



# 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**

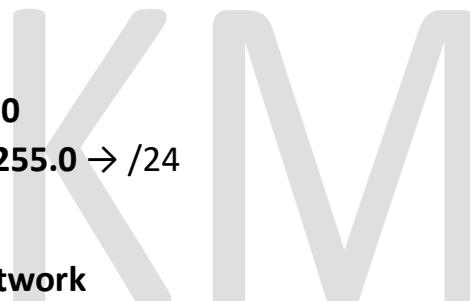
### Example:

IP Address: **192.168.10.0**

Subnet Mask: **255.255.255.0 → /24**

Means:

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



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### 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

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### 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

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### 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
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## STEP-BY-STEP SUBNETTING PROCESS

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### Step 1: Borrow Bits

Default Class C mask = /24

Given mask = /25

You borrowed:

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

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## **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**
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## **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.
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## ✓ 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 | 192.168.10.244 | 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