🚀 Lecture 6 – Network Devices Overview

📶 1. Cisco Router Overview

A **router** is a network device used to **connect multiple networks** and route packets between them.
Cisco is the world's most trusted company for enterprise routers.

Routers use **routing tables + IP addresses** to send data to the correct network.

🔧 2. Modular & Non-Modular Routers

✔️ Modular Router

- Has **slots** where you can insert or remove modules.
- You can upgrade:
    - WAN ports
    - 4G/5G modules
    - Firewall modules
    - Additional Ethernet ports
- **Flexible and scalable**

📍 Example in real life

A company expands and needs more WAN links → they simply add one more WAN card in the router.

✔️ Non-Modular Router

- Fixed hardware.
- **Ports cannot be added or removed**.
- Low cost, suitable for small offices.

📍 **Example**

A small shop with 5–7 devices uses a non-modular router since requirements don't change.

🛑 **3. Types of Cisco Routers**

1️⃣ **Edge Router**

- Placed at the **boundary (edge)** of a network.

- Connects internal network → ISP network.

- High security + high speed.

📍 *Example:* ISP fiber line enters your company → edge router manages it.

2️⃣ **Core Router**

- Located in the **data center core**.

- Handles massive traffic.

- Very high speed (40Gbps, 100Gbps links).

📍 *Example:* In big companies like Google/Amazon/TCS internal backbone uses core routers.

3️⃣ **Branch Router**

- Used in **branch offices**, remote offices.

- Used for WAN links + VPN.

📍 *Example:* Bank branch router connecting to main HQ.

4️⃣ **Virtual Router**

- Software-based router (no physical hardware).

- Used in cloud environments (AWS, Azure).

📍 *Example:* Azure Virtual Network Gateway.

5️⃣ **Industrial Router**

- Used in factories, harsh weather, manufacturing plants.

- Dust-proof, vibration-proof, temperature-resistant.

📍 *Example:* Router used in machines in an oil refinery.

🔥 **Cisco ISR Routers (Very Important for Interview)**

ISR = Integrated Services Router

Best for:

- Branch offices

- Remote offices

Features:

- Security

- VPN

- Voice (VoIP)

- Wireless

- WAN optimization

📍 *Interview question:*
"Which router will you choose for branch office?"
👉 Answer: **Cisco ISR Router**

🔌 **4. Cisco Switches (Overview)**

A **switch connects multiple devices** inside the same network (LAN).
It is called an **intelligent device** because:

- It reads the MAC address

- Sends the packet only to the correct destination

- Reduces network congestion

🧠 **Layer 2 vs Layer 3 Switch**

✔️ **Layer 2 Switch**

- Works using **MAC addresses**

- Performs *switching only*

- No routing capability

📍 Example: Office LAN network connecting PCs → L2 switch

✔️ **Layer 3 Switch**

- Performs **routing + switching**

- Can assign IP

- Can configure routing protocols (RIP, OSPF, EIGRP)

📍 Example: Large buildings where each floor has separate network → L3 switch routes traffic between floors.

🔌 **Ports on Router**

✔️ **WAN Port (Serial Port)**

- Connects router to WAN/ISP

- Old routers use **serial ports**

- Modern routers use **Gigabit WAN ports**

✔️ **Ethernet Port**

- Used for LAN connections

✔️ **Console Port**

- Used to configure router in CLI mode

- Requires console cable + application like **PuTTY**

🔐 5. PuTTY – SSH & Telnet

PuTTY is a tool used to access network devices.

✔️ **SSH (Secure Shell)**

- **Encrypted**

- Username & password cannot be seen

- Recommended for network devices

✔️ **Telnet**

- **Not secure**

- Sends credentials in plain text

- Not recommended

📍 Example:
Accessing router using laptop via console cable → PuTTY → SSH.

💾 6. Router Memories (Very Important Topic)

Routers have **4 types of memory**, each with different purpose.

❇️ 1. ROM (Read Only Memory)

- Fixed memory on motherboard

- Cannot be modified

- Performs **POST** (Power On Self Test)

- Works like **BIOS** in computer

📍 Example: When router is powered on, ROM checks hardware.

❇ 2. Flash Memory

- Stores **Cisco IOS** (Operating System)
- Latest IOS version example: *15.7*
- Stores **VLAN.dat** (switch VLAN configuration)

📍 Example:
If flash fails → router cannot boot IOS.

❇ 3. NVRAM (Non-Volatile RAM)

- Stores **Startup Configuration**
- Data is saved even after power off
- Contains password, hostname, interface config

📍 Example:
You configure router name → save → stored in NVRAM → same name after reboot.

❇ 4. RAM / VRAM (Volatile Memory)

- Stores **Running Configuration**
- Temporary memory
- If router restarts → all running config is lost

📍 Example:
You configure interface IP but forget to save → restart → configuration gone.

🧠 Difference Between Running & Startup Config

Running Config	Startup Config
Stored in RAM	Stored in NVRAM
Temporary	Permanent

Running Config   Startup Config

Lost after reboot Stays even after reboot

📘 **Real Life Example of All Router Memories**

Imagine your router is like a mobile:

- **ROM → Bootloader / BIOS**

- **Flash → Android OS**

- **NVRAM → Saved settings (WiFi name, password)**

- **RAM → Apps currently open**

🏆 **Summary (Easy to Remember)**

- **Router** → Connects networks

- **Switch** → Connects devices

- **Modular router** → Add modules

- **Non-modular** → Fixed ports

- **ISR** → Branch office router

- **Layer 3 switch** → Routing + switching

- **SSH** → Encrypted

- **Telnet** → Not secure

- **ROM** → Boot process

- **Flash** → IOS

- **NVRAM** → startup-config

- **RAM** → running-config