📘 Lecture 4 — Subnet Mask,Class C Subnetting

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1. Subnet Mask

What is a Subnet Mask?

A **Subnet Mask** is a **32-bit number** used in IPv4 that divides an IP address into:

- **Network Portion**
- **Host Portion**

It tells:

- How many bits belong to the **network**
- How many bits belong to **hosts**

Example:

IP Address: **192.168.10.0**
Subnet Mask: **255.255.255.0** → /24
Means:

- First **24 bits = Network**
- Last **8 bits = Host**

Why Subnet Mask is Used?

- Helps routers understand **which network an IP belongs to**
- Helps separate large networks into smaller networks (subnets)
- Controls the number of usable hosts

Daily-Life Example

You have a big office with 200 computers.
Instead of putting all in one network (slow + insecure), you divide them into groups:

- HR Department Network

- IT Department Network
- Sales Team Network

This division is done using **subnet masks**.

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2. Subnetting

Subnetting = Dividing a big network into multiple smaller networks.

Useful for:

- Increasing security
- Reducing congestion
- Better IP management

Example Subnetting Problem

Given:

IP: 192.168.10.0/25

Step 1: Identify Base Network Class

- 192.168.x.x → **Class C**
- Class C default mask = **/24**

So Class C has:

- First 3 octets = Network
- Last 1 octet = Host

STEP-BY-STEP SUBNETTING PROCESS

Step 1: Borrow Bits

Default Class C mask = **/24**
Given mask = **/25**

You borrowed:

- **1 bit** from host portion → now network portion = 25 bits.

Step 2: Calculate Total Subnets

Formula:
Number of Subnets = 2^n
Where **n = number of borrowed bits**

We borrowed **1 bit**, so:

- Subnets = **2^1 = 2 subnets**

Step 3: Calculate Hosts per Subnet

Formula:
Hosts per Subnet = 2^n (remaining host bits)

Originally Class C had 8 host bits.
We borrowed 1 → **7 host bits left**.

So:

- Total IPs = 2^7 = **128**
- Usable = 128 − 2 = **126**

(We subtract 2 because:
1st IP = Network Address
Last IP = Broadcast Address)

Step 4: Create Subnet Ranges

Subnet 1

- Network Address: **192.168.10.0**
- First Usable: **192.168.10.1**
- Last Usable: **192.168.10.126**
- Broadcast Address: **192.168.10.127**

Subnet 2

- Network Address: **192.168.10.128**
- First Usable: **192.168.10.129**
- Last Usable: **192.168.10.254**
- Broadcast Address: **192.168.10.255**

Step 5: New Subnet Mask

Why subnet mask changes?

Because we borrowed 1 bit, so the mask becomes:

/25 = 255.255.255.128

Reason:

- 128 in binary is **10000000**, showing 1 borrowed bit for network.

✓ **Full Summary Table**

Subnet #	Network Address	First Usable	Last Usable	Broadcast	Total Usable Hosts
1	192.168.10.0	192.168.10.1	192.168.10.126	192.168.10.127	126
2	192.168.10.128	192.168.10.129	192.168.10.254	192.168.10.255	126

Why Subnetting is Used?

- To divide networks into smaller groups
- To improve performance
- To prevent broadcast traffic
- To enhance security
- To allocate IPs efficiently (avoid waste)

Daily-Life Example

Imagine a school building:

- Department A needs 100 IPs
- Department B needs 50 IPs
- Department C needs 25 IPs

Instead of giving each department a full Class C network (254 hosts), subnetting allows:

- Each department to get exact IPs it needs
- No wastage
- Better data separation