Okay, let's go deep into **subnetting** — so you and your students can fully understand why we did /24 → /26 and what it means in the real world.

1. Original Network

We started with: 192.168.10.0/24

Subnet Mask: 255.255.255.0

- **/24** means:
    - First 24 bits = Network portion
    - Last 8 bits = Host portion
    - Available host IPs = $2^8 - 2 = 254$ usable addresses
- All devices in this /24 share **the same network ID** (192.168.10.0) and can talk to each other directly **without a router**.

2. Why Subnet?

If we have multiple departments (LANs) in **one organization**:

- Security: Prevent unnecessary broadcast traffic between departments
- Management: Keep each department's IP range separate
- Better control of IP allocation

Subnetting means breaking a single large network into **smaller logical networks**.

3. How We Did It: /24 → /26

We took /24 (255.255.255.0) and **borrowed 2 bits from the host part**:

Step	Value
Original host bits in /24	8
Borrowed bits	2
New host bits	6
New mask	255.255.255.192 (/26)
IPs per subnet	$2^6 = 64$ total (62 usable)

So /24 is split into 4 equal /26 networks:

Subnet #	Network ID	Usable Range	Broadcast
1	192.168.10.0/26	192.168.10.1 – 192.168.10.62	192.168.10.63
2	192.168.10.64/26	192.168.10.65 – 192.168.10.126	192.168.10.127
3	192.168.10.128/26	192.168.10.129 – 192.168.10.190	192.168.10.191
4	192.168.10.192/26	192.168.10.193 – 192.168.10.254	192.168.10.255

4. Does this mean different organizations?

No.
In our lab, **all subnets belong to the same organization**, but they are **different networks** inside it.
Example:

- One company with **Admin**, **Sales**, **HR** departments.
- Each department gets **its own subnet**.
- Without a router, devices in different subnets **cannot** talk to each other.

If different organizations were involved, they would usually have **totally different network IDs** (e.g., 192.168.1.0/24 and 192.168.2.0/24).

5. Why a Router Is Needed

Switches forward frames **inside a single subnet**.
When we split into multiple subnets:

- Traffic between them needs **Layer 3 routing** (router or L3 switch).
- That's why in Lab 1, the router connected each subnet on a different interface.

Lab 1 — Subnetting & Multi-Interface Router

Objective: Learn to subnet a network and connect multiple LANs to a single router using different interfaces.

Scenario

We have 3 departments: **Admin**, **Sales**, and **HR**. They should each be in a separate subnet.
We'll connect them to a single router, each on a different physical interface.

Step 1 — Equipment

- 1 Router (e.g., **Cisco 1941**)
- 3 Switches
- 6 PCs (2 per department)
- Copper straight-through cables

Step 2 — IP Address Planning

We'll use **192.168.10.0/24** and subnet it into 3 subnets.

- Subnet mask: /26 = 255.255.255.192 (64 IPs per subnet)
- Subnet ranges:
    1. Admin: 192.168.10.0 – 192.168.10.63
    2. Sales: 192.168.10.64 – 192.168.10.127
    3. HR: 192.168.10.128 – 192.168.10.191

Assign:

- Router G0/0 → Admin: 192.168.10.1/26
- Router G0/1 → Sales: 192.168.10.65/26
- Router G0/2 → HR: 192.168.10.129/26
- PCs → Sequential host IPs in their subnet

Step 3 — Physical Setup

1. Place the router and switches in Packet Tracer.
2. Connect:
    - Router G0/0 ↔ Switch 1 (Admin)
    - Router G0/1 ↔ Switch 2 (Sales)
    - Router G0/2 ↔ Switch 3 (HR)
    - PCs to their respective switches (straight-through cables)

Step 4 — Router Configuration

On the router:

```
enable
configure terminal
interface g0/0
 ip address 192.168.10.1 255.255.255.192
 no shutdown
exit
interface g0/1
 ip address 192.168.10.65 255.255.255.192
 no shutdown
exit
interface g0/2
 ip address 192.168.10.129 255.255.255.192
 no shutdown
end
write memory
```

Step 5 — PC Configuration

Manually assign IPs in each subnet and **set Default Gateway** to their router interface IP.

Step 6 — Verification

- ping from Admin PC to HR PC — should succeed
- Use show ip interface brief on router to verify all interfaces are **up/up**.