. What is Subnetting?

Imagine you have a **big house** with **10 rooms**. Instead of having **one huge room** for everything, you decide to divide it into **smaller rooms** for specific purposes (e.g., kitchen, bedroom, office).

In networking, **subnetting** is just like that!
We take **a big network** and divide it into **smaller networks (subnets)** to:

✔ Improve organization
✔ Reduce congestion (too much traffic in one place)
✔ Improve security

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2. How Do IP Addresses Work?

Every computer, phone, or device on the Internet has an **IP address** (like a home address).
Example: **192.168.1.5**

🔹 This IP address has **two parts**:

- **Network ID** → Identifies the overall network (like a street name).
- **Host ID** → Identifies a specific device inside that network (like a house number).

Example:
📍 **192.168.1.5**

- **192.168.1** → Network ID
- **.5** → Host ID (specific device)

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3. Why Do We Need Subnet IDs?

Let's say you have **a company with 5000 computers** in one office.
If all computers are in **one big network**, it will be **chaotic** because:

❌ Too much data traffic
❌ Hard to manage all devices
❌ Security risks

💡 **Solution:** Divide the big network into **smaller networks** (subnets).
Each **subnet** gets its own **Subnet ID** to help route data properly.

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4. What is a Subnet Mask?

A **Subnet Mask** tells us which part of an IP address is:
✔ **Network ID**
✔ **Subnet ID**
✔ **Host ID**

Example:

- IP Address: **192.168.1.5**
- Subnet Mask: **255.255.255.0**

🔹 **255.255.255.0** means:
✔ The first **3 parts** (**192.168.1**) are the **Network ID**
✔ The last part (**.5**) is the **Host ID**

This means **all computers in 192.168.1.0 – 192.168.1.255** are in **one subnet**.

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5. CIDR Notation (Shortcut for Subnet Masks)

Instead of writing **255.255.255.0**, we can simply write **/24**.
✔ **192.168.1.5/24** means the first **24 bits** are **Network + Subnet**, and the rest is Host.

🔹 Example Subnets:

CIDR	Subnet Mask	Usable Hosts
/24	255.255.255.0	254
/27	255.255.255.224	30
/30	255.255.255.252	2

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6. How Many Devices Can Fit in a Subnet?

Each subnet has a limited number of available **Host IDs**.

Example 1: **255.255.255.0** (or **/24**)

- The last **8 bits** are used for hosts.
- **2 addresses** are reserved (one for network, one for broadcast).
- **254 devices** can connect.

Example 2: **255.255.255.224** (or **/27**)

- The last **5 bits** are used for hosts.
- **30 devices** can connect.

Final Summary

- **Subnetting** is like dividing a big house into smaller rooms.
- An **IP address** has **Network ID, Subnet ID, and Host ID**.
- A **Subnet Mask** defines which part is Network, Subnet, or Host.
- **CIDR notation** is a shorthand for subnet masks (e.g., **/24** = **255.255.255.0**).
- The **smaller the subnet, the fewer devices** it can hold.