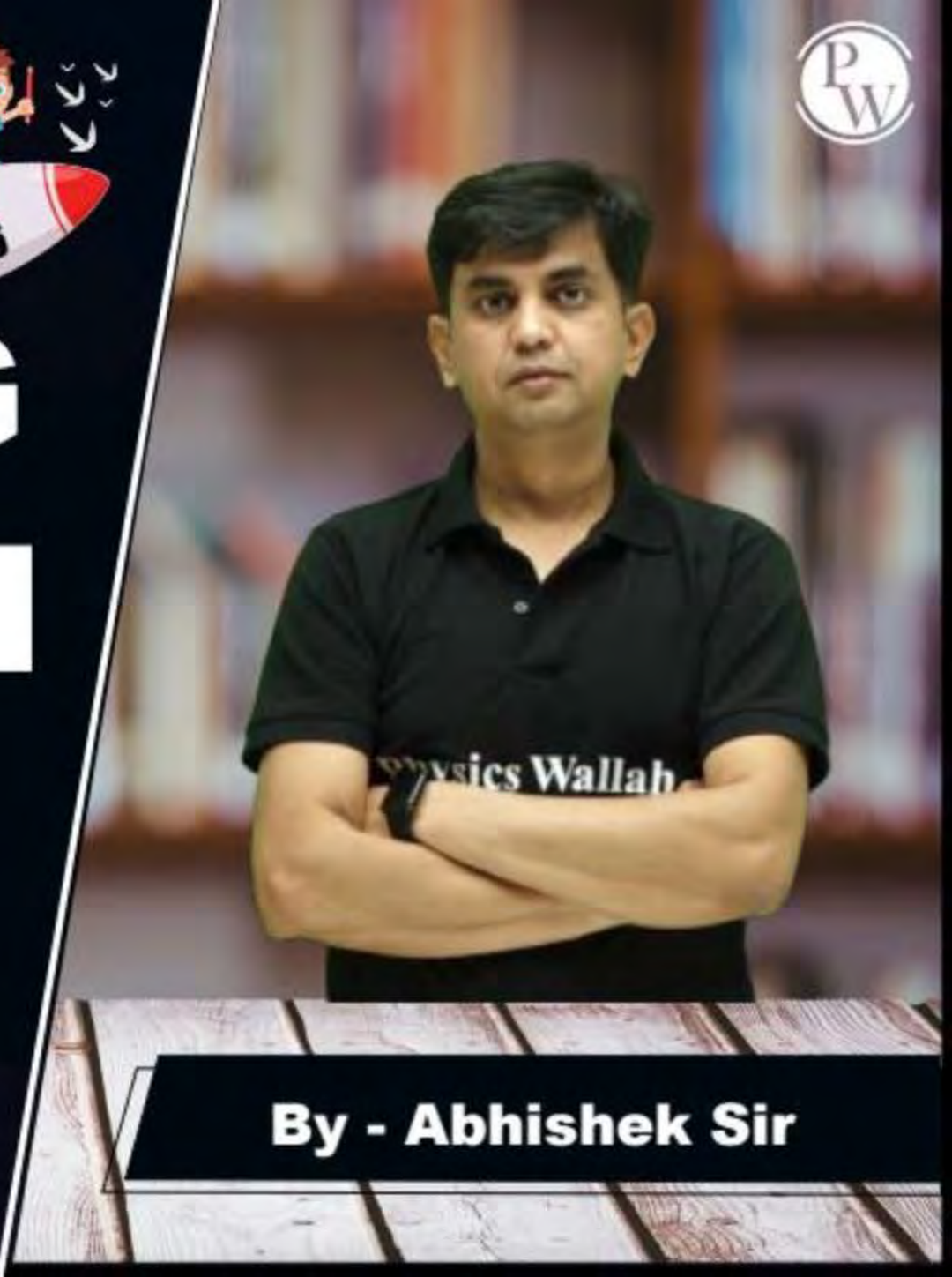
CS & IT ENGINEERING

Computer Network

IPv4 Address

Lecture No. - 04



By - Abhishek Sir

Recap of Previous Lecture

Topic Classful IPv4 Address

Topics to be Covered

Topic Subnetting

ABOUT ME

Hello, I'm Abhishek

- GATE CS AIR - 96
- M.Tech (CS) - IIT Kharagpur
- 12 years of GATE CS teaching experience

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Topic : Subnetting

→ 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]

Topic : Subnetting

Classless Network

Net ID → 27 bits

Host ID → 5 bits

5 bit Host ID

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

Topic : 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

Topic : 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

Topic : Subnetting

Discontinuos Mask

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

Topic : Subnetting

→ 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

→ After subnetting, IP address having three sections :

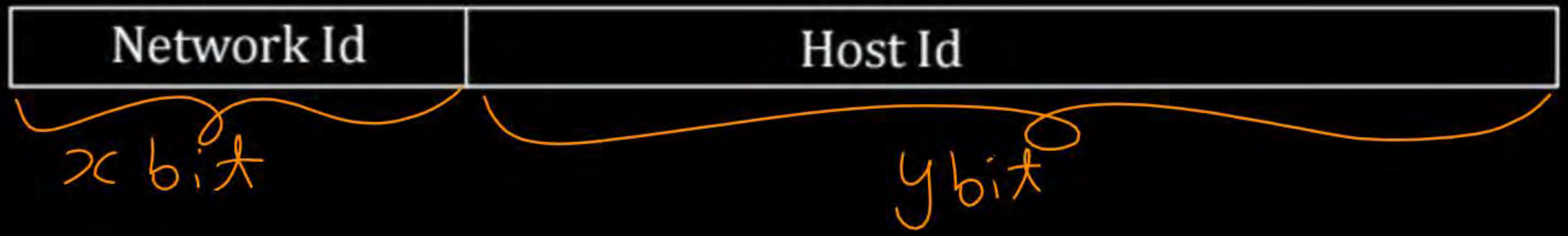
1. Network Identifier (Net ID) : x bits
2. Sub-network Identifier (Subnet ID) : y_1 bits
3. Host Identifier (Host ID) : y_2 bits

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

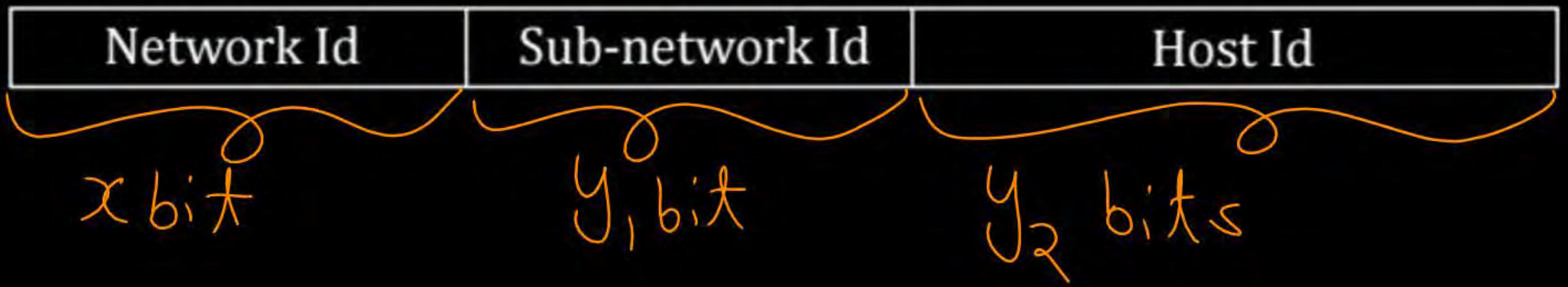
$[\, y = y_1 + y_2 \,]$

Topic : Subnetting

Before Subnetting



After Subnetting



Topic : Sub-network Address

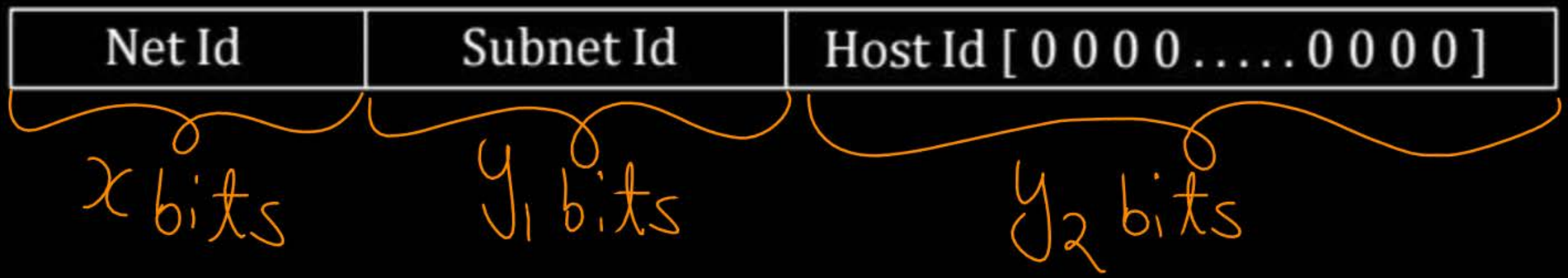
→ Special IP address (32 bits)

→ Used to represent a sub-network

NetID field = As Assigned

Subnet ID = Anything 00...0 to 11...1

HostID field = All Zero Bits



Topic : Sub-network Broadcast Address

→ Special IP address (32 bits)

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

NetID field = As Assigned

Subnet ID = Anything 00...0 to 11....1

HostID field = All One Bits

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

x bits y_1 bits y_2 bits

Topic : Host IP Address

Min^M 2 bit Host ID

→ 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 — 00...0 to 11.....1 — $y_1 \geq 1$

HostID field (y_2 bits) = Any thing
[Except all zero and all one bits] — $y_2 \geq 2$

Class C network (Network Address : 200 . 200 . 200 . 0), with 3-bit subnetting.

Network Address : 200 . 200 . 200 . 0

Broadcast Address : 200 . 200 . 200 . 255
(Network Directed)

Host ID 8 bit
[00000000]
[11111111]

Network Mask : 255.255.255.0
(Class C, default)

200.200.200.17
255.255.255.0
200.200.200.0

Before Subnetting :-

First Host IP Address : 200 . 200 . 200 . 1 [00000001]

Last Host IP Address : 200 . 200 . 200 . 254 [11111110]

$(2^8 - 2)$ hosts

Network Size = 254 Hosts in the network
(Maxm)

After 3-bit Subnetting :-

Net ID 24 bit | Subnet ID 3 bit | Host ID 5 bit

Sub-network Address : 200 . 200 . 200 . _ _ _ 0 0 0 0 0

First Host IP Address : 200 . 200 . 200 . _ _ _ 0 0 0 0 1

Last Host IP Address : 200 . 200 . 200 . _ _ _ 1 1 1 1 0

$(2^5 - 2)$ hosts per subnet

Subnet Broadcast Address (Sub-network Directed) : 200 . 200 . 200 . _ _ _ 1 1 1 1 1

First Sub-network Address : 200 . 200 . 200 . 0

First Host IP Address : 200 . 200 . 200 . 1

Last Host IP Address : 200 . 200 . 200 . 30

First Subnet Broadcast Address : 200 . 200 . 200 . 31
(Sub-network Directed)

[000 00000]
000 00001
000 11110
[000 11111]

Second Sub-network Address : 200 . 200 . 200 . 32

First Host IP Address : 200 . 200 . 200 . 33

Last Host IP Address : 200 . 200 . 200 . 62

Second Subnet Broadcast Address : 200 . 200 . 200 . 63
(Sub-network Directed)

[001 00000]
001 00001
001 11110
[001 11111]

8th

Last Sub-network Address : 200 . 200 . 200 . 224 [111 00000]

First Host IP Address : 200 . 200 . 200 . 225 111 00001

Last Host IP Address : 200 . 200 . 200 . 254 111 11110

Last Subnet Broadcast Address : 200 . 200 . 200 . 255 [111 11111]
(Sub-network Directed)

Sub-network Mask : ?

Sub-network Size = Max^m hosts can be in each subnet = $(2^5 - 2) = 30$ hosts

Network Size = No. of subnets * subnet size

$= 2^3 * (2^5 - 2)$ hosts $= 240$ hosts

Subnet ID → 3 bit Host ID → 5 bits

1st subnet → 0 to 31

2nd subnet → 32 to 63

3rd subnet → 64 to 95

4th subnet → 96 to 127

5th subnet → 128 to 159

6th subnet → 160 to 191

7th subnet → 192 to 223

last 8th subnet → 224 to 255

2 mins Summary

Topic Subnet Address

Topic Subnet Broadcast Address

Topic [illegible]

THANK - YOU