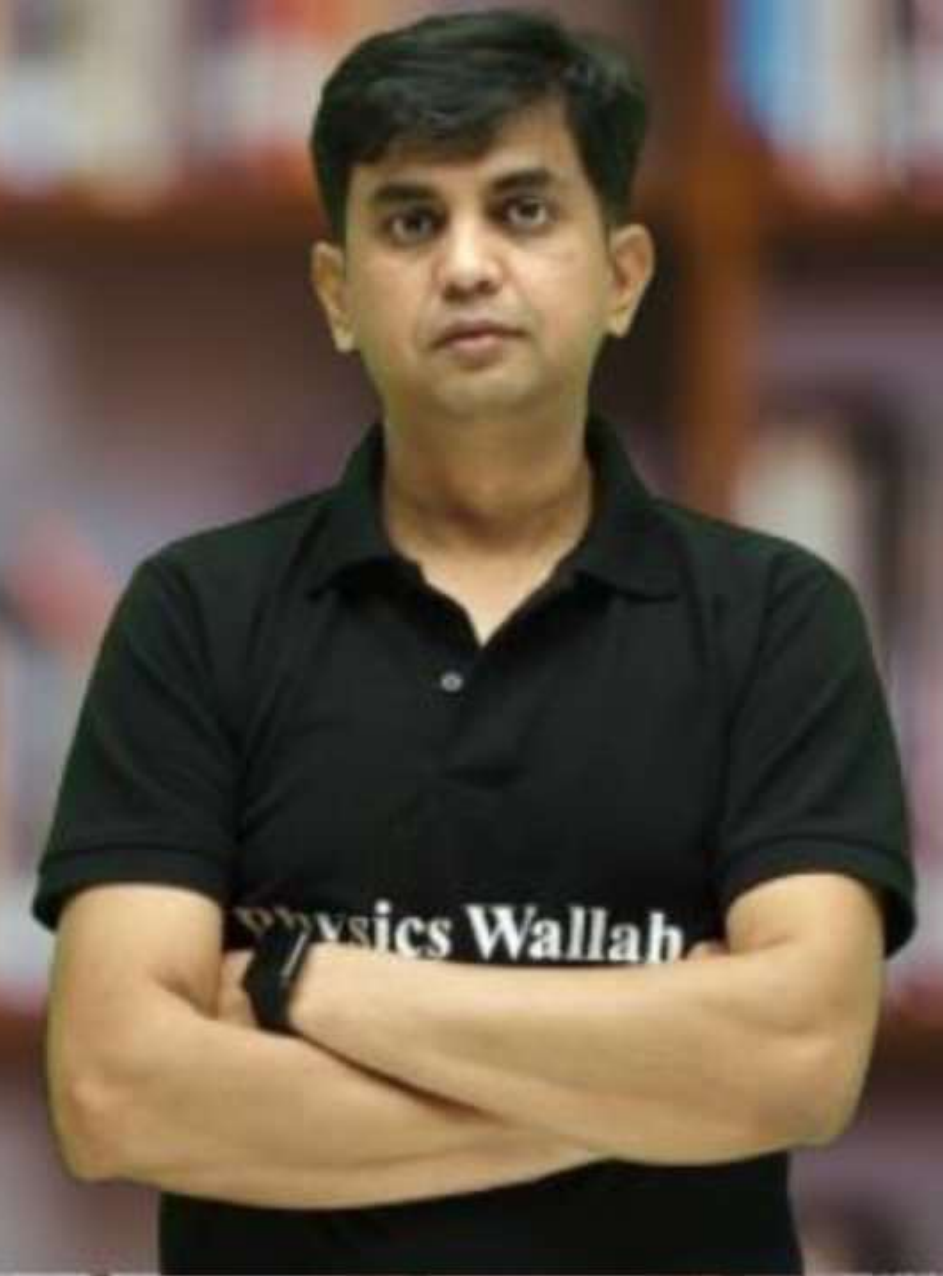# CS & IT ENGINEERING

2025

Computer Network

IPv4 Addressing

Lecture No. - 02

By - Abhishek Sir

Recap of Previous Lecture

Topic — IPv4 Address

Topic — Network Address

Topic — Broadcast Address

Topics to be Covered

Topic — Network Size

Topic — Network Mask

Topic — Classful IPv4 Address

ABOUT ME

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#Q. Consider a class-less IPv4 network, the broadcast address (special IPv4 address) of this network is "175 . 175 . 175 . 255", which is/are can be a network address (special IPv4 address) of this network ?

(A) 175 . 160 . 0 . 0

(B) 175 . 175 . 0 . 0

(C) 175 . 175 . 160 . 0

(D) 175 . 175 . 175 . 0

[Ans : C & D]

Broadcast Add. ⇒ 175·175·175·255

175·175· 1010 1111 · 1111 1111

$\underbrace{}$ Min^m 20 bit Net ID $\underbrace{}$ Max^m 12 bit Host ID

Network Address :-

① 12 bit host ID ⇒ 175·175·160·0

② 11 — // —

8 bit host ID ⇒ 175·175·175·0

① 2 bit — // —

Topic : Multicast Transmission

IGMP

→ One-to-many transmission

→ One host is sender and group of hosts are receiver

Source IP Address   =   Host IP Address

Destination IP Address   =   Multicast Address
                              [Special IP Address as a Group ID]

→ Host IP address (32-bits)

→ Used to identify a host uniquely world wide

NetID field $(x - bits)$ =   As Assigned

HostID field $(y - bits)$ =   Any thing
[Except all zero and all one bits]

#Q. Consider a class-less IPv4 network where network id bits assigned to this network are "1100 1100 1010", what is the first and last host IP address of this network which can be assigned to a host?

Network Address = 204·160·0·0

First Host IP Add. = 204·160·0·1

1100 1100   1010 0000   0000 0000   0000 0001

1100 1100   1010 1111   1111 1111   1111 1110

Last Host IP Add. = 204·175·255·254

Broadcast Add. = 204·175·255·255

#Q. Consider an IPv4 address of a class-less IPv4 network is "115 . 120 . 125 . 130 / 19", write network address, broadcast address, first and last host IP address of this network?

IP Add. ⟹ 115.120.125.130/19

115.120. 011,11101 · 130/19

⟨19 bit Net ID⟩   ⟨13 bit Host ID⟩

Last Host IP ⟹
115.120.127.254/19

Network Address = 115.120.96.0/19

115.120. 011,00000 · 0 /19

⟨Net ID⟩   ⟨Host ID⟩

Broadcast Add. = 115.120.127.255/19

115.120.011,11111 · 255/19

First Host IP ⟹ 115.120.96.1/19

#Q. In the network "200 . 10 . 11 . 144 / 27", the fourth octet (in decimal) of the last IP address of the network which can be assigned to a host is _____ .

IP Add. = 200.10.11.144/27

200.10.11.100 10000/27

NetID (27 bit)   Host ID
                  5 bit

Ans = 158

Last host IP Add. =

200.10.11.100 11110/27

200.10.11.158/27

→ Network Size : Maximum possible number of hosts can be in a network

→ HostID field (y - bits)

Network Size = $[2^y - 2]$ hosts per network

#Q. Consider a class-less IPv4 network, the number of bits in the network id field are 22, how many maximum number of hosts can be in this network?

$$Net\ ID \Rightarrow x\ bits = 22\ bits$$

$$Host\ ID \Rightarrow y\ bits = (32-x) = (32-20) = 10\ bits$$

$$Network\ Size = (2^y - 2)$$

$$= (2^{10} - 2)\ hosts\ per\ network$$

$$= 1022\ hosts\ per\ network$$

$$\boxed{Ans = 1022}$$

→ Network Mask (Netmask) [32-bits]

$$\text{NetID field} \quad = \quad \text{All One Bits}$$

$$\text{HostID field} \quad = \quad \text{All Zero Bits}$$

Network Id [1 1 1 1 1 .... 1 1]	Host Id [0 0 0 0 0 .... 0 0]

x bits y bits

→ Binary string used to produce "Network Address" of an IP address

Network Address ← IP Address [bit-wise AND] Netmask

→ All hosts belongs to same network must have same "Network Address"

IP Address :

Network Id	Host Id

[bit - wise AND]

Network Mask :

1 1 1 1 . . . . . . 1 1 1	0 0 0 0 . . . . 0 0 0 0

Network Address :

Network Id	0 0 0 0 . . . . 0 0 0 0

$$a \text{ AND } 1 = a$$
$$a \text{ AND } 0 = 0$$
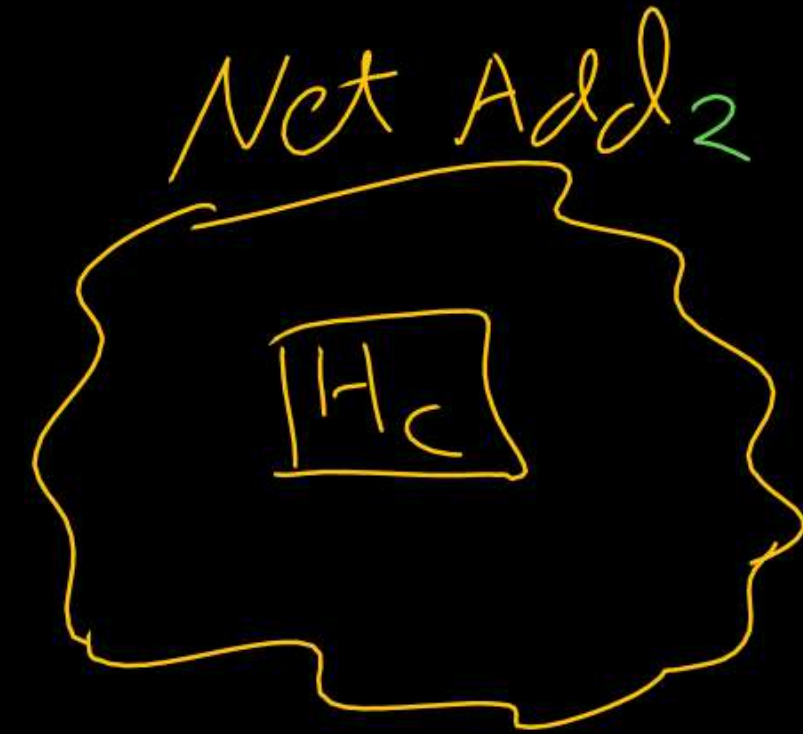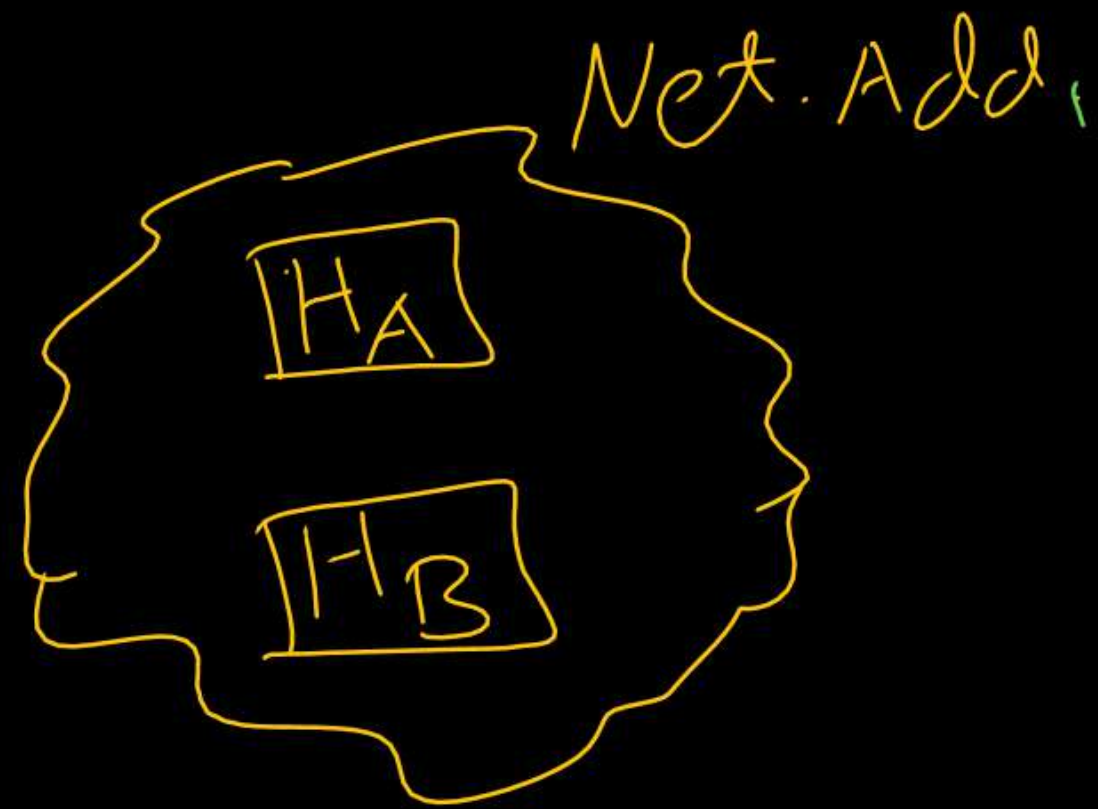
#Q. Consider a class-less IPv4 network, the network mask of this network is "255 . 255 . 248 . 0", how many maximum number of hosts can be in this network?

NetMask → 255.255.248.0

255.255. 11111000 . 0

NetID (21 bit)   11 bit HostID

Network Size = $(2^{11} - 2)$ hosts per network
            = 2046 hosts per network

#Q. A subnet has been assigned a subnet mask of "255 . 255 . 255 . 192". What is the maximum number of hosts that can belong to this subnet?

(A) 14

(B) 30

(C) 62

(D) 126

$$\text{Mask} \Rightarrow 255.255.255.192$$

$$255.255.255.\underbrace{11000000}_{6 \text{ bit Host ID}}$$

$$\text{Max}^m \text{ no. of hosts} = (2^6 - 2) \text{ hosts}$$

$$= 62 \text{ hosts}$$

Ans : C

#Q. The subnet mask for a particular network is "255 . 255 . 31 . 0". Which of the following pairs of IP addresses could belong to this network?

[GATE 2003]

(A) 172 . 57 . 88 . 62 and 172 . 56 . 87 . 233

(B) 10 . 35 . 28 . 2 and 10 . 35 . 29 . 4

(C) 191 . 203 . 31 . 87 and 191 . 234 . 31 . 88

(D) 128 . 8 . 129 . 43 and 128 . 8 . 161 . 55

H.W.

IIT-M

#Q. Suppose computers A and B have IP addresses "10 . 105 . 1 . 113" and "10 . 105 . 1 . 91" respectively and they both use the same netmask N. Which of the values of N given below should not be used if A and B should belong to the same network?

[GATE 2010]

(A) 255 . 255 . 255 . 0

(B) 255 . 255 . 255 . 128

(C) 255 . 255 . 255 . 192

(D) 255 . 255 . 255 . 224

IIT-G
H.W.

#Q. Consider three machines M, N and P with IP addresses "100 . 10 . 5 . 2", "100 . 10 . 5 . 5" and "100 . 10 . 5 . 6" respectively. The subnet mask is set to "255 . 255 . 255 . 252" for all the three machines. Which one of the following is true?

[GATE 2019]

(A) M, N and P all belong to the same subnet

(B) Only N and P belong to the same subnet

(C) Only M and N belong to the same subnet

(D) M, N, and P belong to three different subnets

#Q. Two computers C1 and C2 are configured as follows. C1 has IP address "203 . 197 . 2 . 53" and netmask "255 . 255 . 128 . 0". C2 has IP address "203 . 197 . 75 . 201" and netmask "255 . 255 . 192 . 0". Which one of the following statements is true?

IIT KGP

[GATE 2006]

H.W.

(A) C1 and C2 both assume they are on the same network

(B) C2 assumes C1 is on same network, but C1 assumes C2 is on a different network

(C) C1 assumes C2 is on same network, but C2 assumes C1 is on a different network

(D) C1 and C2 both assume they are on different networks

Problem : How many bits are assigned for network id field?

→ IPv4 address are categorized into two type :

    1. Classfull IPv4 Address

       → Static Assignment : NetID field size defined implicitly

    2. Classless IPv4 Address

       → Dynamic Assignment : Need to define NetID field size explicitly

→ Classfull IPv4 Address are of five types :

1. Class A

2. Class B

3. Class C

4. Class D

5. Class E

→ IP Address = 0...

[Start with Zero bit]

Network ID : 8 - bits

Host ID : 24 - bits

→ IP address range : 0.0.0.0 to 127.255.255.255

Number of Networks = 2^7

Number of Hosts per Network = $[2^{24} - 2]$

→ Network Mask : 255.0.0.0

→ IP Address = $\overline{10}$..

[Start with One & Zero bits]

Network ID : 16 - bits

Host ID : 16 - bits

→ IP address range : 128.0.0.0 to 191.255.255.255

Number of Networks = 2^{14}

Number of Hosts per Network = $2^{16} - 2$

→ Network Mask : 255.255.0.0

→ IP Address = 110...

                           [Start with One, One & Zero bits]

      Network ID   : 24 - bits

      Host ID   : 8 - bits

→ IP address range : 192 . 0 . 0 . 0 to 223 . 255 . 255 . 255

      Number of Networks   = 2^{21}

      Number of Hosts per Network = $[2^8 - 2] = 254$ hosts

→ Network Mask : 255 . 255 . 255 . 0

#Q. In the IPv4 addressing format, the number of networks allowed under Class C addresses is :

IIT-D

(A) 2^7

(B) 2^{14}

(C) 2^{21}

(D) 2^{24}

Ans : C

→ IP Address = 1110..

[Start with One, One, One & Zero bits]

→ IP address range : 224.0.0.0 to 239.255.255.255

→ Used for "Multicasting"

→ Class D IPv4 address can not be a host IP address /Special IP Add

→ It is used as "Group Id" by IGMP
[Internet Group Message Protocol]

→ IP Address = <u>1111</u>...

[Start with four times Ones]

→ IP address range : <u>240 . 0 . 0 . 0</u> to <u>255 . 255 . 255 . 255</u>

→ Special IP Add.

→ <u>Reserved</u> for <u>future use</u>

Classful,
Class A,
Class B,
Class C,

Class	IP	NetID Bits	First Octet	Efficincy
Class A	0....................	8 - bits	0 to 127	50 %
Class B	10....................	16 - bits	128 to 191	25 %
Class C	110..................	24 - bits	192 to 223	12.5 %
Class D	1110................	N. A	224 to 239	6.25 %
Class E	1111................	N. A	240 to 255	6.25 %

100%.

→ Number of bits for network id field are assigned 'Dynamically'

→ No any prefix bits for IPv4 address
  [Unlike Classfull IPv4 Address]

→ Classless IPv4 Address : P . Q . R . S / x

→ Prefix / Slash notation [x] represent "number of network id bits"

Topic Network Size

Topic Network Mask

Topic Classful IPv4 Address

THANK - YOU