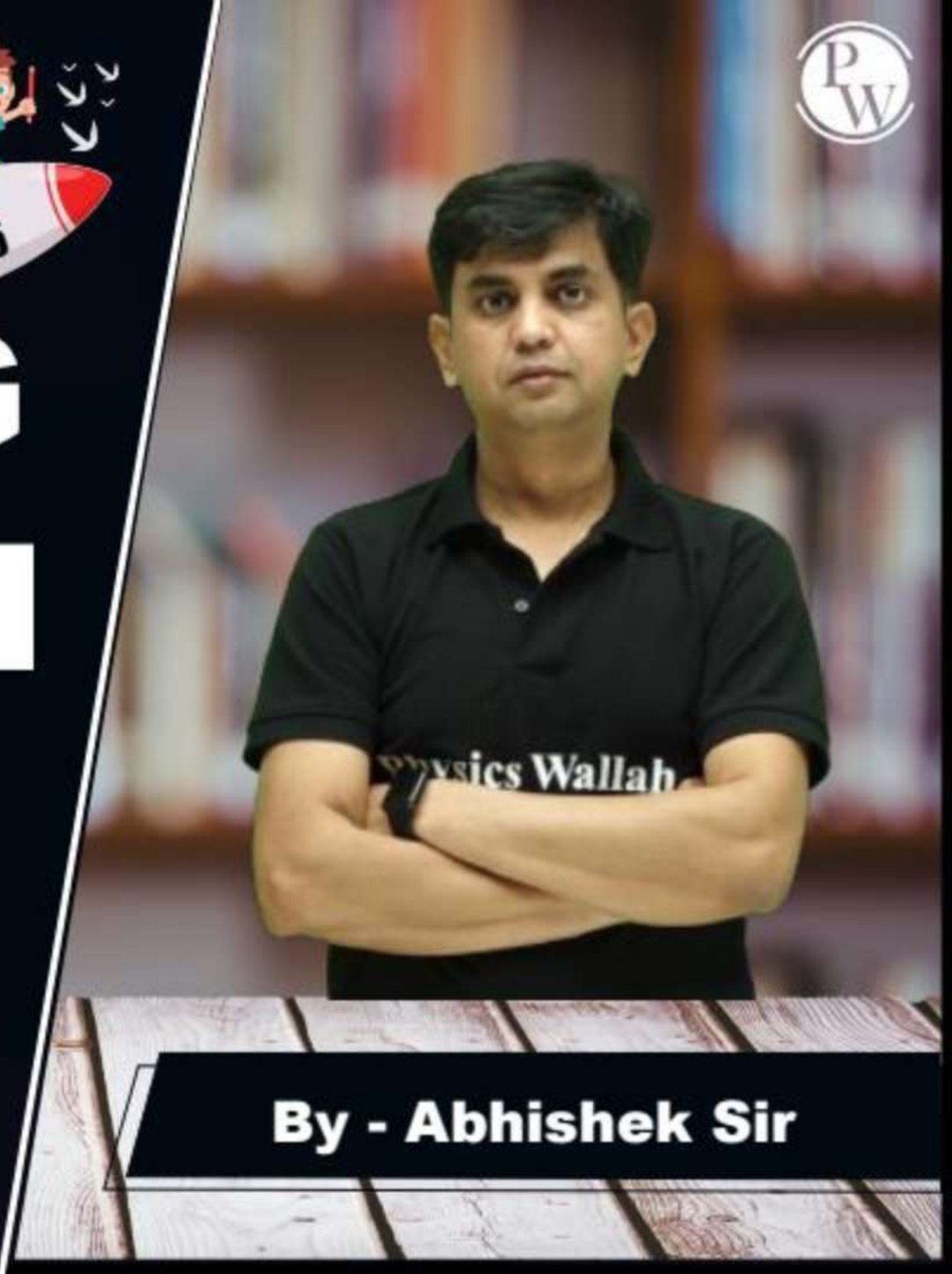
CS & IT ENGINEERING

Computer Network

IPv4 Addressing

Lecture No. - 05



Recap of Previous Lecture

Topic Subnetting

Topic Subnet Mask

Topics to be Covered

- Topic: Subnetting
- Topic: VLSM
- Topic: Forwarding Table

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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#Q. A subnetted Class B network has the following broadcast address : 144 . 16 . 95 . 255. Its subnet mask

[GATE-2006]

(A) is necessarily 255 . 255 . 224 . 0

(B) is necessarily 255 . 255 . 240 . 0

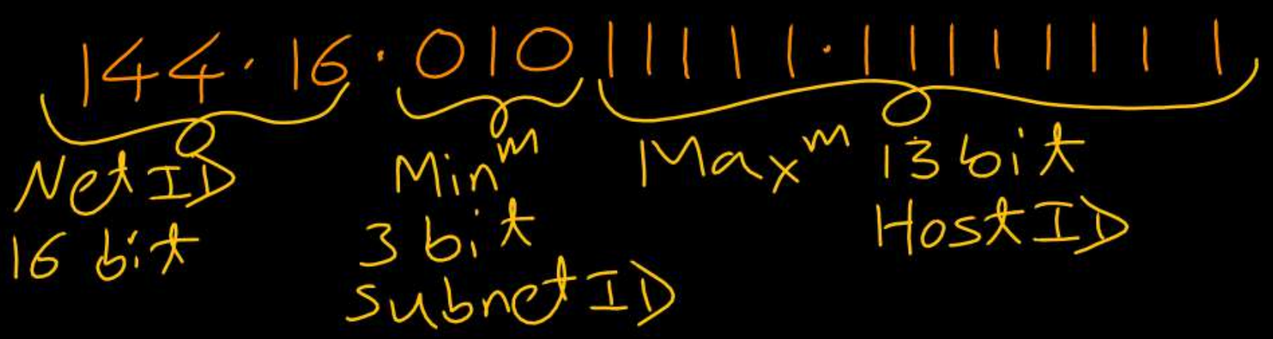
(C) is necessarily 255 . 255 . 248 . 0

(D) could be any one of 255 . 255 . 224 . 0, 255 . 255 . 240 . 0, 255 . 255 . 248 . 0

Ans : D

Class B:-

Subnet Broadcast Add. = 144.16.95.255



Subnet Mask:-

① 3 bit subnet = 255.255.224.0

② 4 — // — = 255.255.240.0

③ 5 — // — = 255.255.248.0

Classless network (Network Address : 40 . 50 . 64 . 0 / 19), with 4-bit subnetting.

Network Address : 40 . 50 . 64 . 0 / 19

Broadcast Address : 40 . 50 . 95 . 255 / 19
(Network Directed)

Before Subnetting :-

First Host IP Address : 40 . 50 . 64 . 1 / 19

Last Host IP Address : 40 . 50 . 95 . 254 / 19

Network Size = $[2^{13} - 2]$ hosts in the network

Netmask = 19 = 255.255.224.0

After 4-bit Subnetting :-

Net ID 19bit | Subnet ID 4bit | Host ID 9bit

Sub-network Address : 40.50.010_ _ _ _0.000000000/23

First Host IP Address : 40.50.010_ _ _ _0.000000001/23

Last Host IP Address : 40.50.010_ _ _ _1.111111110/23

Subnet Broadcast Address : 40.50.010_ _ _ _1.111111111/23
(Sub-network Directed)

Subnetmask = 23 = 255.255.254.0

First Sub-network Address : 40 . 50 . 0 1 0 **0 0 0 0** 0 . 0 / 23

: 40 . 50 . **64** . 0 / 23

First Host IP Address : 40 . 50 . 0 1 0 **0 0 0 0** 0 . 1 / 23

: 40 . 50 . **64** . 1 / 23

Last Host IP Address : 40 . 50 . 0 1 0 **0 0 0 0** 1 . 254 / 23

: 40 . 50 . **65** . 254 / 23

First Subnet Broadcast Address : 40 . 50 . 0 1 0 **0 0 0 0** 1 . 255 / 23

(Sub-network Directed) : 40 . 50 . **65** . 255 / 23

Second Sub-network Address : 40 . 50 . 0 1 0 **0 0 0 1** 0 . 0 / 23

: 40 . 50 . **66** . 0 / 23

First Host IP Address : 40 . 50 . 0 1 0 **0 0 0 1** 0 . 1 / 23

: 40 . 50 . **66** . 1 / 23

Last Host IP Address : 40 . 50 . 0 1 0 **0 0 0 1** 1 . 254 / 23

: 40 . 50 . **67** . 254 / 23

Second Subnet Broadcast Address : 40 . 50 . 0 1 0 **0 0 0 1** 1 . 255 / 23

(Sub-network Directed) : 40 . 50 . **67** . 255 / 23

Last Sub-network Address : 40 . 50 . 0 1 0 **1 1 1 1** 0 . 0 / 23
: 40 . 50 . **94** . 0 / 23

First Host IP Address : 40 . 50 . 0 1 0 **1 1 1 1** 0 . 1 / 23
: 40 . 50 . **94** . 1 / 23

Last Host IP Address : 40 . 50 . 0 1 0 **1 1 1 1** 1 . 254 / 23
: 40 . 50 . **95** . 254 / 23

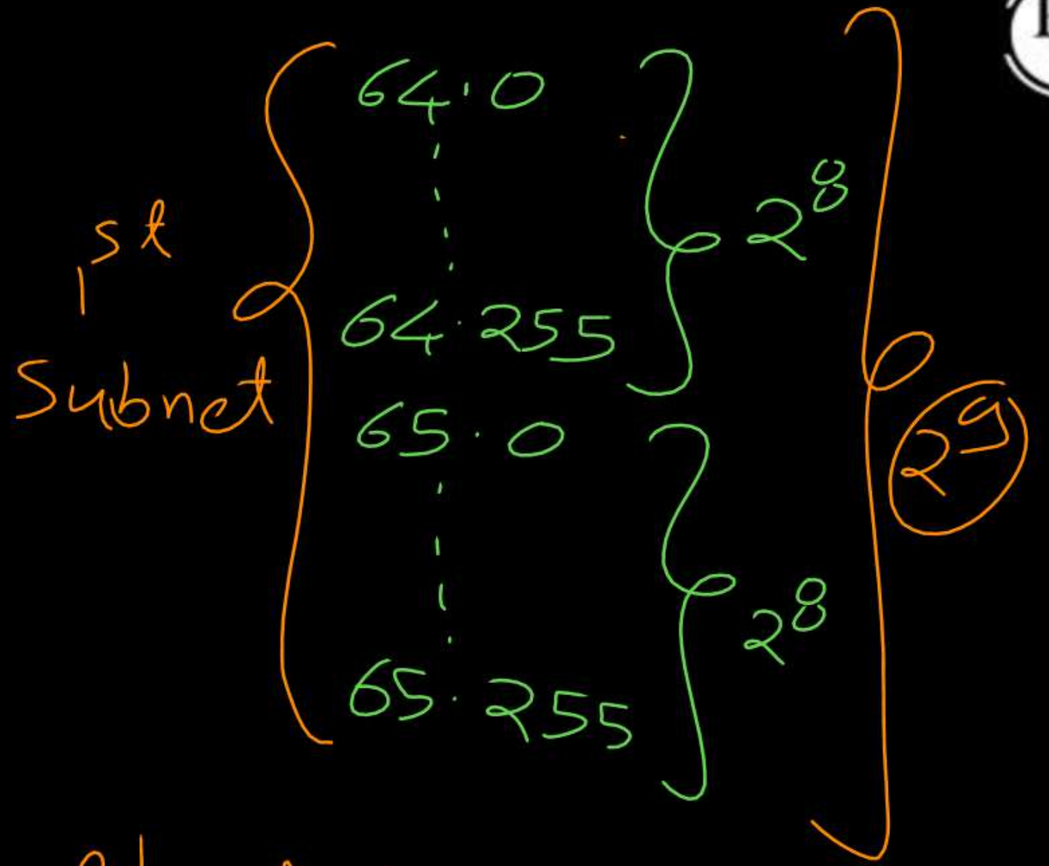
Last Subnet Broadcast Address : 40 . 50 . 0 1 0 **1 1 1 1** 1 . 255 / 23
(Sub-network Directed) : 40 . 50 . **95** . 255 / 23

1st subnet Add. → 40.50.64.0/23

2nd → 66.0

3rd → 68.0

16th → 94.0



No. of hosts in each subnet $= (2^9 - 2) = 510$ hosts

Topic : VLSM

→ VLSM : Variable Length Subnet Mask

→ Variable Length Network prefixes
[Unlike fixed length prefixing]

→ Allow variable size sub-networks (subnets)
[efficient utilization of IP address space]

Topic : VLSM

* Host ID
  5 bit

Ex 1 :-

Host ID 4 bit

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

Host ID 3 bit

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 : VLSM

* Host ID
5 bit

Ex 2 :-

Host ID
3 bit

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

Host ID
2 bit

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

#Q. A company has a class C network address of "204 . 204 . 204 . 0" . It wishes to have three subnets, one with 100 hosts and two with 50 hosts each. Which one of the following options represents a feasible set of subnet address/subnet mask pairs?

[GATE 2005]

(A) 204 . 204 . 204 . 128 / 255 . 255 . 255 . 192
204 . 204 . 204 . 0 / 255 . 255 . 255 . 128
204 . 204 . 204 . 64 / 255 . 255 . 255 . 128

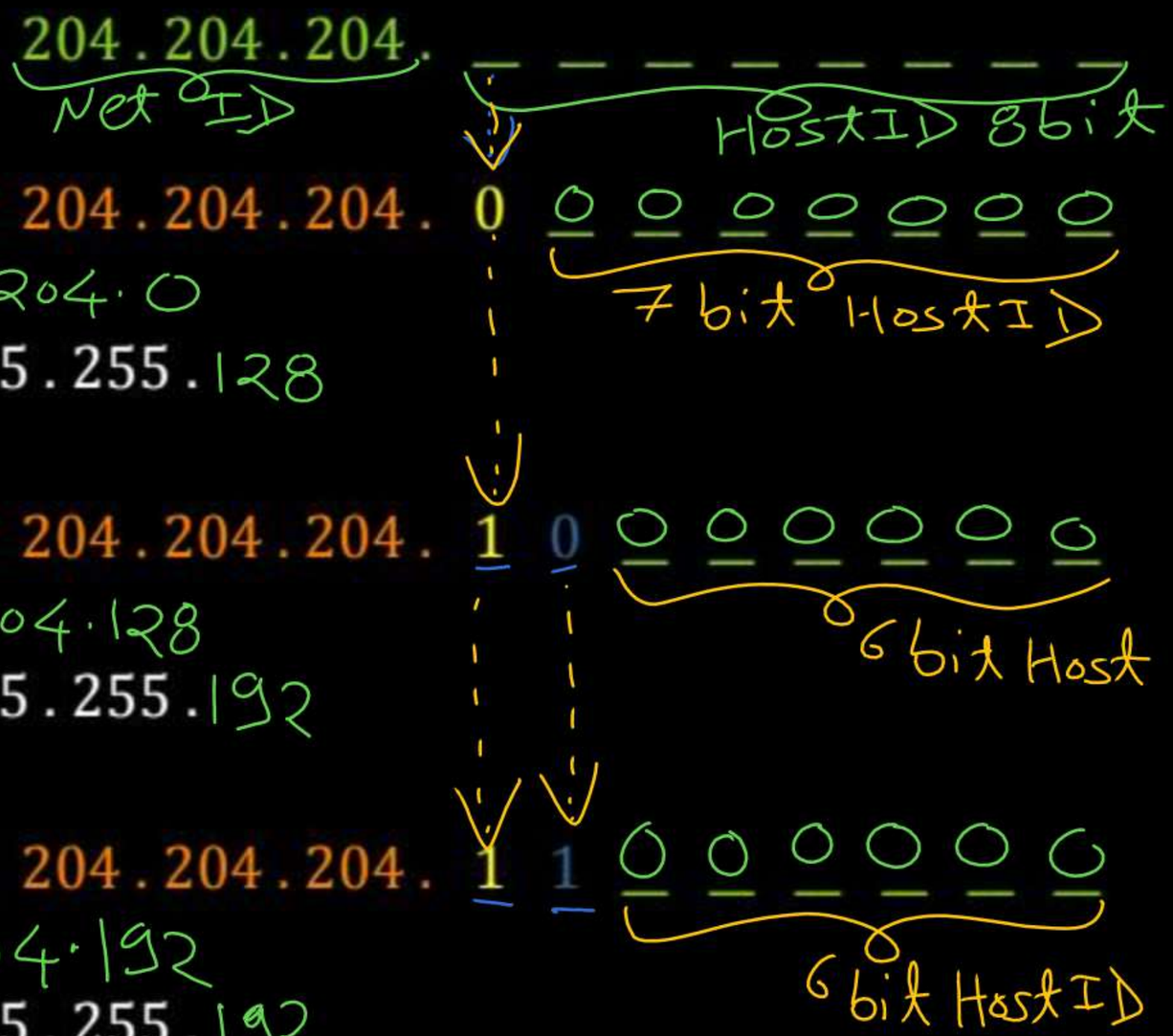
(B) 204 . 204 . 204 . 0 / 255 . 255 . 255 . 192
204 . 204 . 204 . 192 / 255 . 255 . 255 . 128
204 . 204 . 204 . 64 / 255 . 255 . 255 . 128

(C) 204 . 204 . 204 . 128 / 255 . 255 . 255 . 128
204 . 204 . 204 . 192 / 255 . 255 . 255 . 192
204 . 204 . 204 . 224 / 255 . 255 . 255 . 192

(D) 204 . 204 . 204 . 128 / 255 . 255 . 255 . 128
204 . 204 . 204 . 64 / 255 . 255 . 255 . 192
204 . 204 . 204 . 0 / 255 . 255 . 255 . 192

Ans: D

Class C network (Network Address : 204 . 204 . 204 . 0)



Subnet-1 Address : 204 . 204 . 204 . 0

[for 100 host] 204.204.204.0

Subnet Mask = 255 . 255 . 255 . 128

Subnet-2 Address : 204 . 204 . 204 . 1 0

[for 50 host] 204.204.204.128

Subnet Mask = 255 . 255 . 255 . 192

Subnet-3 Address : 204 . 204 . 204 . 1 1

[for 50 host] 204.204.204.192

Subnet Mask = 255 . 255 . 255 . 192

Class C network (Network Address : 204 . 204 . 204 . 0)

204 . 204 . 204 . _ _ _ _ _ _ _ _

Subnet-1 Address : 204 . 204 . 204 . 1 0 0 0 0 0 0 0

[for 100 host] 204.204.204.128

Subnet Mask = 255 . 255 . 255 . 128

7 bit HostID

Subnet-2 Address : 204 . 204 . 204 . 0 0 0 0 0 0 0 0

[for 50 host] 204.204.204.0

Subnet Mask = 255 . 255 . 255 . 192

6 bit HostID

Subnet-3 Address : 204 . 204 . 204 . 0 1 0 0 0 0 0 0

[for 50 host] 204.204.204.64

Subnet Mask = 255 . 255 . 255 . 192

6 bit HostID

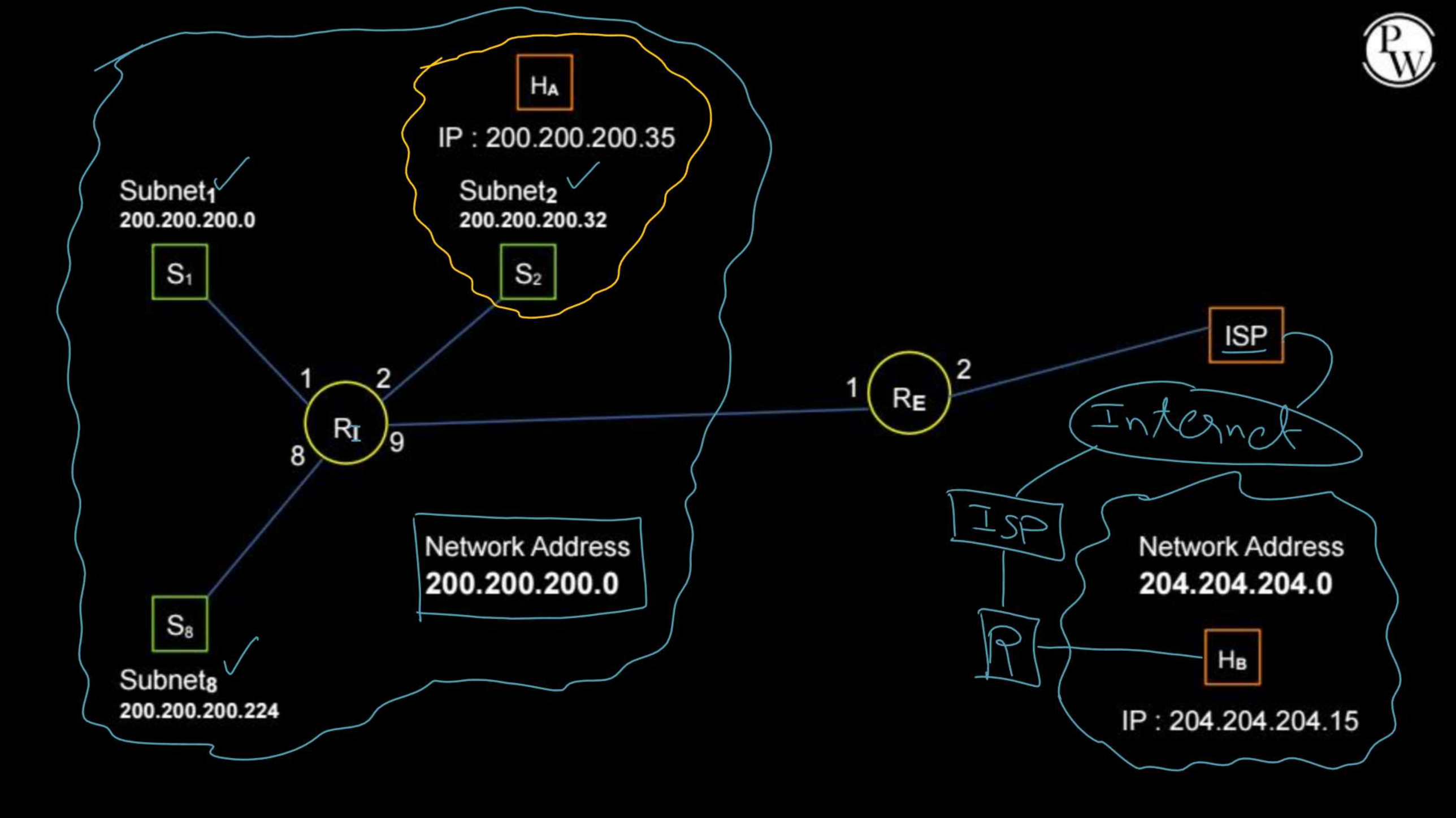
Class C Network :-

Network Address : 200 . 200 . 200 . 0
Default Netmask : 255 . 255 . 255 . 0

After 3-bit subnetting :-

Subnet Mask : 255 . 255 . 255 . 224

1st Subnet Address : 200 . 200 . 200 . 0
2nd Subnet Address : 200 . 200 . 200 . 32
3rd Subnet Address : 200 . 200 . 200 . 64
4th Subnet Address : 200 . 200 . 200 . 96
5th Subnet Address : 200 . 200 . 200 . 128
6th Subnet Address : 200 . 200 . 200 . 160
7th Subnet Address : 200 . 200 . 200 . 192
8th Subnet Address : 200 . 200 . 200 . 224


HA
IP : 200.200.200.35
Subnet1
200.200.200.0
Subnet2
200.200.200.32
S1
S2
1
2
RI
8
9
S8
Subnet8
200.200.200.224
Network Address
200.200.200.0
1
RE
2
ISP
Internet
ISP
R
Network Address
204.204.204.0
HB
IP : 204.204.204.15

Topic : Forwarding Table

Router (R_E) forwarding table

Destination Mask

Network Address	Network Mask	Interface ID	Next Hop
200 . 200 . 200 . 0	255. 255 . 255 . 0	1	R_I
Default		2	ISP

Topic : Forwarding Table

Router (R_1) forwarding table

Subnet Address	Subnet Mask	Interface ID	Next Hop
200 . 200 . 200 . 0	255 . 255 . 255 . 224	1	R_1 ONLink
200 . 200 . 200 . 32	255 . 255 . 255 . 224	2	R_2 ONLink
200 . 200 . 200 . 64	255 . 255 . 255 . 224	3	R_3 ONLink
⋮			
200 . 200 . 200 . 224	255 . 255 . 255 . 224	8	R_8 ONLink
Default		9	R_E

2 mins Summary

Topic Subnetting

Topic VLSM

Topic Forwarding Table

THANK - YOU