port channel technology** that was originally developed by Cisco as a switch-to-switch technique for grouping several Fast Ethernet or Gigabit Ethernet ports into one logical channel.

Network Looks: Before and After EtherChannel

- Four connections between switches before and after configuring port channel(etherchannel).



- Once your port channel (EtherChannel) is up and working, layer 2 STP and layer 3 routing protocols will treat those bundled links as a single one.
- Etherchannel may happens for Layer 2 EtherChannels as well as Layer 3 EtherChannels.
- Layer 2 EtherChannels combine links that switches use as switch ports, with the switches using Layer 2 switching logic to forward and receive Ethernet frames over the EtherChannels.
- Layer 3 EtherChannels also combine links, but the switches use Layer 3 routing logic to forward packets over the EtherChannels.

Preface To Layer 2 EtherChannel Configuration

- Two neighboring switches can treat multiple parallel links between each other as a single logical link called an EtherChannel.
- **Without EtherChannel:** a switch treats each physical port as an independent port, *applying MAC learning, forwarding and STP logic per physical port.*
- **With EtherChannel:** the switch applies all those same processes to a group of physical ports as **one entity**: the EtherChannel.
- Without EtherChannel, with parallel links between two switches, STP/RSTP would block all links except one, but with EtherChannel, the switch can use all the links, load balancing the traffic over the links
- **EtherChannel Restrictions:** Interfaces in an EtherChannel must be configured identically: speed, duplexing, and VLAN settings (in the same VLAN if they are access ports, or the same trunk properties) must be the same.
- When setting up EtherChannels, we can use up to eight interfaces bundled together:
 - Up to eight Fast Ethernet connections, providing up to 800 Mbps
 - Up to eight Gigabit Ethernet connections, providing up to 8 Gbps
 - Up to eight 10-Gigabit Ethernet connections, providing up to 80 Gbps
- Typically, we can have a total of six EtherChannels on a switch, but this is larger on the higher-end IOS switches.

Preface To Layer 2 EtherChannel Configuration

- Two neighboring switches can treat multiple parallel links between each other as a single logical link called an EtherChannel.
- **Without EtherChannel:** a switch treats each physical port as an independent port, *applying MAC learning, forwarding and STP logic per physical port.*
- **With EtherChannel:** the switch applies all those same processes to a group of physical ports as **one entity**: the EtherChannel.
- Without EtherChannel, with parallel links between two switches, STP/RSTP would block all links except one, but with EtherChannel, the switch can use all the links, load balancing the traffic over the links
- **EtherChannel Restrictions:** Interfaces in an EtherChannel must be configured identically: speed, duplexing, and VLAN settings (in the same VLAN if they are access ports, or the same trunk properties) must be the same.
- When setting up EtherChannels, we can use up to eight interfaces bundled together:
 - Up to eight Fast Ethernet connections, providing up to 800 Mbps
 - Up to eight Gigabit Ethernet connections, providing up to 8 Gbps
 - Up to eight 10-Gigabit Ethernet connections, providing up to 80 Gbps
- Typically, we can have a total of six EtherChannels on a switch, but this is larger on the higher-end IOS switches.

Layer 2 Etherchannel Configuration

1. Manual (Static) Configuration

2. Dynamic Configuration

Allowing dynamic protocols to create the etherChannel

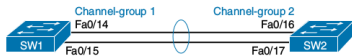
- **PAgP:** Cisco-proprietary Port Aggregation Protocol (PAgP).
- **LACP:** The IEEE standard Link Aggregation Control Protocol (LACP) based on IEEE standard 802.3ad.
 - ⇒ Cisco switches support two different configuration options.
 - ⇒ They use a dynamic protocol to negotiate whether a particular link becomes part of an EtherChannel or not.
 - ⇒ The switch can use the protocol to send messages to/from the neighboring switch and discover whether their configuration settings pass all checks.
 - ⇒ If a given physical link passes, the link is added to the EtherChannel and used; if not, it is placed in a down state, and not used, until the configuration inconsistency can be resolved.

Manual EtherChannel Configuration

Manual Configuration

- Add the **channel-group** number **mode** on command in interface configuration mode under each physical interface that should be in the channel to add it to the channel.
- Use the same number for all commands on the same switch, but the channel-group number on the neighboring switch can differ.
- Three terms as synonyms: **EtherChannel**, **PortChannel**, and **Channel-group**.
- channel-group for configuration, show command refers EtherChannel, output of this show command refers portchannel

Example: LAN Used in EtherChannel



```
SW1#configure terminal
SW1(config)#interface fa 0/14
SW1(config-if)#channel-group 1 mode on
SW1(config-if)#exit
SW1(config)#interface fa 0/15
SW1(config-if)#channel-group 1 mode on
SW1(config-if)#^Z
```

Verification

```
SW1#show spanning-tree vlan 1

/* Check fort:port-channel */
-----
SW1#show etherchannel 1 summary
:::
Group Port-channel Protocol Ports
-----+-----+-----+-----
1      Po1 (SU)      -      Fa0/14 (P) Fa0/15 (P)
```

Observations:

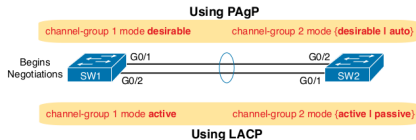
- ✎ It lists as a heading "Port-channel", with Po1 below it. That is the Channel name.
- ✎ It also lists both Fa0/14 and Fa0/15 in the list of ports, with a (P) beside each. the P means that the ports are bundled in the port channel and have passed all the configuration checks and are valid to be included in the channel.
- ✎ Check out the other FLAG codes in the command output.

Dynamic EtherChannel Configuration

Dynamic Configuration

- PAgP configuration- CISCO'S
- LACP configuration- Industry standard IEEE

Example: LAN Used in EtherChannel



Configuration

```
SW1#configure terminal
SW1(config)#interface fa 0/14
SW1(config-if)#channel-group 1 mode active
SW1(config-if)#exit
SW1(config)#interface fa 0/15
SW1(config-if)#channel-group 1 mode active
SW1(config-if)#^Z
```

Verification & Observations:

```
SW1#show spanning-tree vlan 1
```

```
SW1#show etherchannel 1 summary
```

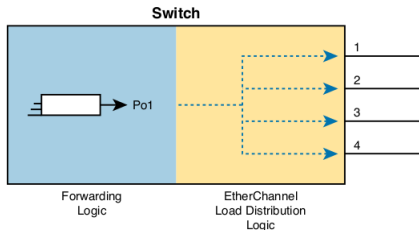
```
SW1#show etherchannel 1 port-channel
```

EtherChannel Load Distribution

Load Balance

- When using Layer 2 EtherChannels, a switch's MAC learning process associates MAC addresses with the PortChannel interfaces and not the underlying physical ports.
- Later, when a switch makes a forwarding decision to send a frame out a PortChannel interface, the switch must do more work: to decide out which specific physical port to use to forward the frame.
- IOS documentation refers to those rules as EtherChannel load distribution or load balancing.

Example: LAN Used in EtherChannel



Configuration & Verification

```
SW1#configure terminal
SW1(config)#port-channel load-balance <
    Method>
SW1(config)#port-channel load-balance src-
    mac
-----
SW1# show etherchannel load-balance
```

EtherChannel Load Distribution Methods

Method	Description	Layer
src-mac	Source MAC address	2
dst-mac	Destination MAC address	2
src-dst-mac	Both src and dest MAC	2
src-ip	Source IP address	3
dst-ip	Destination IP address	3
src-dst-ip	Both source and dest IP	3
src-port	Source TCP or UDP port	4
dst-port	Destination TCP or UDP port	4
src-dst-port	Both src and dest TCP or UDP	port 4

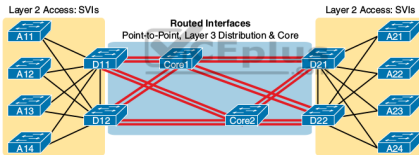
Layer 3 EtherChannel

Layer 3 EtherChannel

Introduction

- The routed interfaces can be used with a single point-to-point link between pairs of Layer 3 switches, or between a Layer 3 switch and a router.
- However, in most designs, the network engineers use at least two links between each pair of distribution and core switches, as shown in right figure.
- While each individual port in the distribution and core could be treated as a separate routed port, it is better to combine each pair of parallel links into a **Layer 3 EtherChannel**.

Presence of Two Links



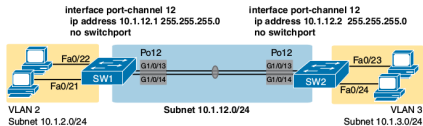
Combine multiple links (.e. routed ports) into a single link to forward packets in layer 3

Configuration

```
SW1#configure terminal
SW1(config)#interface G1/0/13
SW1(config-if)#channel-group 12 mode on
SW1(config-if)#exit
SW1(config)#interface G1/0/14
SW1(config-if)#channel-group 12 mode on
SW1(config-if)#^Z
```

```
SW1(config)#interface port-channel 12
SW1(config)#no switchport
SW1(config)#ip address 10.1.12.1
255.255.255.0
```

IP at port-channel & Verification



Similarly SW2 to be configured

```
SW1#show interfaces port-channel 12
SW1#show interfaces status
SW1#show ip route
```

Review Questions

1. An engineer configures a switch to put interfaces G0/1 and G0/2 into the same Layer 2 EtherChannel. Which of the following terms is used in the configuration commands?
 - (A) EtherChannel
 - (B) PortChannel
 - (C) Ethernet-Channel
 - (D) Channel-group
2. Which combinations of keywords on the channel-group interface subcommand on two neighboring switches will cause the switches to use LACP and attempt to add the link to the EtherChannel? (Choose two answers.)
 - (A) desirable and active
 - (B) passive and active
 - (C) active and auto
 - (D) active and active
3. A Cisco Catalyst switch needs to send frames over a Layer 2 EtherChannel. Which answer best describes how the switch balances the traffic over the four active links in the channel?
 - (A) Breaks each frame into fragments of approximately one-fourth of the original frame, sending one fragment over each link
 - (B) Sends the entire frame over one link, alternating links in sequence for each successive frame
 - (C) Sends the entire frame over one link, choosing the link by applying some math to fields in each frames headers
 - (D) Sends the entire frame over one link, using the link with the lowest percent utilization as the next link to use
4. Which of the following is/are true concerning EtherChannels?
 - (A) You can have up to six ports in a channel
 - (B) You can have up to eight channels on a switch
 - (C) Ports must be configured identically to form a channel
 - (D) RSTP dynamically groups ports into a channel
5. There are four connections between two switches running RSTP PVST+ and you want to figure out how to achieve higher bandwidth without sacrificing the resiliency that RSTP provides. What can you configure between these two switches to achieve higher bandwidth than the default configuration is already providing?
 - (A) Set PortFast and BPDU Guard, which provides faster convergence.
 - (B) Configure unequal cost load balancing with RSTP PVST+
 - (C) Place all four links into the same EtherChannel bundle.
 - (D) Configure PPP and use multilink.

THANK YOU