What is an IP Address?

- An IPv4 address is a 32-bit number, written as 4 decimal numbers (0-255) separated by dots. Example: 192.168.1.5

- Each of the 4 parts (called octets) is 8 bits. So: 8 x 4 = 32 bits total.

Why are IPs limited to 0-255 per block?

- Because 1 octet = 8 bits = 2^8 = 256 values -> range: 0 to 255.

- Example: 192.168.1.5 is valid; 800.567.300.1 is invalid (over 255).

What is CIDR?

- CIDR = Classless Inter-Domain Routing.

- CIDR notation is like 192.168.1.0/24 -> the number after the slash (/) means "how many bits are for the network".

- Example: /24 means 24 bits for the network and 8 bits for hosts.

What is a Subnet Mask?

- Another way to express CIDR in full decimal format.

- Example: /30 -> 255.255.255.252 (binary: 11111111.11111111.11111111.11111100)

CIDR vs Subnet Mask

- CIDR is short form (e.g., /30)

- Subnet mask is full form (e.g., 255.255.255.252)

- Both mean the same thing: how a 32-bit IP is divided between network and host.

How to Calculate IPs from CIDR?

Formula:

- Total IPs = 2^(32 - CIDR)

- Usable IPs = Total - 2 (1 for network address, 1 for broadcast)

Examples:

- /30 -> Total IPs = 4, Usable = 2

- /29 -> Total = 8, Usable = 6

- /24 -> Total = 256, Usable = 254

Real DevOps Use Case: AWS VPC Example

Step 1: Create VPC with CIDR block

- CIDR: 10.0.0.0/16 -> 65,536 total IPs (2^16)

- Means 16 bits for network, 16 bits for hosts

Step 2: Create Subnets

- Public Subnet: 10.0.1.0/24 -> 254 usable IPs

- Private Subnet: 10.0.2.0/24 -> 254 usable IPs

- Each subnet has the same first 24 bits (network) and different host ranges.

Where You Use CIDR & Subnets in DevOps?

- AWS VPC (CIDR block & subnets)

- AWS Security Groups (allow/deny IP ranges using CIDR)

- Docker custom bridge networks

- Kubernetes pod/service networks

- VPN access rules and firewalls

Summary:

- IPv4 address = 32 bits, split into 4 octets (0-255)

- CIDR (/X) tells how many bits are for the network.

- Subnet mask = same info in decimal format (e.g., 255.255.255.252)

- Used everywhere in DevOps (AWS, Docker, Kubernetes, firewalls)

Key Chart:

| CIDR | Subnet Mask | Total IPs | Usable IPs |
|---|---|---|---|
| /30 | 255.255.255.252 | 4 | 2 |
| /29 | 255.255.255.248 | 8 | 6 |
| /28 | 255.255.255.240 | 16 | 14 |
| /27 | 255.255.255.224 | 32 | 30 |
| /24 | 255.255.255.0 | 256 | 254 |