Networking 2 - EtherChannel Operation (Review Notes)

6.1.1 Link Aggregation

- **EtherChannel** groups multiple physical links into **one logical link**, bypassing STP blocking.
- **Benefits:** Fault tolerance, load sharing, increased bandwidth, and redundancy.

6.1.2 EtherChannel

- Groups **Fast Ethernet or Gigabit Ethernet** ports into a **port channel (logical interface)**.

- Improves **switch-to-switch communication** speed.

6.1.3 Advantages of EtherChannel

✔ **Easy Configuration:** Configure once on the EtherChannel interface instead of individual ports.
✔ **Cost-effective:** No need for expensive high-speed links.
✔ **Load Balancing:** Spreads traffic across links using MAC/IP-based methods.
✔ **Redundancy:**

- If one physical link fails, the EtherChannel remains active.
- **No STP recalculations**

6.1.4 Implementation Restrictions

❌ **Cannot mix interface types (e.g., Fast Ethernet + Gigabit Ethernet).**
❌ **Limited number of links:**

- **Up to 8** ports per EtherChannel.
- **Supports up to 6** EtherChannels per switch.

❌ **Consistent Configuration Needed:**

- Both ends must match in terms of **trunking, VLANs, Layer 2 ports, and duplex settings**.

6.1.5 Auto-Negotiation Protocols

EtherChannels can be formed in **two ways:**

1. **Static (Manual)** – No negotiation required.
2. **Dynamic (Auto-Negotiation)** – Uses **PAgP** (Cisco proprietary) or **LACP** (IEEE standard).

6.1.6 PAgP (Port Aggregation Protocol) - Cisco Proprietary

- **Automatically forms EtherChannel by exchanging packets every 30 sec.**
- **Ensures configuration consistency** before forming a channel.
- **PAgP Modes:**
    - **On** → Forces EtherChannel **without negotiation** (both sides must be "On").
    - **Desirable** → Actively sends PAgP packets to form a channel.
    - **Auto** → **Passively** waits for PAgP packets (won't form channel if both sides are Auto).

✅ **Best combination for PAgP: Desirable + Auto OR Desirable + Desirable**
❌ **Auto + Auto won’t form EtherChannel!**

6.1.8 LACP (Link Aggregation Control Protocol) - IEEE Standard

- Works like PAgP but **not Cisco-exclusive**
- **Allows up to 8 active links + 8 standby links**
- **LACP Modes:**
    - **On** → Forces EtherChannel **without negotiation** (must match on both ends).
    - **Active** → **Actively** sends LACP packets to form a channel.
    - **Passive** → **Passively** waits for LACP packets

✅ **Best combination for LACP: Active + Passive OR Active + Active**
❌ **Passive + Passive won’t form EtherChannel!**

Key Takeaways:

✔ EtherChannel bypasses STP blocking, increases bandwidth, and provides redundancy.
✔ Requires identical settings on both ends (trunking, VLANs, port speed, etc.).
✔ Two main protocols:

- **PAgP (Cisco-only):** Uses Desirable/Auto modes.
- **LACP (Standard):** Uses Active/Passive modes.
  ✔ Static EtherChannel (On mode) doesn't use negotiation but requires manual setup.

6.2 EtherChannel Configuration

6.2.1 Configuration Guidelines

To successfully configure EtherChannel, follow these key guidelines:

Guideline	Description
EtherChannel Support	All interfaces must support EtherChannel; they do not need to be contiguous.
Speed & Duplex	All interfaces in an EtherChannel must have the same speed and duplex mode.
VLAN Matching	Interfaces must belong to the same VLAN or be configured as a trunk.
Allowed VLAN Range	If VLAN ranges differ, EtherChannel will not form, even in auto/desirable mode.

6.2.2 LACP Configuration Example

LACP-based EtherChannel is **not enabled by default** and requires manual configuration.

Topology

S1 and S2 are connected via two FastEthernet links (**F0/1 and F0/2**) to form an EtherChannel using **LACP**.

Configuration Steps

1. **Specify the interfaces** forming the EtherChannel.
2. **Create the port channel** using the channel-group command with **LACP mode active**.
3. **Configure the port channel** (e.g., set as trunk and specify allowed VLANs).

Commands to Configure LACP EtherChannel

```
S1(config)# interface range FastEthernet 0/1 - 2
S1(config-if-range)# channel-group 1 mode active
S1(config-if-range)# exit
```

```
S1(config)# interface port-channel 1
S1(config-if)# switchport mode trunk
S1(config-if)# switchport trunk allowed vlan 1,2,20
```

Important EtherChannel Commands

Command	Description
interface range <interface>	Select multiple interfaces to configure together.
channel-group <id> mode <mode>	Add interfaces to EtherChannel (PAgP/LACP/On).
interface port-channel <id>	Enter the logical EtherChannel interface.
switchport mode trunk	Set EtherChannel as a trunk port.
switchport trunk allowed vlan <vlans>	Define allowed VLANs on the trunk.

Modes for EtherChannel:

- **on** – Manual, no negotiation.
- **active** – LACP-enabled, actively negotiates.
- **passive** – LACP-enabled but waits for negotiation.
- **desirable** – PAgP-enabled, actively negotiates.
- **auto** – PAgP-enabled but waits for negotiation.

6.3 Verify and Troubleshoot EtherChannel

6.3.1 Verify EtherChannel

After configuring EtherChannel, verification is essential to ensure proper operation. The following commands help verify its status.

Command	Description
show interfaces port-channel	Displays the status of the port channel interface.
show etherchannel summary	Summarizes EtherChannel groups, ports, and statuses.
show etherchannel port-channel	Displays details about specific port channels.
show interfaces etherchannel	Shows EtherChannel configuration for interfaces.

6.3.2 Common Issues with EtherChannel Configurations

Misconfigurations can prevent EtherChannel from forming. Here are common causes:

Issue	Description
VLAN Mismatch	All ports must be in the same VLAN or configured as trunks.
Trunking Misconfiguration	Some ports are set to trunk mode while others are not. Trunk mode should be set on the EtherChannel, not individual ports.
Allowed VLAN Mismatch	Allowed VLANs must be the same on all trunk ports.
Incompatible PAgP/LACP Modes	Both ends must have compatible dynamic negotiation modes.

> Don't confuse **PAgP/LACP (EtherChannel protocols)** with **DTP (Dynamic Trunking Protocol)**, which only automates trunk formation.

6.3.3 Troubleshoot EtherChannel Example

If EtherChannel is not operational, follow these steps to troubleshoot:

Step 1: View EtherChannel Summary

Use show etherchannel summary to check the status.

Flags Analysis:

- **(SD) → Port-Channel is Down**
- **(D) → Ports are Down**
- Possible misconfigurations exist.

Step 2: View Port-Channel Configuration

Use show interfaces port-channel <id> to check the configuration.

Step 3: Correct the Misconfiguration

- Ensure **matching speed, duplex, and VLAN settings** on both switches.
- If using **trunking**, set it on the **port-channel**, not individual interfaces.
- Verify **PAgP/LACP mode compatibility** on both ends.

Step 4: Verify EtherChannel is Operational

Re-run show etherchannel summary to confirm the EtherChannel is now **Up (P)**.