IP & IP address

A name (domain name) indicate what we seek, An address (IP addr.) indicate where its is. A route indicate how to get there.

- An IP address is an online device address used for communicating across the internet.

Simple way → IP address is like a digital address for a device on the internet.

and IP is internet protocol. It ensure data reach the right system.

Example → You are sending your friend a book ~~on stand~~ or message through internet.

TCP (transmission control protocol) ensure that your data reaches in same way just like you send.

& IP (internet protocol) ensure that the data reaches the right place (right IP address).

Two type of IP address

i) IPv4 ii) IPv6

- **IPv4 :-**

octet

Represents as (e.g) → 192.86.0.1 → one octet represents in 8 bi

→ 192.86.0.00000001 (Representation of 1 in binary number)

So 192.86.0.1 can be written as

11000000 . 01010110 . 00000000 . 00000001

8 bits 8bits 8bits 8bits

= 8 x 4 = 32

- Size of IPv4 = 32 bits

- Now each bit represent 0, 1 which mean two state.

So 8 bit can make ⇒ 2^8 = 256 unique address.

→ 00000000 - 1st address
→ 00000001 - 2nd address
→ 00000010 - 3rd address
⋮
→ 11111111 - 256th address

- So IPv4 can provide ⇒ 4.3 billion unique address
⇒ 2^{32} = 4.3 billion

- IPv6 →

Represent as → 2001 : 0db8 : 85a3 : 0000 : 0000 : 8a2e : 0370 : 7334

group of 8

2001 : 0db8 : 85a3 : 0000 : 0000 : 8a2e : 0370 : 7334

4 4 4 . . . . .

→ In 8 octet group there are 4 length of bits.

→ Each octet here represent hexadecimal values.

Hexadecimal →

- It is a base 16 - numbering system
- Uses → 0-9 ~~letters~~ numbers → 10
  A-F letters → 6
  16

→ In IPv4, each bit represent 0 & 1. So size of IPv4 is →

total bits X total octet = 8 X 4 = 32 bits

→ In IPv6, each bit represent hexadecimal value (16 values). So size is

~~total bit x total octet~~

→ octets X bits in octet = 8 X 4 = 32

→ Now 32 x hexadecimal digits in each bit = 32 X 16 = 128 bits

Size of IPv6 is = 128 bits

So No of unique address $= 2^{128} = 340$ undecillion.

We will focus on IPv4.

• Classes in IP address

- Classes in IP address

IP Class	Address range	Subnet Masking	Application
Class A	1 to 126	255.0.0.0	Used for large number of hosts.
Class B	128 to 191	255.255.0.0	Used for medium size network
Class C	192 to 223	255.255.255.0	Used for local area network
Class D	224 to 239	NA	Reserve for multicasting
Class E	240 to 254	NA	This class reserve for research & development

First octet always says the class of IP address

e.g. 198.168.0.1

↳ This is class C IP address.

Q How we can find IP address into binary form

→ We know, there are four octet in IP address

→ Each octet is of 8 bits → 00000000

→ We can write 1 as → 00000001

→ For 0 its → 00000000

- For 168 how we can find

We know

bit	1st bit	2nd bit	3rd bit	4th bit	5th	6th	7th	8th
written as	2^0	2^1	2^2	2^3	2^4	2^5	2^6	2^7
	⇒1	⇒2	⇒4	⇒8	⇒16	⇒32	⇒64	⇒128

or 0 0 0 0 0 0 0 0 ⇒ Now adelition of 128 to 1 ⇒ 255
128 64 32 16 8 4 2 1.

Now for 168

- First we create table

128	64	32	16	8	4	2	1

- Follow 3 steps then

1) Check if given no. (168) is greater than table number (125)
2) If true, write 1 below 128 & subtract given no. to table number ⇒ ie 168 ⇒ 128 ⇒ True

& 168 (subtract)
−128
040

128	64	32	16	8	4	2	1
1							

3) If given no., say 106 ⇒ 128 → False
Write 0 below 128 & skip subtract

168
128 True
40

128	64	32	16	8	4	2	1
1							

→ Next is 64, we take the new number i.e the subtracted (40)
is 40 ≥ 64 False
do write 0 and skip subtract

128	64	32	16	8
1	0			

→ Next is 32, is 40 ≥ 32 True
Then write 1 below 32 & subtract

40
−32
8

128	64	32	16	8
1	0	1		

→ Next is 16, is 8 ≥ 16, False write 0 & skip subtract

128	64	32	16	8	4
1	0	1	0		

→ Next is 8, is 8 ≥ 8, True, write 1 & subtract

8
−8
0

128	64	32	16	8	4	2
1	0	1	0	1		

→ Now 0 is here, so we can write 0 on the left values

128	64	32	16	8	4	2	1
1	0	1	0	1	0	0	0

So 168 in binary is 10101000
Similar with 198

So far we have studied → IP, IP address, IPv4, IPv6
→ IP classes
→ change IP address to binary numbers

Now the Network Part & host part in IP address

We know IP classes i.e

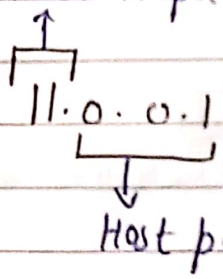
Class A → 1.0.0.1 to 126.255.255.254

Class B → 128.0.0.1 to 191.255.255.255

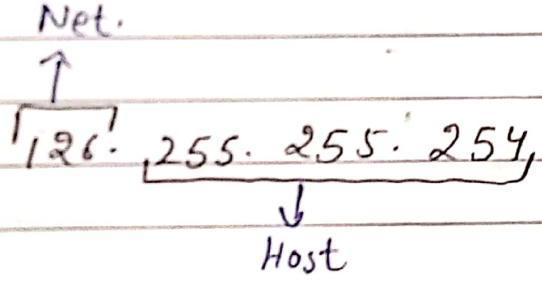
Class C → 192.0.1.1 to 223.255.255.254

In Class A →

e.g. Network part



to



255.255.254
8bit . 8bit . 8bit = 24

$= 2^{24} = 16.8$ Million host

What is Network & host

Network Part →

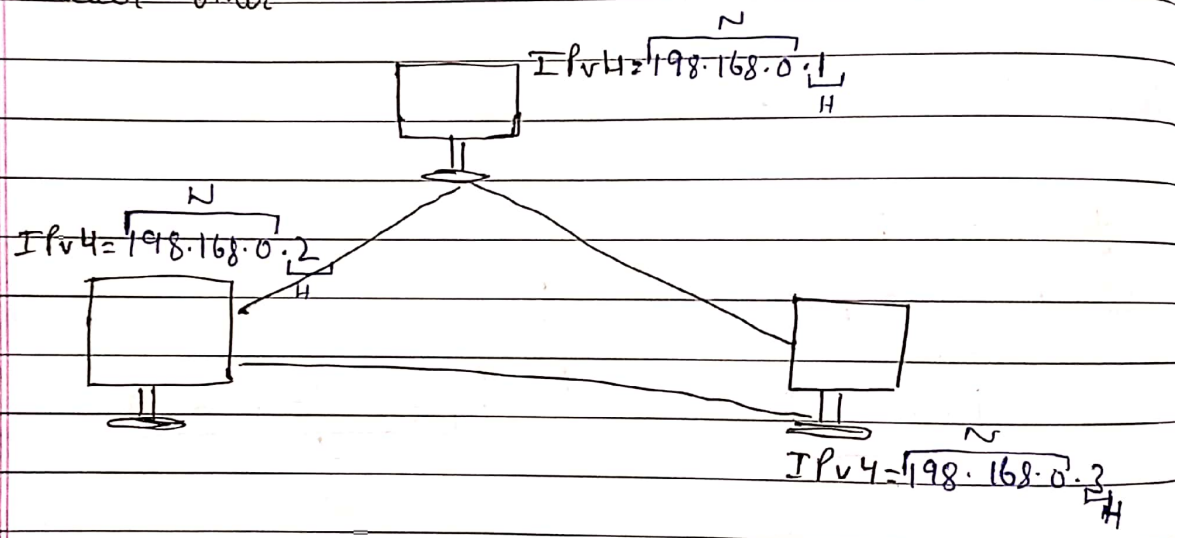
All devices which are connected with eachother have same network Part.

So network part define the network to which devices belong.

Host part:

The host part identifies a specific device within that network.

e.g. Let say multiple computer connected with each other



Here the network part is same define, ~~which~~ the network address by which these computers are connected

And host is different, host is like individual computer, like your phone, your laptop, so host are different.

Now we discussed about network & host in classes.

Class A →

Network

11.0.0.1

Host

11 is the networking address and 0.0.1 are no. of host which can are connected to that address.

Class B:

128.0.0.1 (H) to 191.255.255.254 (Host)
N — Network

2 octet = 16 bit
$= 2^{16}$ = host can connect

- In class B, two octet define the network part and rest two octet define the host.

e.g.

129.69.72.3 (H)
N

- Here 129.69 define the network address by which computers are connected with each other
- And the host part define the address of that host system i.e phone, laptop.

Class C:

192.0.1.1 (H) to 223.255.255.254 (H)
N — N

1 octet = 8
$2^8 = 256$

- In class C, three octet define the network part and rest one octet define the host part.

Here you can take any example.

192.168.1.1 ..... 192.168.254 Valid IP addr

how?

Date
Page 10

read this

Important points:

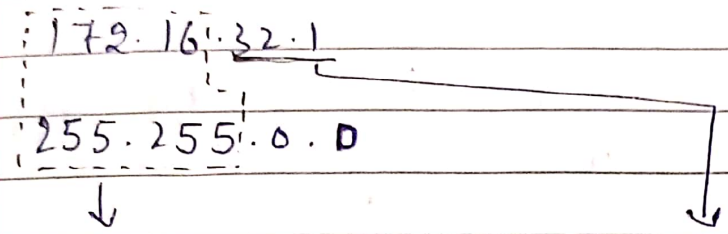
- In IP address, all 256 host are not available
- Its 256 - 2 = 254 host that are available.
- This is because in IP address, say 192.168.1.0. Here 0 represent network itself i.e 192.168.1.0 is for network

And, say 192.168.1.255, here .255 address is used to send data to all hosts so cannot assign. So 192.168.255 is brodcast IP address

Subnet mask →

- Let say I write IP address 172.16.32.1
- How you can say what is network part and what is host part.
- For this we use subnet mask.
- When we write ipconfig in terminal it will write ip address and the subnet mask of that IP address.
- Subnet mask is written as 255.255.0.0
- This 255 difine the address used for identifying the network address.

back to example if the IP address, 172.16.32.1 has subnet mask 255.255.0.0



This is our network part and host part is .32.1
So 172.16 is our network add. and .32.1 is our host

IPv4

e.g. 19.236.3.12

subnet 255.0.0.0

So 19 is the network part and .236.3.12 is host part.

So 19 is our network add. and .236.3.12 is our host

CIDR:

Before we know about CIDR first know classful addressing.

- Classful addressing:

It is basically IP address divided into classes. Class A, Class B, class C etc.

Why ~~CIDR~~ classful fails

Let's take an example

- Classful addressing was like giving out houses without considering the need.
- This lead to waste because some people got bigger house while they need small and vice-versa.

To solve this we introduce CIDR->

Classless interdomain routing.

Written as -> IP address

192.168.1.0/24 -> Notation for CIDR

-> define 24 bits are used for network addressing

->

- This also define subnet mask i.e 24 = 8bits x 8bits

-> 255.255.0.0

8bits 8bits

Let say I have 127, how we gonna find subnet

-> 192.168.0.0/27

- If it is 24, then it is in class ie Class B
- Now 27 is not in class, it is classless

192.168.0.0/24 → 8×8×8 = 24
Network

255.255.255.0
8 8 8

Net bit = 24
Number of network = 2^{24}
1 host = $2^8 - 2 = 256 - 2$
= 254

196.168.0.0/27
→ 8×8×8 = 24 bits
24 + 3 = 27

255.255.255.0
8 8 8 | 3+5
24

So
bits
8 8 8 3 + 5 bit
Network | Host

192.168.0.0/27
bits
8 8 8 . 3 + 5

Net bit = 24
Subnet bit = 3
host bit = 5

Number of subnet = 2^3
= 8 − 1 = 7
↓
1 is for network

Number of host = $2^5 - 2 = 30$
So host will be 30

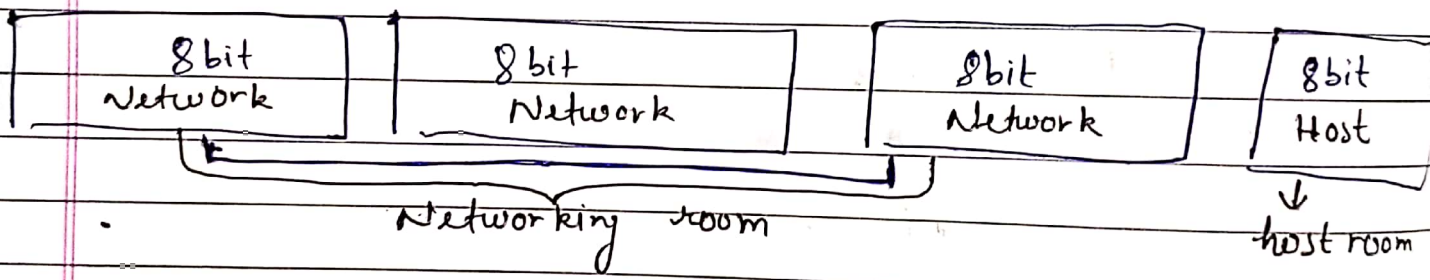
Now we need to find these subnets which is 7 here.

Now then let take example →

→ Privously it was 0.0/24 which define

bit
8 8 8 8

Think each 8 bit as a subnet room

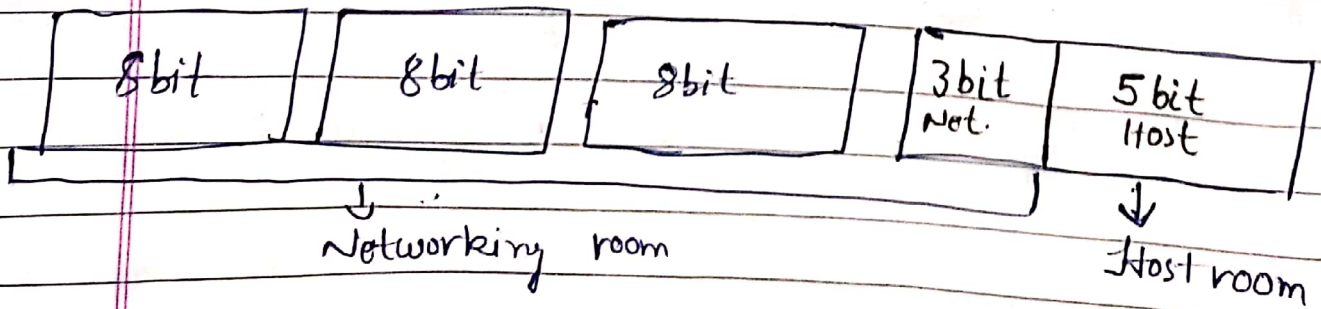


→ But now its 196.168.0.0/27

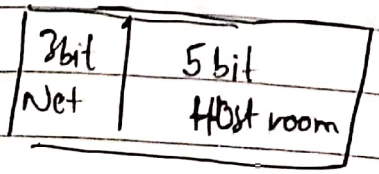
8 . 8 . 8 . 3 + 5

(27) Network Host

Now we are taking some portion of 4th octet to make it network.



→ Now take this



If we want to ~~write~~ ~~it~~ ~~compare it with~~ represent this room we use table

3			5					
128	64	32	16	8	4	2	1	= 256 — (1)

⇒ 128+64+32 = 224 (2) | 16+8+4+2+1 = 31 → Not used in any calculation

128 64 192 32 224 15 16 31 16 8 4 2 1 31

Magic Number = ~~1+2~~ · 1-2 = 256 - 224 = 32

32 is my magic number & 7 subnet is possible (previous page)

Total subnetwork i.e my total 7 subnetworks

(1) →	192.168.0.0/27
(2) →	192.168.0.32/27
(3) →	192.168.0.64/27
(4) →	192.168.0.96/27
(5) →	192.168.0.128/27
(6) →	192.168.0.160/27
(7) →	192.168.0.192/27
(8) →	192.168.0.224/27 → Not available for device assignment

- Now number of host is 30
Take 192.168.0.0/27 to 0.32/27
- we know 192.168.0.0 define network ~~is~~ not ~~taken~~ also 0.32/27 is for brodcast.
- So available IP addresses are

192.168.0.1 —— 192.168.0.31

Total host ⇒ 31 - 1 = 30