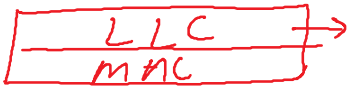
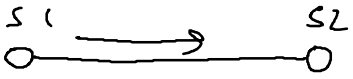
Data Link Layer

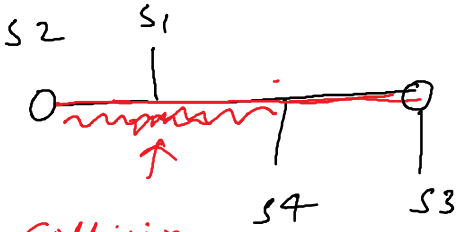


→ Error control / flow cont

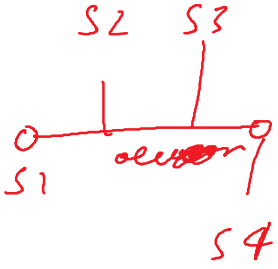
Access Control :-



multiple Access

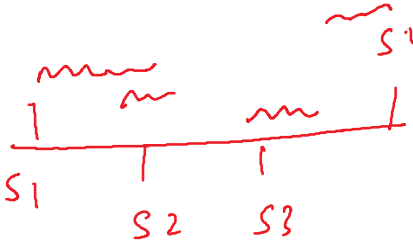


Collision



ALOHA :-

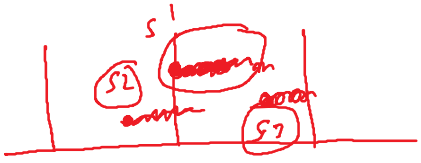
pure



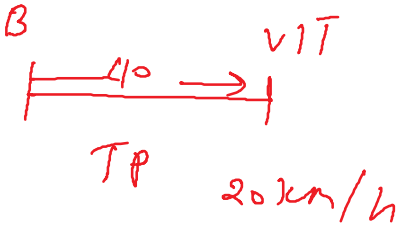
T_t

T_p

VT



$VT = 2Tf$



Tt

1GB file → upload

Problem

Monday, March 21, 2022 9:11 AM

- A group of N stations share 100 Kbps slotted ALOHA channel. Each station output a 500 bits frame on an average of 5000 ms even if previous one has not been sent. What is the required value of N?

$B = 100$ kbps

protocol = Slotted Aloha

No of station (N) = ?

$\Rightarrow n = 0.368$ (Slotted Aloha)

$t = n \times B$

$= 0.368 \times 100$ kbps

$= 36.8$ kbps

$\Rightarrow = \frac{500 \text{ bits}}{5000 \text{ ms}}$

Throughput of every station $= \frac{500 \text{ bits}}{5000 \times 10^{-3} \text{ sec}}$

$= 100$ bits/sec

Total Throughput = Total No of station $\times$ Throughput of each station

36.8 kbps $= N \times 100$

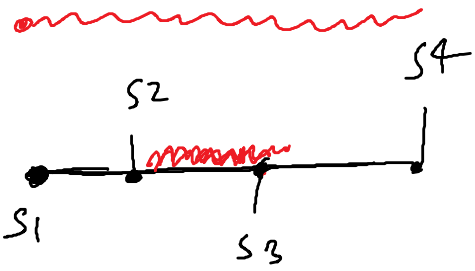
36.8 kbps =

N = 368

=

CSMA

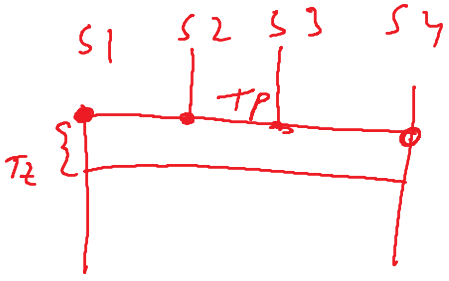
Monday, March 21, 2022 9:25 AM



Frame

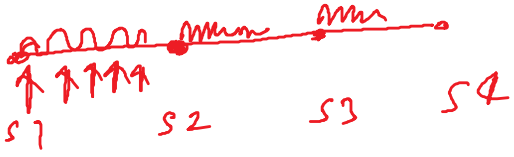
100 bit

CSMA



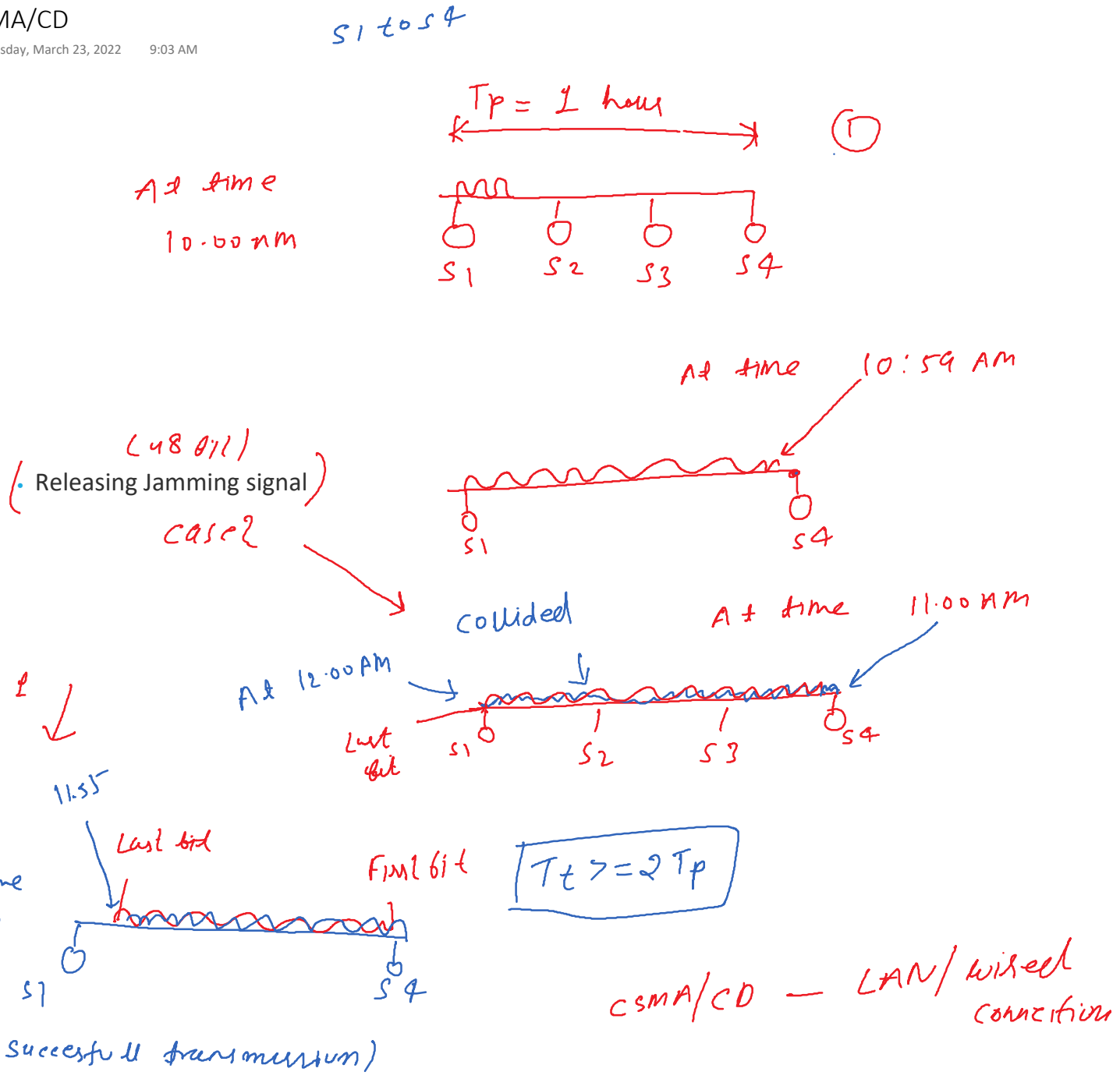
Vulnerable Time = Tp

1-persistence



CSMA/CD

Wednesday, March 23, 2022 9:03 AM



A network using CSMA/CD has a bandwidth of 10 Mbps. If the maximum propagation time is 25.6 µs, what is the minimum size of the frame?

$$T_t >= 2T_p$$

$$\frac{L}{B} >= 2 \times 25.6\ \mu s$$

$$L >= 2 \times 25.6 \times 10^{-6} \times 10 \times 10^{6}\ bits$$

$L >= 2 \times 25.6 \times 10 \times 10 \times 10$

$= 512$ bit

- A network with CSMA/CD protocol in the MAC layer is running at 1 Gbps over a 1 km cable with no repeaters. The signal speed in the cable is 2 x 10^8 m/sec. The minimum frame size for this network should be

protocol – CSMA/CD

$B = 1$ Gbps

$d = 1$ km

$S = 2 \times 10^8$ m/sec

$L = ?$

$Tt \geq 2Tp$

$\frac{L}{B} \geq 2\frac{d}{S}$

$L \geq \frac{2 \times 1\text{km} \times 1\text{Gbps}}{2 \times 10^8 \text{ m/s}}$

$L \geq \frac{2 \times 10^3 \times 10^9}{2 \times 10^8}$

$L \geq 10000$ bit

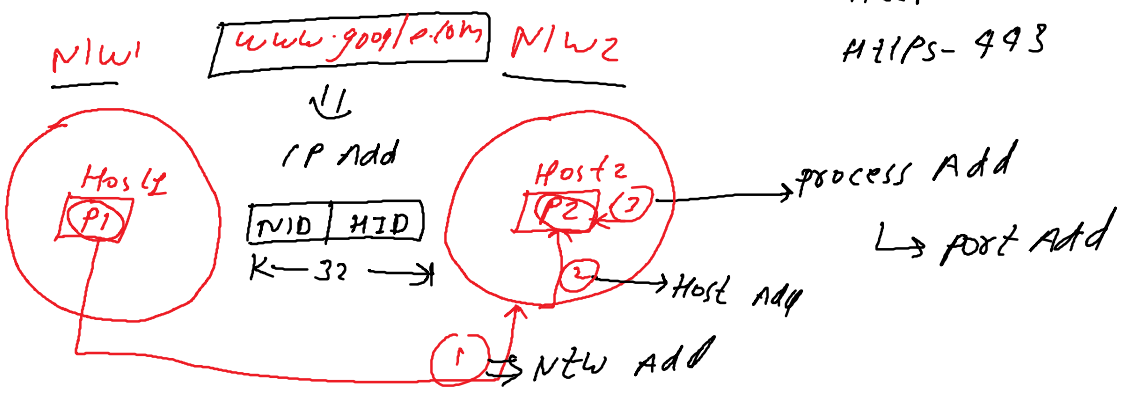
IP Address

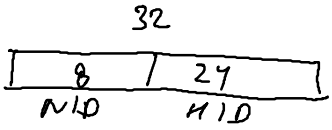
Friday, March 25, 2022 9:21 AM

HTTP - 80

HTTPS - 443

DNS





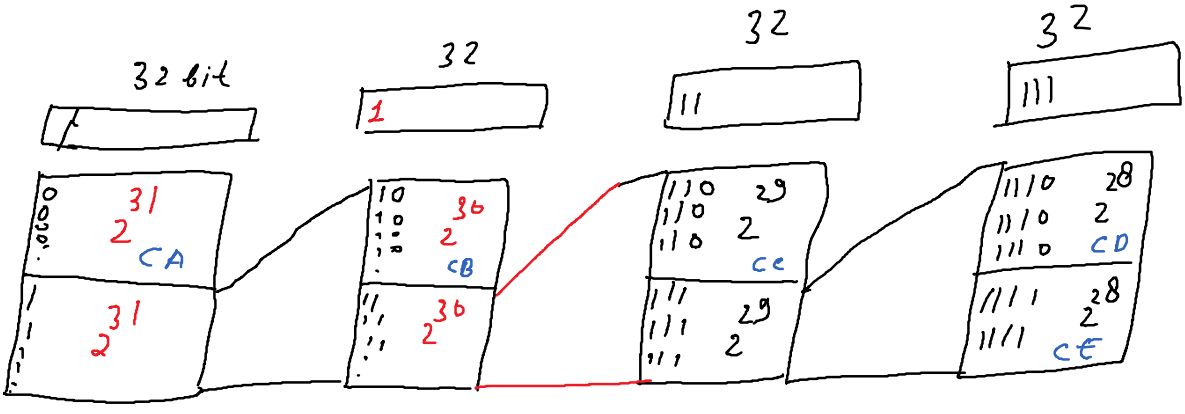
Initially

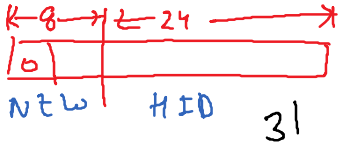
Add. space = $2^8 \Rightarrow 256$ (Ntw Add space)

$2^{24} = 16M$ (Host Add space)

⇒ classfull → obsolete

⇒ classless → CIDR





CLASS A :—

Total No of IP Add :— 2^{31}

Total No of Ntw :— $2^7 - 2 = 126$

Total No of Host/Ntw :- $2^{24}-2$

Range of 1st octet :-

0 0 0 0 0 0 0 0 – 0 ✓ (Broadcasting)

0 0 0 0 0 0 0 1 – 1

0 0 0 0 0 0 1 0 – 2

⋮

0 1 1 1 1 1 1 1 – 127 ✓ (127.0.0.1)

↓

loop back Add

Lower → 1.0.0.0

1.0.0.1

Upper → 126.255.255.255

Class B :-

Total No of IP ADD :- 2^{30}

Total No of Ntw :- 2^{14}

Total No of Host :- $2^{16}-2$

Range of 1st octet :-

1 0 0 0 0 0 0 0 . ⇒ 128

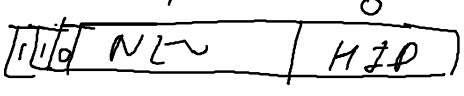
0 0 0 0 0 0 1 .

⋮

1 1 1 1 1 1 1 . ⇒ 191

$\Rightarrow 64 \times 2^8$

Class C



Total No of IP Add – 2^{29}

Ntw :- 2^{21}

Total No of IP Add - 2^{21}

$N/w = 2^{21}$

$H/N = 2^{8}-2$

Range of 1 octet - 110 00000 — 192

00001

:

11111 — 223

$2^5 \times 2^{16}$

$= 2^{21}$

[192 - 223]

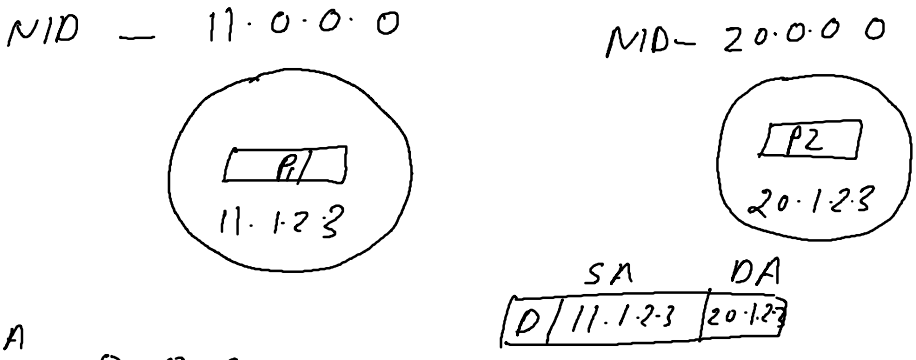
CLASS D :- 1110

IP Add = 2^{28}

Range [224 - 239]

DBA and LBA

Wednesday, March 30, 2022 9:31 AM

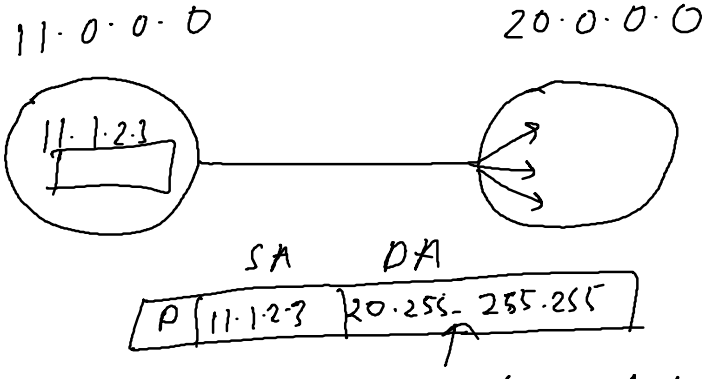


NID_A → NID_A . 0.0.0

NID_B → NID . NID . 0.0

NID_C → NID . NID . NID . 0

→ UNICAST



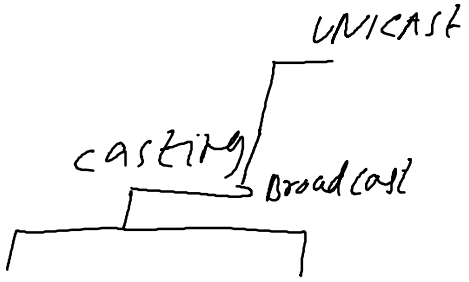
multicast

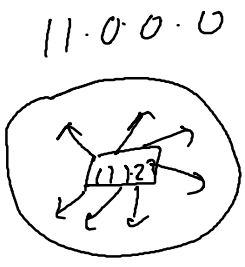
DBA (Directed broadcast Add)

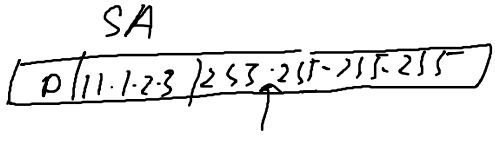
DBA_A — NID . 255 . 255 . 255

DBA_B — NID . NID . 255 . 255

DBA_C — NID . NID . NID . 255





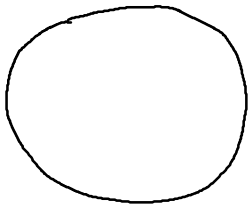


Limited Broadcast Add

	IP	NID	DBN	LBA
①	130.1.2.3 → B	?	?	?
	=	130.1.0.0	130.1.255.255	255.255.255.255
②	250.0.1.2	X	X	X

Subnetting

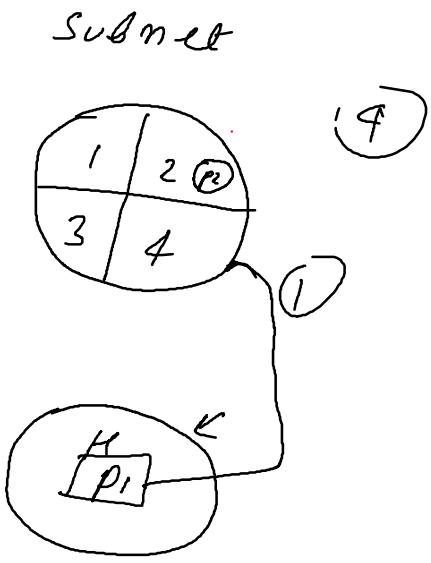
Friday, April 8, 2022 8:39 AM



NID HID HID HID

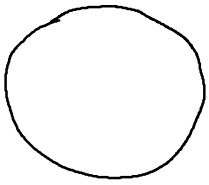
$\Rightarrow 2^{24}$ ← A

$\Rightarrow 2^{16}$ ← B

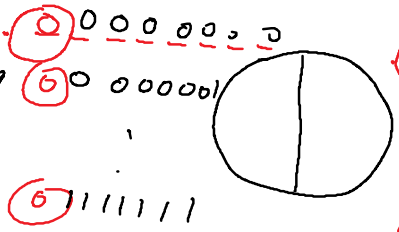


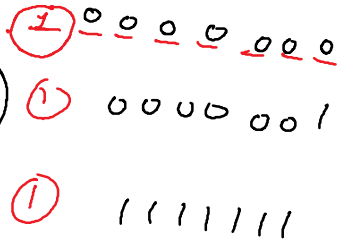
No of Host $\Rightarrow 2^8 - 256 - 2 = 256$

200.1.2.0 ← NID



Subnetting ⇒





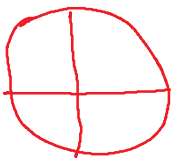
(0, 1, 2, ... 127) (128, 129, ... 255)

(NID)	First Add →	200.1.2.0	200.1.2.128
(DBA)	Last Add →	200.1.2.127	200.1.2.255

No of Host (Subnetting) = $128 - 2 = 126 \times 2 = 252$

200.1.2.0

4 Subnet



⇒ Subnet mask ?

255.255.255.11000000

255.255.255.192

Subnet mask :- 200.1.2.00000000

↳ 32 bits

1's → NID & SID

0's → HID

⇒ 11111111.11111111.11111111.10000000

255.255.255.128

- In a class B, network on the internet has a subnet mask of 255.255.240.0. What is the maximum number of hosts per subnet? Number of subnet?

Subnet mask- 255.255.240.0

11111111.11111111.11110000.00000000

No of host- 2^{12} -2 =4094

Number of subnet- NID+SID=20
16+SID=20
SID=4
2^4=16

- If the subnet mask 255.255.255.128 belongs to class C, find-

1. Number of subnets (2) 2. Number of hosts in each subnet (126)

- Suppose a network with IP Address 192.16.0.0. is divided into 2 subnets, find number of hosts per subnet.

192.16.0. 0 =192.16.0.10000000

NO OF HOST=2^7-2=126

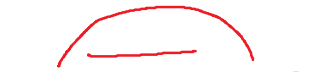
- Also for the first subnet, find-

1. Subnet Address
2. First Host ID
3. Last Host ID
4. Broadcast Address

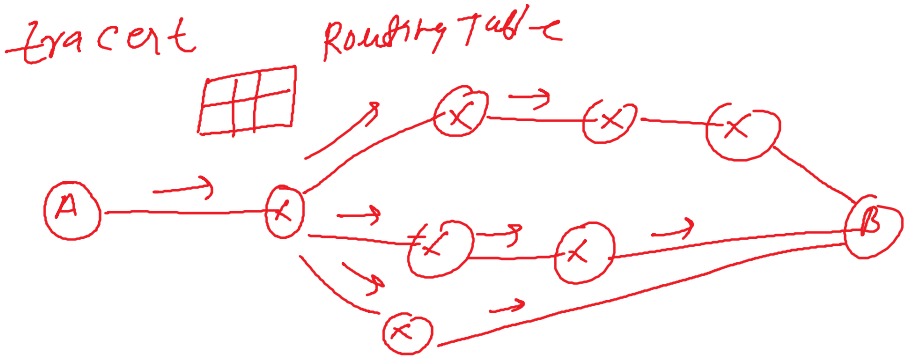
Why we need subnet mask?

Routing

Wednesday, April 13, 2022 8:37 AM



Routing :—



Routing

Adv — Low traffic

No duplicate pkt

Dis — Less Reliable

— Routing table is req

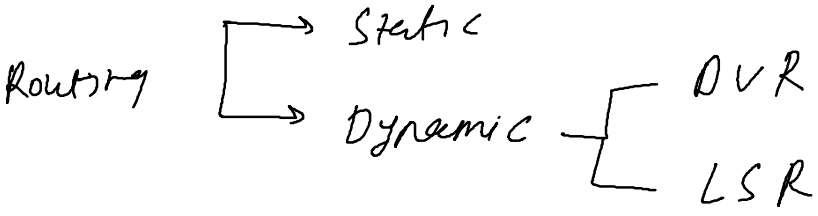
flooding

Adv

1. Shortest path is guarantee
2. Reliability
3. NO Routing

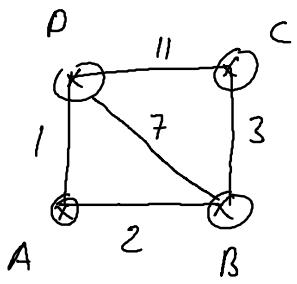
dis: - 1. Traffic high

2. duplicate pkt



Distance Vector Routing (DVR)

De	Dis	NH
A	1	A
B	7	B
C	11	C
D	0	D



De	Di	NH
A	∞	—
B	3	B
C	0	C
D	11	D

Step 1 :- Based on neighbours RT

Routing table

Destinat	Distance	Next Hop

Des	Dis	NH
A	0	A
B	2	B
C	∞	—
D	1	D

Des	Dis	Next Hop
A	2	A
B	0	B
C	3	C
D	7	D

Step 2:

At A :- DV from B, D

At B :- DV from A, C, D

At C :- Distance Vetor (DV) from B, D

At D :- DV from A, B, C

At A :- DV from B, D

from B

2
0
3
7

From D

1
7
11
0

Des	Dis	NH
A	0	A
B	2	B
D	5	D (B)

$A \rightsquigarrow B = \min \begin{cases} A \xrightarrow{2} D + B \rightsquigarrow B \\ A \xrightarrow{1} D + D \xrightarrow{7} B \end{cases} = \begin{matrix} 2+0=2 \\ 1+7=8 \end{matrix}$

$A \rightsquigarrow C = \min \{ A \xrightarrow{2} D + B \xrightarrow{3} C \quad = 5$

$(1 \quad 11 \quad = 12$

$A \rightsquigarrow C = \min \begin{cases} A \xrightarrow{2} D + B \xrightarrow{5} C & \\ A \xrightarrow{1} D + D \xrightarrow{11} C & = 12 \end{cases}$

$A \rightsquigarrow D = \min \begin{cases} A \xrightarrow{2} B + B \xrightarrow{7} D & = 9 \\ A \xrightarrow{1} D + D \xrightarrow{0} D & = 1 \end{cases}$

At B :- DV from A, C, D

from A

0
2
∞
1

From C

∞
3
0
11

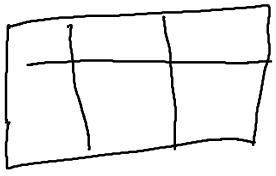
From D

1
7
11
0

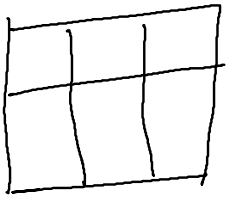
De	Di	NH
A	2	A
B	0	B
C	3	C
D	3	A

$BA = 2$ $BC = 3$ $BD = 7$

At C



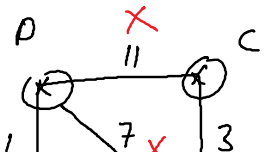
At D



step 3 :-

Final RT

De	Dis	NH
A	1	A
B	3	B
C	6	A
D		

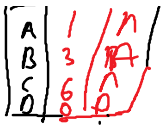


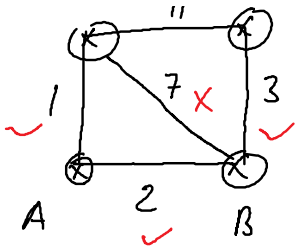
De	Di	NH
A	5	B
B	3	B
C	0	C
D	6	B

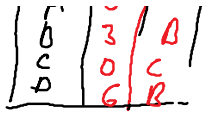
RT

step 1 : Based on neighbours

Routing table







Routing table

Destinat	Distance	Next Hop

Des	Dis	Nxt
A	0	A
B	2	B
C	5	B
D	1	D

Des	Dis	Next Hop
A	2	A
B	0	B
C	3	C
D	3	A

drawback :- count to infinity problem

LSR

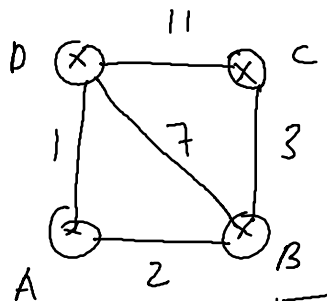
Friday, April 15, 2022 8:41 AM

D	
C	11
B	7
A	1

C	
D	11
B	3

DVR = local knowledge

LSR = Global -11-

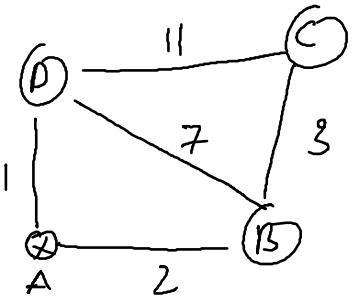


step (1)

A	
B	2
D	1

B	
A	2
D	7
C	3

← Link state packet



Step 2:- A & A

Step 3:- Dijkstra Algo

Des	DIS	NH
A	0	A
B	2	B
C	5	B
D	1	D