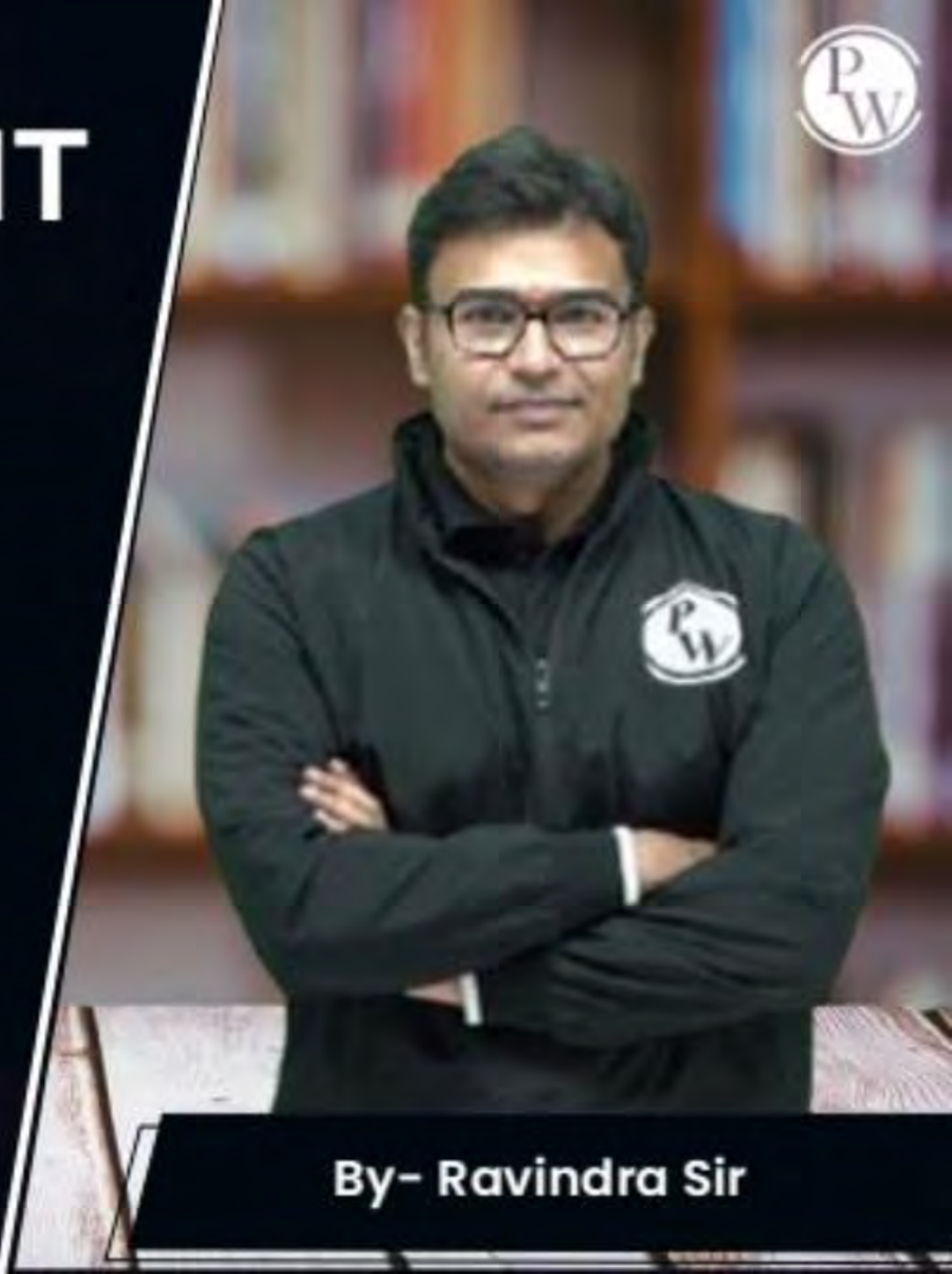
Computer Science & IT

COMPUTER NETWORKS (CN)

IP address Subnetting Supernetting

Lecture No. 12



By- Ravindra Sir

Recap of Previous Lecture

- Topic
- Topic
- Topic

Supersetting

Topics to be Covered

- Topic
- Topic
- Topic

Superscripting & Flow Control

Extra Ordinary Individuals: Stories to Ignite Student Motivation

Surya Sen – The Schoolteacher Who Took On the British Empire

Background: A humble teacher from Chittagong (now in Bangladesh), drawn to India's independence movement.

Struggles: Lived in hiding for years. Betrayed, captured, and brutally tortured — his limbs were broken and teeth pulled out.

Achievements: Led the legendary Chittagong Armoury Raid at age 30 — one of the boldest anti-British acts by civilians.

Impact: He taught revolution in the day and lived it at night. If he could take on an empire with students and steel, you can take on a syllabus with focus and fire

Extra Ordinary Individuals: Stories to Ignite Student Motivation

Ratibhai Makwana

Background: Dalit entrepreneur from rural Gujarat; faced caste-based ostracism and denied banking support early on.

Education: Master's-level experience through hands-on entrepreneurship (formal degrees not highlighted, but started business in modest conditions).

Career Achievements: Founded Gujarat Pickers Industries (1962), expanded from handloom “pickers” into polymers and petrochemicals.

Impact: Overcame caste prejudice to build a crores-worth enterprise; cemented a legacy of industrial inclusion in Gujarat.

Extra Ordinary Individuals: Stories to Ignite Student Motivation

Havildar Hangpan Dada – The Ghost Who Guards the Border

Background: Indian Army soldier from Arunachal Pradesh.

Struggles: Volunteered for the toughest terrains — icy, high-altitude conflict zones. Faced overwhelming odds with minimal backup.

Achievements: Killed 4 terrorists single-handedly in a gunfight at 12,000 ft. Continued fighting after being shot — died saving his unit.

Impact: He gave his last breath without blinking. If he could fight while bleeding at -20°C, you can revise one more topic before rest.

Extra Ordinary Individuals: Stories to Ignite Student Motivation

E. Sreedharan ("Metro Man" of India)

Background: Modest middle-class upbringing in Kerala; no inherited privilege.

Education: Bachelor's from IIT Madras (Civil Engineering), followed by advanced training in civil and transportation engineering.

Career Achievements: Led Delhi Metro Rail Corporation (DMRC) from 1995 to 2012, delivering world-class metro infrastructure.

Impact: Transformed public transit in India; established Pune and Kochi metros; became a symbol of efficient public engineering leadership.

RBR Rules for Supernetting :-

1) all n/w's should be Contiguous
2) Size of all n/w Should be same
3) No of n/w should be power of 2
4) First IP addrn should be divisible by total size of the n/w

N1 : 200.1.0.0/24 — 2^8

N2 : 200.1.1.0/24 — 2^8

N3 : 200.1.2.0/24 — 2^8

N4 : 200.1.3.0/24 — 2^8

$4 = 2^2$

4×2^8

$= 2^{10}$

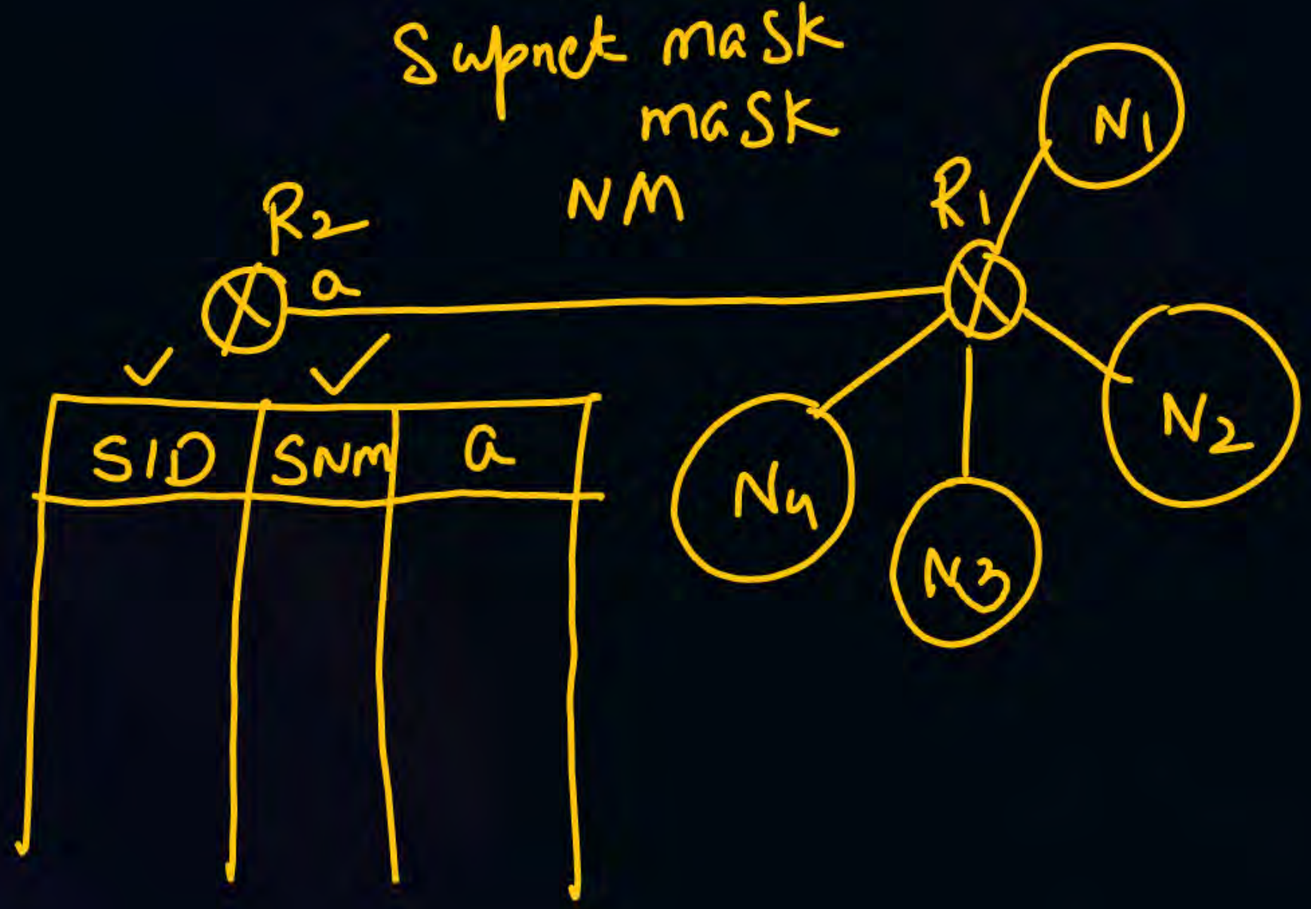
200.1.00000000.00000000

1) Conti

2) Same size

3) Power of 2

4) I IP add should be divisible by size of the Supernet


Subnet mask
mask
NM
R2
a
R1
N1
N2
N3
N4
SID
SNM
a

Supernet mask :-

1's → fixed part

0's → variable (host) part

200.1.00000000.00000000/24
200.1.00000001.00000000/24
200.1.00000010.00000000/24
200.1.00000011.00000000/24

255.256.111111|00.00000000

255.265.252.0 → Supnet mask

SID

200.1.00000000.00000001
255.255.252.0

200.1.0.0/22 → SID

200.1.0.0/24 -2^8

200.1.1.0/24 -2^8

200.1.2.0/24 -2^8

200.1.3.0/24 -2^8

$4 \times 2^8 = 2^{10}$ → HID = 10 bits ✓

32 - 10 = 22 → NID & SID ✓

1) 2) 3) 4) SM = $\underbrace{11111111.11111111.111111}_{\text{NID}}\underbrace{00.00000000}_{\text{HID}}$

SID - I IP add in SID

200.1.0.0/22

200.1.32.0/24 -2^8

200.1.33.0/24 -2^8

⋮

200.1.47.0/24 -2^8

47

-32

15

$+1$

16 $= 2^4$

1) Conti

2) Size

3) No of n/w power of 2

4) I IP should be divisible by size of SN

$2^4 \times 2^8 = 2^{12}$ Host Id = 12

NID = 32 − 12 = 20 bits

SM : 11111111.11111111.11110000.00000000

255 . 255 . 240 . 0

SID 200.1.32.0/20

100.1.2.0/25 -2^7 ✓
100.1.2.128/26 -2^6 ✓
100.1.2.192/26 -2^6 ✓

1) 100.1.2.0 | 0000000 − 0
NID | 1111111 − 127

100.1.2.10 | 000000 − 128
⋮
10 111111 − 191

100.1.2.11 | 000000 − 192
⋮
111111 − 255

100.1.2.128/26 -2^6
100.1.2.192/26 -2^6
2^7 HID=7

2) 100.1.2.0/25 -2^7 NID=25
100.1.2.128 | 25 -2^7
2^8

→ 100.1.2.00000000/24
2^8

→ 255.255.255.0 → SM

2^7
2^7
2^8

Classfull

- FLSM
- VLSM

Classless (CIDR)

- FLSM
- VLSM

Supernetting

a) Repeat b) handsome

100.1.2.0/25
100.1.2.128/26
100.1.2.192/26
2^6
2^6
100.1.2.0/25
100.1.2.128/25
2^8
100.1.2.0/24

1) 100.1.2.0 (NID) 00000000 – 100.1.2.0
11111111 – 100.1.2.127

2) 100.1.2.10 (NID) 000000 – 100.1.2.128
10111111 – 100.1.2.191

3) 100.1.2.11 (NID) 000000 – 100.1.2.192
11111111 – 100.1.2.255

$2^6 + 2^6 = 2^7 + 2^7 = 2^8$

HID = 8

11111111.11111111.11111111.00000000

255.255.255.0 → SM

100.1.2.0/24 → SID

Classfull < FLSM / VLSM

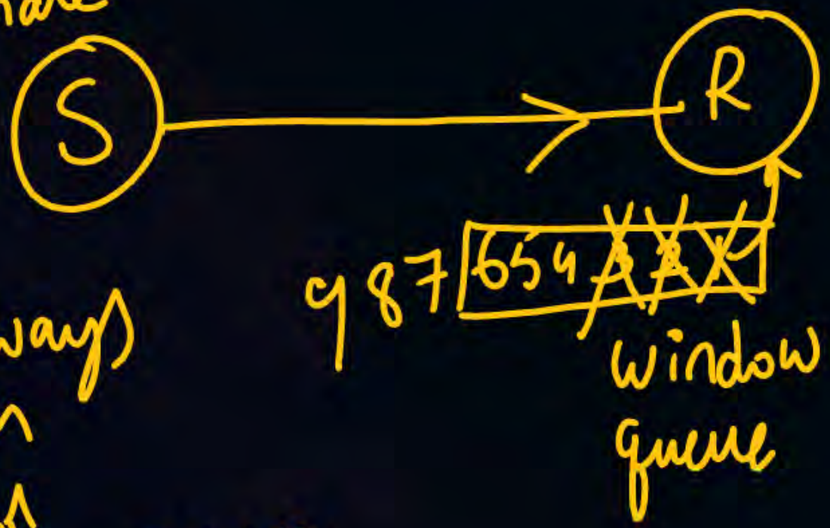
A
B
C
D
E

CIDR Blocks < FLSM / VLSM

Supernetting

Flow control :-

The process of stopping a sender from sending more that what a receiver can handle is called flow control.



Sender should always listen to receiver

Closed loop protocol
Sender should listen to Receiver.

Delays in CN :-

Transmission delay :

The time taken by a sender to transmit a packet on to the outgoing link is called transmission delay of the packet

If BW = 1 bps, Data Size = 10 bits
What is transmission delay (T_t)

1 Sec — 1 bit

1 bit — 1 Sec
10 bits — 10 Sec

$L = 1000$ bits $BW = 1$ kbps

$$T_t = L/B = \frac{1000}{1000} = 1 \text{ Sec}$$

$L - 1$ kb $BW = 1$ kbps

b → bits
B → Bytes

$T_t = ?$

	Data	BW
K	1024	10^3
M	2^{20}	10^6
G	2^{30}	10^9

$$\frac{1 \text{ kb}}{1 \text{ kbps}} = \frac{1024}{10^3} = 1.024 \text{ Sec}$$

Propagation delay :-

Time taken by a signal to reach from one end of the link to other end of the link is called propagation delay

Fibre optics net

Propagation delay $(T_p) = \frac{d}{v}$

fibre optics — $v = 70\% = 0.7 \times 3 \times 10^8$ m/s $= \underline{2.1 \times 10^8 \text{ m/s}}$

$V = 3 \times 10^8$ m/s

$10^{-5}\ \text{sec} \times \frac{10^{-6}}{10^{-6}}$ $\quad 10 \times (10^{-6}\ \text{sec})$

$10\ \mu\text{sec}$

$d = 2.1\ \text{km} \qquad v = 2.1 \times 10^{8}\ \text{m/s}$

msec
μsec

$T_p = ?$

$$T_p = \frac{d}{v} = \frac{2.1 \times 10^{3}\ \text{m}}{2.1 \times 10^{8}\ \text{m/s}} = 10^{-5}\ \text{sec}$$

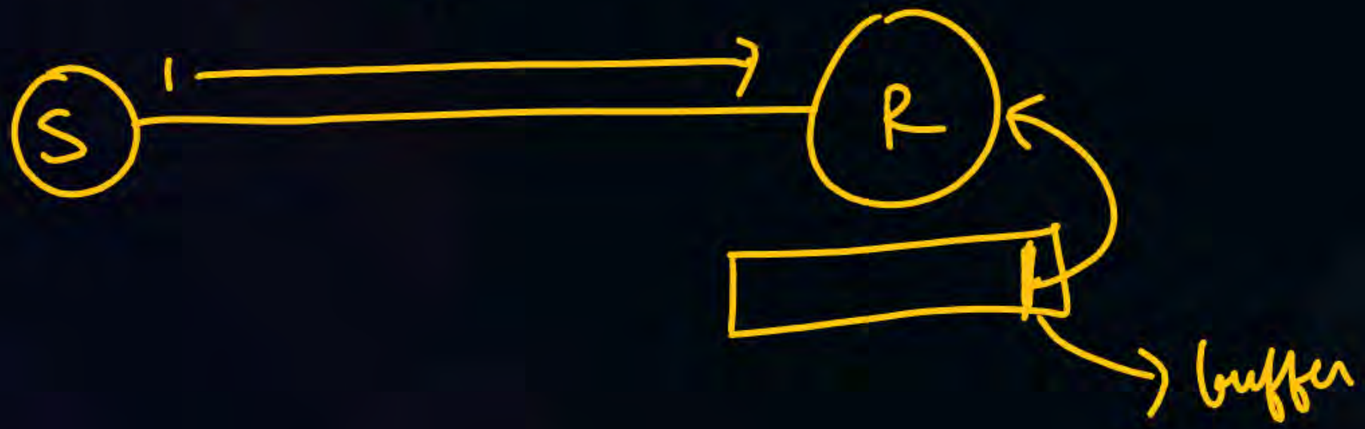
$$10^{-5}\ \text{sec} \times \frac{10^{-3}}{10^{-3}} = 10^{-2} \times (10^{-3}\ \text{sec})$$

$$= 10^{-2} \times \text{msec}$$

$$= 10^{-2}\ \text{msec}$$

The total time taken by a Sender to send a packet to the Receiver is $(T_t + T_p)$

→ once the packet is received by the receiver, it will go and sit in the buffer. The time for which a packet waits in the buffer is called queuing delay (T_q)



THANK - YOU