

# DAY 6 - IPv4

Purinat33

## IPv4 Addresses

- 32 bits addresses.
- Separated into 4 octets of 8 bits each.
- Written in dotted decimal notation

|          |          |          |          |
|----------|----------|----------|----------|
| 192      | 168      | 1        | 254      |
| 11000000 | 10101000 | 00000001 | 11111110 |

Each octet have values from 0-255.

## Network and Host portion:

eg. 192.168.1.2 / 24

- /24 bits netmask signifies **How many bits are used to identified the network portion** (Which network the IP belongs to).
  - 192.168.1.0 Network.
  - 192.168.1.2 Host
  - 24 bits are used to identify the Network.
  - 32- 24 = 8 bits are used to identify the Host.

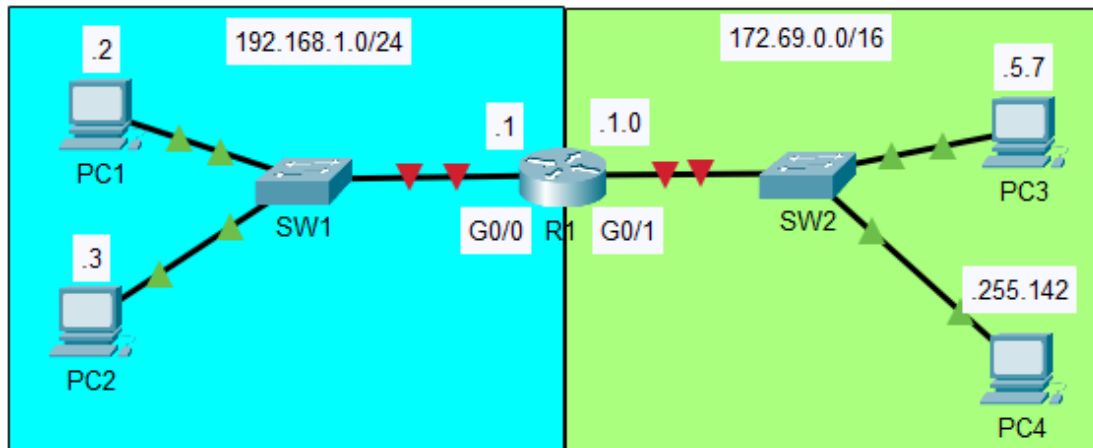
## Netmask

- How many bits are used to identified the network portion.

eg.

- /8
  - 8 bits network portion.
  - 11111111 .00000000.00000000.00000000
  - 255 .0.0.0
- /16
  - 16 bits network portion.
  - 11111111 . 11111111 .00000000.00000000

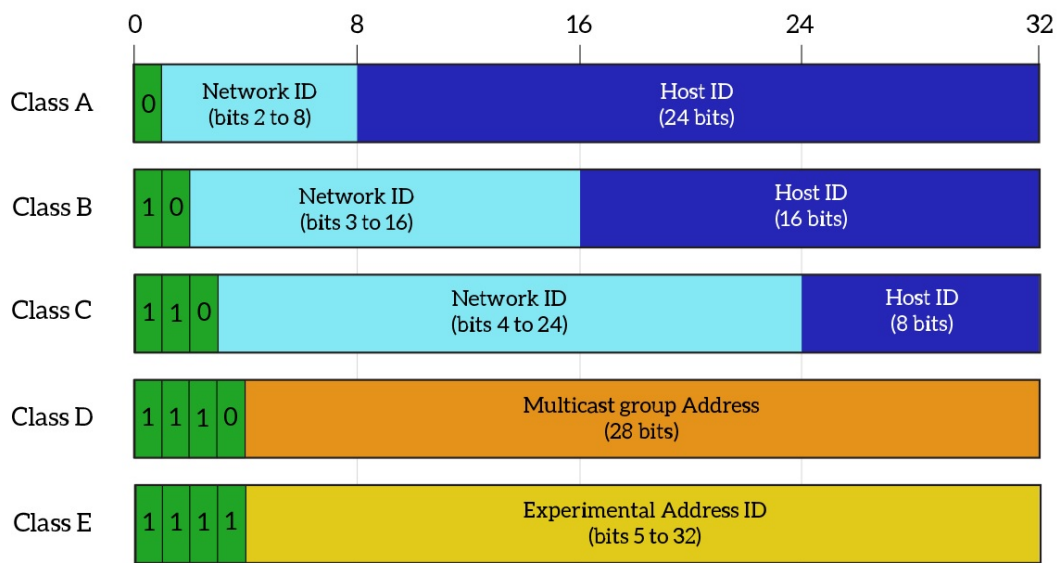
- 255 . 255 .0.0
- /24
  - 24 bits network portion.
  - 11111111 . 11111111 . 11111111 .00000000
  - 255 . 255 . 255 .0
- /21
  - 21 bits network portion.
  - 11111111 . 11111111 . 11111000 .00000000
  - 255 . 255 . 248 .0



- 192.168.1.0/24 Network
  - PC1: 192.168.1.2
  - PC2: 192.168.1.3
  - R1's G0/0 Interface: 192.168.1.1
- 172.69.0.0/16 Network
  - PC3: 172.69.5.7
  - PC4: 172.69.255.142
  - R1's G0/1 Interface: 172.69.1.0

## IPv4 Address Classes:

| Class | 1st octet of IP address | Default Subnet Mask | Network / Host | Number of networks | Maximum nodes in a network |
|-------|-------------------------|---------------------|----------------|--------------------|----------------------------|
| A     | 1 - 126                 | 255.0.0.0           | N.H.H.H        | 126                | 16,777,214                 |
| B     | 128 - 191               | 255.255.0.0         | N.N.H.H        | 16,384             | 65,534                     |
| C     | 192 - 223               | 255.255.255.0       | N.N.N.H        | 2,097,152          | 254                        |
| D     | 224 - 239               |                     |                |                    |                            |
| E     | 240 - 254               |                     |                |                    |                            |



## What is Loopback Address:

- Notice Class A nor B have 127.x.x.x .
- This is because 127.x.x.x ranges are used for **Loopback Addressing**
- Address used to test the network model on the local device.

```
C:\Users\User>ping 127.0.0.1

Pinging 127.0.0.1 with 32 bytes of data:
Reply from 127.0.0.1: bytes=32 time<1ms TTL=128
Reply from 127.0.0.1: bytes=32 time<1ms TTL=128
Reply from 127.0.0.1: bytes=32 time<1ms TTL=128
Reply from 127.0.0.1: bytes=32 time<1ms TTL=128

Ping statistics for 127.0.0.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

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## Important IP Addresses in each network:

1. **Network Address:** When all host's bits == 0
2. **Broadcast Address:** When all host's bits == 1  
(These cannot be used as host/device's IP Addresses)

eg. 192.168.6.4/24

- **Network Address** = 192.168.6. 00000000 (192.168.6.0)
  - **Broadcast Address** = 192.168.6. 11111111 (192.168.6.255)
3. **First Usable Host Address** = The IP address *after* the network address.
  4. **Last Usable Host Address** = The IP address *before* the broadcast address.

eg. 192.168.6.4/24

- **Network Address** = 192.168.6. 00000000 (192.168.6.0)
- **Broadcast Address** = 192.168.6. 11111111 (192.168.6.255)
- **First Host** = 192.168.6.1
- **Last Host** = 192.168.6.254

5. **Number of usable hosts:**  $\text{pow}(2, 32 - \text{netmask}) - 2$

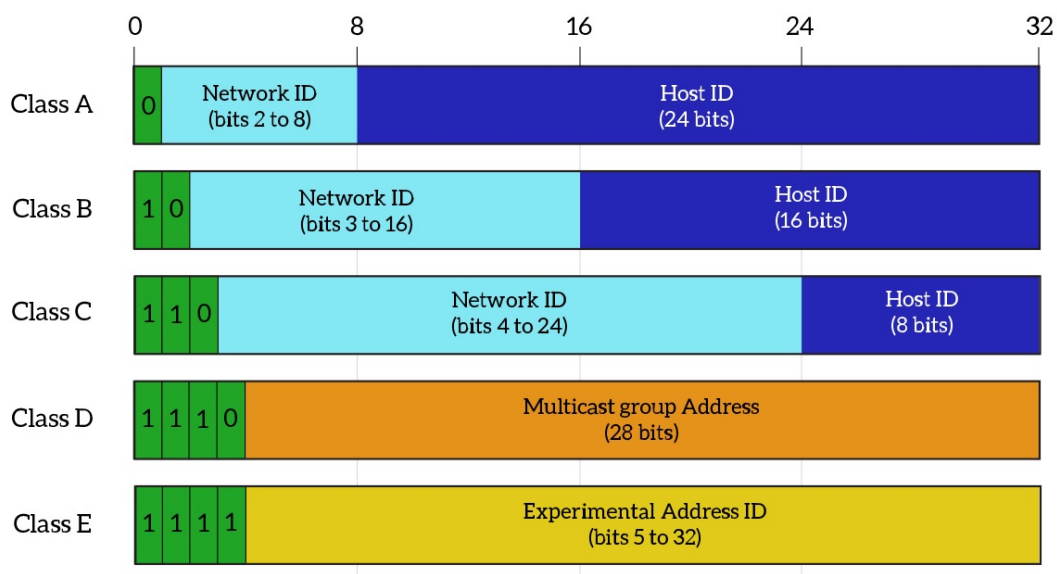
eg. 192.168.6.4/24

- **Network Address** = 192.168.6. 00000000 (192.168.6.0)
  - **Broadcast Address** = 192.168.6. 11111111 (192.168.6.255)
  - **First Host** = 192.168.6.1
  - **Last Host** = 192.168.6.254
  - **Usable Hosts** =  $\text{pow}(2, 32 - 24) - 2 = 256 - 2 = 254$
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# Summary

## IPv4 Address Classification:

| Class | 1st octet of IP address | Default Subnet Mask | Network / Host | Number of networks | Maximum nodes in a network |
|-------|-------------------------|---------------------|----------------|--------------------|----------------------------|
| A     | 1 - 126                 | 255.0.0.0           | N.H.H.H        | 126                | 16,777,214                 |
| B     | 128 - 191               | 255.255.0.0         | N.N.H.H        | 16,384             | 65,534                     |
| C     | 192 - 223               | 255.255.255.0       | N.N.N.H        | 2,097,152          | 254                        |
| D     | 224 - 239               |                     |                |                    |                            |
| E     | 240 - 254               |                     |                |                    |                            |



- **127.x.x.x** : **Loopback Address**, for testing networking on the local device.

## IP Address:

- Separated in 4 Octets of 8 bits each.
- Each octet can have value between **0** to **255**.
- **x.x.x.x/y** with **/y** netmask denoting how many *bits* are part of the *Network* identifier, while the remaining bits identify the unique *host* within that Network.
- **Important IP Address** given an IP:
  - **Network IP**: The identifier of *the Network* itself.
    - \* All Host bits = **0**
  - **Broadcast IP**: The broadcast address of that network.

\* All Host bits = 1

eg: Given a **Class B** IP address of 172.16.59.4/16 :

1. **Netmask:** /16
2. **Network Portion:** 172.16 .59.4
3. **Host Portion:** 172.16. 59.4
4. ***Network Address:*** 172.16.0.0
5. ***Broadcast Address:*** 172.16.255.255
6. **First Usable Address:** 172.16.0.1
7. **Last Usable Host:** 172.16.255.254

Fast identifying important IPs will be in a separate note

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