Breaking It Down: Subnetting, CIDR, and Network IDs

1️⃣ Address Classes and Their Limitations

- Originally, IP addresses were divided into **Class A, B, and C** networks.
- Each class had fixed sizes:
  - **Class A:** 8-bit network ID, ~16M hosts
  - **Class B:** 16-bit network ID, ~65K hosts
  - **Class C:** 24-bit network ID, ~254 hosts
- **Problem:** These sizes were too rigid. A company might need **500** IPs, but Class C (254 hosts) was too small, and Class B (65,534 hosts) was too big.

2️⃣ Subnetting and Its Limitations

- **Subnetting** helped divide larger networks into smaller sub-networks.
- But it still relied on the **original class structure**, which was not flexible enough.

3️⃣ CIDR (Classless Inter-Domain Routing) to the Rescue! 🚀

- **CIDR removes address classes.** Instead of fixed network sizes, it allows **custom network sizes**.
- Uses **Subnet Masks** (like `255.255.255.0`) to define networks.
- **CIDR Notation** (`/24`, `/23`, etc.) helps simplify things.

4️⃣ Example: How CIDR Works

Let's take an IP address:

- `9.100.100.100/24`
  - **Subnet Mask:** `255.255.255.0`
  - **Network ID:** `9.100.100.0`
  - **Host ID:** `100` (The remaining part)
  - **Usable IPs:** 254

Now, instead of using **two separate /24 subnets**, we can use:

- `9.100.100.100/23`
  - **Subnet Mask:** `255.255.254.0`
  - **Network ID:** `9.100.100.0`
  - **Usable Hosts: 510**
  - **Why?** `2^9 = 512`, but we remove **2 IPs** (network + broadcast).

🔑 Key Takeaways:

✔ CIDR allows **flexible network sizes** without wasting IPs.
✔ Routers **store fewer routing table entries**, improving efficiency.
✔ **Larger subnets = more usable hosts.**