CS & IT ENGINEERING

2025

Computer Network

IPv4 Addressing

Lecture No. - 03

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Topic — Network Size

Topic — Network Mask

Topic — Classful IPv4 Address

Topics to be Covered

Topic — Subnetting

Topic — Subnet Mask

ABOUT ME

Hello, I'm Abhishek

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#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?

(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

Ans : D

A)

```
172.  57. 88. 62          172. 56. 87.233
255.255. 31.  0           255.255. 31.  0
---------------------     ---------------------
172. 57. □.  0            172. 56. □.  0
```

B)

```
 10. 35. 28.  2            10. 35. 29.  4
255.255. 31.  0           255.255. 31.  0
--------------------      --------------------
 10. 35. 28.  0            10. 35. 29.  0
```

```
28 → 00011100
31 → 00011111
28 ← 00011100

29 → 00011101
31 → 00011111
29 ← 00011101
```

c)

```
191 . 203 . 31 . 87
255 . 255 . 31 .  0
--------------------
191 . 203 .    .  0
```

```
191 . 234 . 31 . 88
255 . 255 . 31 .  0
---------------------
191 . 234 .    .  0
```

D)

```
128 .   8 . 129 . 43
255 . 255 . 31 .  0
--------------------
128 .   8 . 1 .  0
```

```
128 .   8 . 161 . 55
255 . 255 . 31 .  0
---------------------
128 .   8 . 1 .  0
```

$$129 \rightarrow 10000001$$
$$31 \rightarrow 00011111$$
$$1 \leftarrow 00000001$$

$$161 \rightarrow 10100001$$
$$31 \rightarrow 00011111$$
$$1 \leftarrow 00000001$$

#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]

$IP_A \rightarrow$ 10.105.1.113
$IP_B \rightarrow$ 10.105.1.91

(A) 255 . 255 . 255 . 0

(B) 255 . 255 . 255 . 128

(C) 255 . 255 . 255 . 192

(D) 255 . 255 . 255 . 224

113 → 01110001
91 → 01011011

Ans : D

#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

$IP_M \rightarrow 100.10.5.2$
$IP_N \rightarrow 100.10.5.5$
$IP_P \rightarrow 100.10.5.6$

Subnet Mask $\rightarrow$ 255.255.255.252

Ans: B

M $\rightarrow$ 2 = 00000010
N $\rightarrow$ 5 = 00000101
P $\rightarrow$ 6 = 00000110

252 $\rightarrow$ 11111100

#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?

[GATE 2006]

IIT KGP

(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

Ans : C

Host C_1

IP$_1$: 203 . 197 .   2 . 53
Netmask$_1$: 255 . 255 . 128 .   0

Net. Add.$_1$: 203 . 197 . ◯ . 0

IP$_2$: 203 . 197 . 75 . 201
Netmask$_1$: 255 . 255 . 128 .   0

Net. Add.   : 203 . 197 . ◯ . 0

Host C_2

IP$_2$: 203 . 197 . 75 . 201
Netmask$_2$: 255 . 255 . 192 .   0

Net. Add.$_2$: 203 . 197 . 64 . 0

IP$_1$: 203 . 197 .   2 . 53
Netmask$_2$: 255 . 255 . 192 .   0

Net. Add.   : 203 . 197 . ◯ . 0

$2 \rightarrow 00000010$
$128 \rightarrow 10000000$
$0 \leftarrow 00000000$

$75 \rightarrow 01001011$
$128 \rightarrow 10000000$
$0 \leftarrow 00000000$

$75 \rightarrow 01001011$
$192 \rightarrow 11000000$
$64 \leftarrow 01000000$

$2 \rightarrow 00000010$
$192 \rightarrow 11000000$
$0 \leftarrow 00000000$

→ Dividing (logically) a network into smaller manageable sub-networks

→ Sub-network (subnet) : Clustering of hosts inside a network

→ Clustering of hosts based on some bits of host identifier (HostId) field
   [In practice, most significant bits of host identifier]

* Host ID
    5 bit

* 2 bit
    Subnetting

0 0	0 0 0
0 0	0 0 1
0 0	0 1 0
0 0	0 1 1
0 0	1 0 0
0 0	1 0 1
0 0	1 1 0
0 0	1 1 1
0 1	0 0 0
0 1	0 0 1
0 1	0 1 0
0 1	0 1 1
0 1	1 0 0
0 1	1 0 1
0 1	1 1 0
0 1	1 1 1

1 0	0 0 0
1 0	0 0 1
1 0	0 1 0
1 0	0 1 1
1 0	1 0 0
1 0	1 0 1
1 0	1 1 0
1 0	1 1 1
1 1	0 0 0
1 1	0 0 1
1 1	0 1 0
1 1	0 1 1
1 1	1 0 0
1 1	1 0 1
1 1	1 1 0
1 1	1 1 1

→ Before subnetting, IP address having two sections :

    1. Network Identifier (Net ID) : x - bits

    2. Host Identifier   (Host ID) : y - bits

→ Size of IP address field = $(x + y)$ bits

Topic : Subnetting $[y_1 - \text{bit subnetting}]$

(P W)

→ After subnetting, IP address having three sections :

1. Network Identifier   (Net ID)   : x - bits

2. Sub-network Identifier (Subnet ID) : y_1 - bits

3. Host Identifier   (Host ID)   : y_2 - bits $\Big\}$ y bit

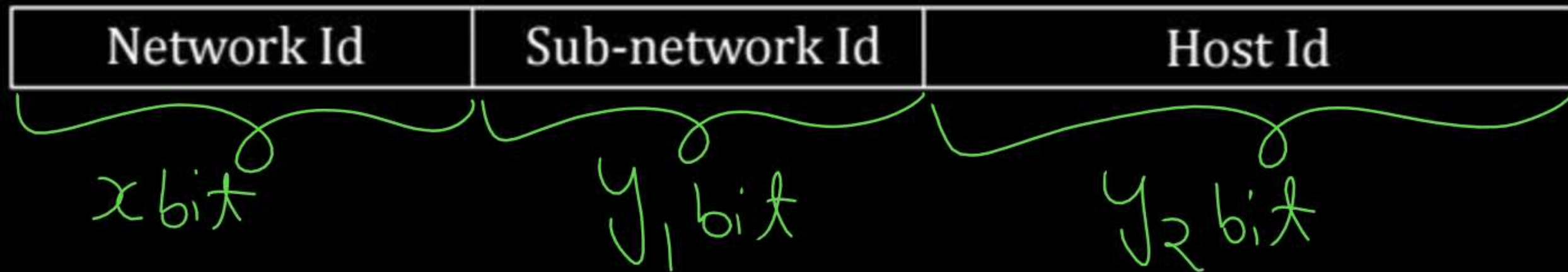→ Size of IP address field = $(x + y_1 + y_2)$ bits

$[\, y = y_1 + y_2 \,]$

Before Subnetting

Network Id	Host Id

x bit .... y bit

After Subnetting

Network Id	Sub-network Id	Host Id

x bit .... y_1 bit .... y_2 bit

→ Special IP address (32-bits)

→ Used to represent a sub-network

NetID field $=$ As Assigned

Subnet ID $=$ [Anything]

HostID field $=$ [All Zero Bits]

Net Id	Subnet Id	Host Id [0 0 0 0 ..... 0 0 0 0]

x bit y_1 bit y_2 bit

→ Special IP address (32-bits)

→ Used to broadcast a packet to all hosts belongs to a sub-network

$$\text{NetID field} \quad = \quad \text{As Assigned}$$

$$\text{Subnet ID} \quad = \quad [\text{Anything}]$$

$$\text{HostID field} \quad = \quad [\text{All One Bits}]$$

Net Id	Subnet Id	Host Id [1 1 1 1 .... 1 1 1 1]

x bit $\qquad$ y_1 bit $\qquad$ y_2 bit
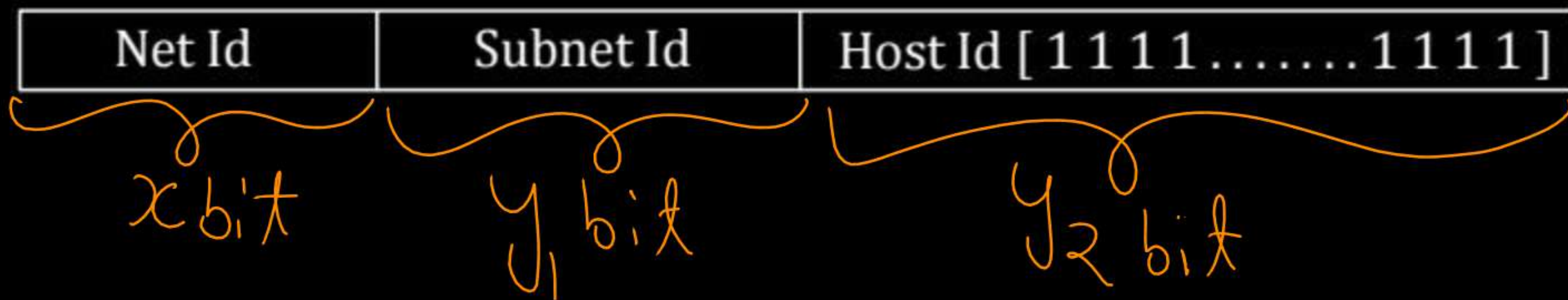
→ Host IP address (32-bits)

→ Used to identify a host uniquely world wide

NetID field   (x - bits)   =   As Assigned

Subnet ID field (y_1 - bits)   =   [Anything]

HostID field   (y_2 - bits)   =   Any thing

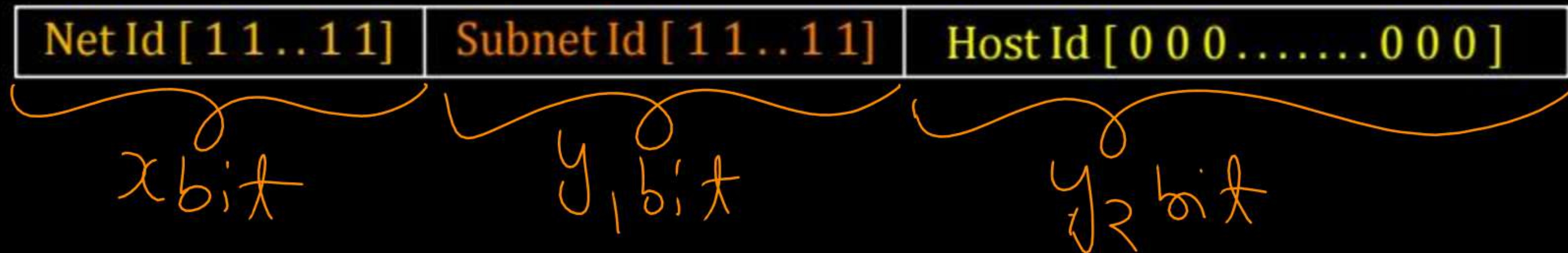   [Except all zero and all one bits]

Net Id	Subnet Id	Host Id
x bit	y_1 bit	y_2 bit

→ Sub-network Mask (Subnet mask) [32-bits]

NetID field	=	All One Bits
Subnet ID field	=	All One Bits
HostID field	=	All Zero Bits

→ Used to generate subnet address from a given IP address

Net Id [1 1 .. 1 1]	Subnet Id [1 1 .. 1 1]	Host Id [0 0 0 .... 0 0 0]

x bit y_1 bit y_2 bit

Topic Subnetting

Topic Subnet Mask

THANK - YOU