**EtherChannel**

**I. What is EtherChannel?**

- **Link Aggregation**: At its core, EtherChannel is a link aggregation technology. This means it bundles **multiple physical Ethernet links into a single logical link**.

- **Port Channel**: This logical link is called a "port channel." Think of it as a single, wider pipe instead of multiple smaller pipes

- It is used to provide fault-tolerance, load sharing, increased bandwidth, and redundancy between switches, routers, and servers.

- PagP EtherChannel can be configuzred with a maximum of 8 Ethernet ports of the same kind.

**II. Purpose of EtherChannel**

EtherChannel combines multiple physical links into a single logical link for increased bandwidth and redundancy, working alongside STP to prevent loops. PAgP and LACP are the protocols used for this, and this module provides configuration, verification, and troubleshooting guidance.

**III. Benefits of EtherChannel**

* **Increased Bandwidth:** Aggregates links for higher throughput.
* **Redundancy:** Ensures network continuity despite link failures.
* **Load Balancing:** Optimizes traffic distribution.
* **Simplified Management:** Centralized configuration.
* **STP Efficiency:** Streamlines Spanning Tree operations.

**IV. PagP Operation (Posr Aggregation Protocol)**

- PAgP takes place into two modes:

+ Auto Mode: Interface can respond to PagP packet negotiation but will never start one on its own. (Switch cấu hình ở chế độ “auto” nhưng không chủ động thương lượng/ đàm phán để tạo EtherChannel).

+ Desirable Mode: Interface actively attemps a negotiating state for PagP packet negotiation.(lSwitch ở chế độ auto và lắng nghe các gói PagP từ các switch khác).

**V. PagP Operation (Posr Aggregation Protocol) auto mode**

- PAgP's "auto" mode is a passive operational state. This means a switch configured in "auto" mode does not actively initiate the creation of an EtherChannel. Instead, it waits for another switch (configured in "desirable" mode) to send a negotiation request

- Steps by step:

1. **Listening:**

* A switch configured in "auto" mode continuously listens for PAgP packets sent from neighboring switches.
* It will not send any PAgP packets to actively request the creation of an EtherChannel.

**2. Receiving Request:**

* If another switch configured in "desirable" mode sends a PAgP packet, the switch in "auto" mode receives this packet.
* The PAgP packet from the "desirable" switch contains information indicating its desire to create an EtherChannel.

3. **Responding:**

* Upon receiving the PAgP packet from the "desirable" switch, the switch in "auto" mode responds by sending back PAgP packets.
* These response packets confirm that the "auto" switch agrees to participate in the EtherChannel creation.

4. **Creating EtherChannel:**

* If both switches (one "desirable" and one "auto") agree to participate, they proceed to create the EtherChannel.
* The physical links between the two switches are bundled into a single logical link (port channel).

5. **Remaining Idle:**

* If the switch in "auto" mode does not receive any PAgP packets from a "desirable" switch, it remains idle and does not create an EtherChannel.
* It continues to listen for PAgP packets in case a "desirable" switch appears later.

**VI. PagP Operation (Posr Aggregation Protocol) desirable mode**

- PAgP's "desirable" mode is an active operational state. This means a switch configured in "desirable" mode actively initiates the creation of an EtherChannel. It proactively seeks to establish an EtherChannel with neighboring switches.

- Desirable mode process:

1. **Initiating Request:**

* A switch configured in "desirable" mode actively sends PAgP packets to neighboring switches.
* These packets announce that the "desirable" switch wants to create an EtherChannel.

2. **Seeking Partner:**

* The "desirable" switch continuously sends PAgP packets to find neighboring switches that can cooperate to create an EtherChannel.
* It will accept neighboring switches that are in either "auto" or "desirable" mode.

3. **Negotiating:**

* When the "desirable" switch receives a response from a neighboring switch (in "auto" or "desirable" mode), they begin the negotiation process.
* This process includes verifying the compatibility of the physical links (speed, duplex, VLAN, etc.).

4. **Creating EtherChannel:**

* If the negotiation process is successful and compatibility is confirmed, the two switches create the EtherChannel.
* The physical links between the two switches are bundled into a single logical link (port channel).

5. **Maintaining State:**

* The "desirable" switch continues to send PAgP packets to maintain the EtherChannel state.
* It monitors the status of the physical links within the EtherChannel and makes necessary adjustments if there are issues.

**VII. LACP (Link Aggregation Control Protocol) – Vendor Neutral (IEEE 802.3ad)**

- There are certain parameters to match physical interfaces for EtherChannel include:

+ Speed and Duplex

+ Access or trunk mode

+ The VLANS allowed on the interface

+ The Native VLAN, if it’s a trunk port

+ Spanning-tree settings

- **Standard:** Vendor-independent link aggregation.

- **Dynamic:** Auto EtherChannel negotiation.

- **Modes:** Active (initiate), Passive (respond).

- **Checks:** Ensures link compatibility (speed, VLANs).

- **Load Balancing:** Distributes traffic across links.

- **Redundancy:** Failover if a link fails.

- **Monitoring:** Tracks link health.

- **Benefit:** Increased bandwidth.

**VII. LACP Active**

**1. Proactive Negotiation:**

* A device configured in Active LACP mode actively initiates the negotiation process. It doesn't wait for another device to start the conversation.
* It sends LACP Data Units (LACPDUs) to its connected neighbors, signaling its intent to form an EtherChannel.

**2. Always Negotiating:**

* Regardless of whether it receives LACPDUs from the other side, an Active LACP device will continue to send its own LACPDUs.
* This ensures that it's constantly trying to establish or maintain an EtherChannel.

**3. Forming EtherChannels:**

* An Active LACP device will form an EtherChannel with any device that is configured in either Active or Passive LACP mode.
* This flexibility makes it highly adaptable in various network environments.

**4. Use Case:**

* Active LACP is often preferred in scenarios where you want to ensure that an EtherChannel is established as soon as possible.
* It is also used when you want to be sure that your side of the connection will always be the one that is attempting to create the port channel.

**VIII. LACP Passive**

**1. Reactive Negotiation:**

* A device in Passive LACP mode does not actively initiate EtherChannel negotiations. It waits for another device to send LACP Data Units (LACPDUs).
* It only responds to LACPDUs received from an Active LACP device.

**2. Waiting Mode:**

* Essentially, it's in a listening state. It will only participate in forming an EtherChannel if another device actively requests it.

**3. Forming EtherChannels:**

* A Passive LACP device will only form an EtherChannel with a device that is configured in Active LACP mode.
* It will not form an Etherchannel with another device that is also in passive mode.

**4. Use Case:**

* Passive LACP is often used when you want to allow EtherChannels to form only when explicitly requested by another device.
* It can be useful for avoiding unintended EtherChannel formations.