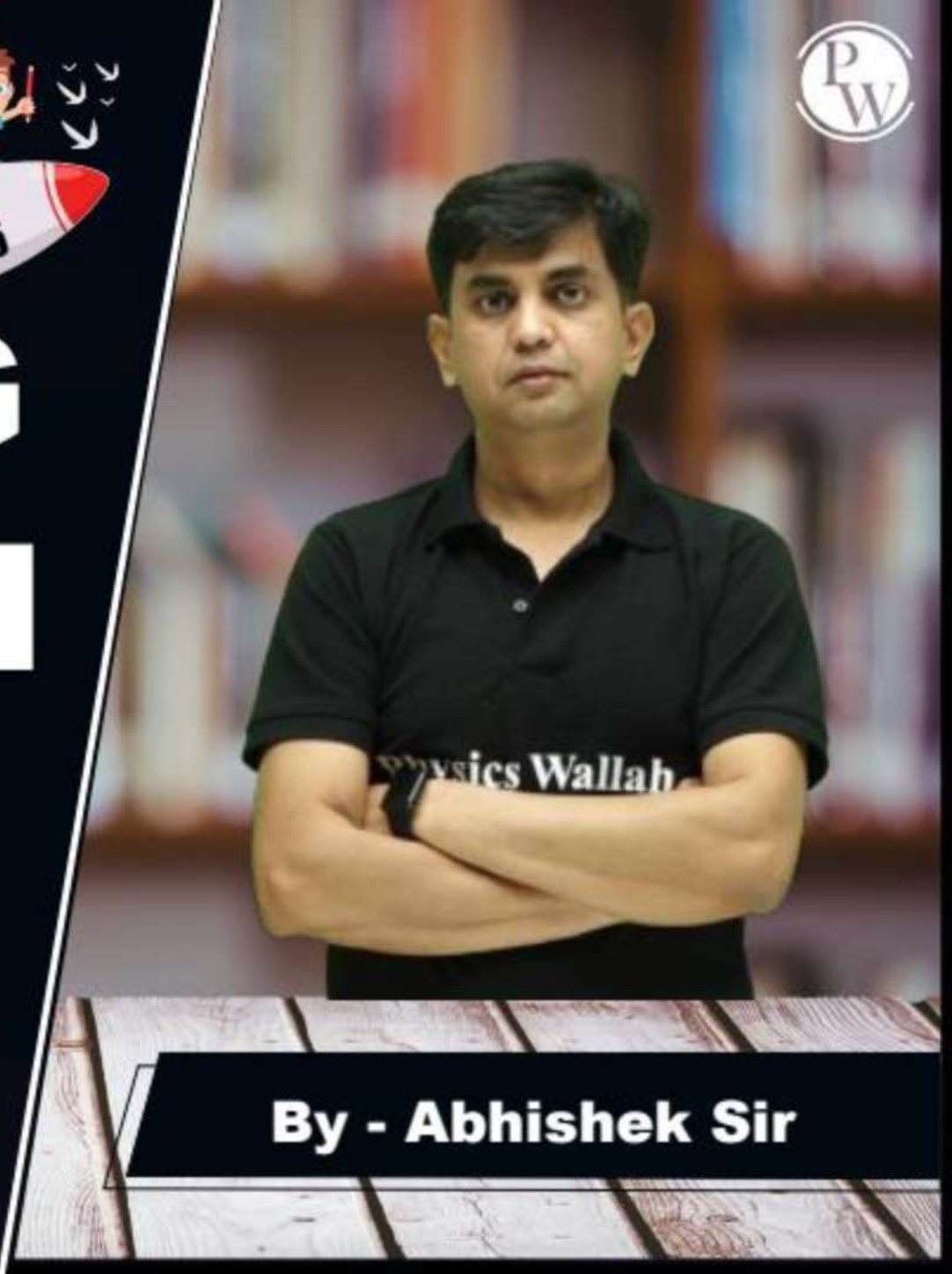
CS & IT ENGINEERING

Computer Network

Switching & Routing

Lecture No. - 04



By - Abhishek Sir

Recap of Previous Lecture

Topic Routing

Topic Link State Routing

Topic Distance Vector Routing

Topics to be Covered

Topic Distance Vector Routing

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 : Distance Vector Routing

→ Based on Bellman-Ford equation
[Dynamic programming]

→ Bellman-Ford equation

Let $D_x(Y)$: Cost of the least-cost path from X to Y

$$D_x(y) = \min_v \{ C(X, V) + D_v(Y) \}$$

→ Minimum taken over all neighbors V of X

$C(X, V)$: Direct cost of link from X to V

$D_v(Y)$: V's estimated least-cost path cost to Y

Topic : Distance Vector Routing

→ Each router maintain separate "Distance Vector" estimate
[Best known minimum distance to all other routers]

→ Each router sends their own "Distance Vector" estimate to
their neighbor routers only

→ When a router receives new "Distance Vector" estimate from any neighbor,
It update its own "Distance Vector" using Bellman-Ford equation

First Round :-

Node	Cost	Via
A	0	A

Node	Cost	Via
B	0	B

Node	Cost	Via
C	0	C

Node	Cost	Via
D	0	D

A	0

B	0

C	0

D	0

Second Round :-

Node	Cost	Via
A	0	A
B	3	B

Node	Cost	Via
A	3	A
B	0	B
C	2	C

Node	Cost	Via
B	2	B
C	0	C
D	4	D

Node	Cost	Via
C	4	C
D	0	D

A	0
B	3

A	3
B	0
C	2

B	2
C	0
D	4

C	4
D	0

Third Round :-

Node	Cost	Via
A	0	A
B	3	B
C	5	B

Node	Cost	Via
A	3	A
B	0	B
C	2	C
D	6	C

Node	Cost	Via
A	5	B
B	2	B
C	0	C
D	4	D

Node	Cost	Via
B	6	C
C	4	C
D	0	D

A	0
B	3
C	5

A	3
B	0
C	2
D	6

A	5
B	2
C	0
D	4

B	6
C	4
D	0

Fourth Round :-

Node	Cost	Via
A	0	A
B	3	B
C	5	B
D	9	B

Node	Cost	Via
A	3	A
B	0	B
C	2	C
D	6	C

Node	Cost	Via
A	5	B
B	2	B
C	0	C
D	4	D

Node	Cost	Via
A	9	C
B	6	C
C	4	C
D	0	D

A	0
B	3
C	5
D	9

A	9
B	6
C	4
D	0

Node	Cost	Via
A	0	A
B	3	B
C	5	B
D	9	B

Node	Cost	Via
A	3	A
B	0	B
C	2	C
D	6	C

Node	Cost	Via
A	5	B
B	2	B
C	0	C
D	4	D

Node	Cost	Via
A	9	C
B	6	C
C	4	C
D	0	D

stablished Distance vector

Topic : Distance Vector Routing

=> Distributed : (Decentralized)

→ Each node notifies neighbors only when its "Distance Vector" changes

→ Neighbors then notify their neighbors only, if necessary

→ No notification received, no action taken

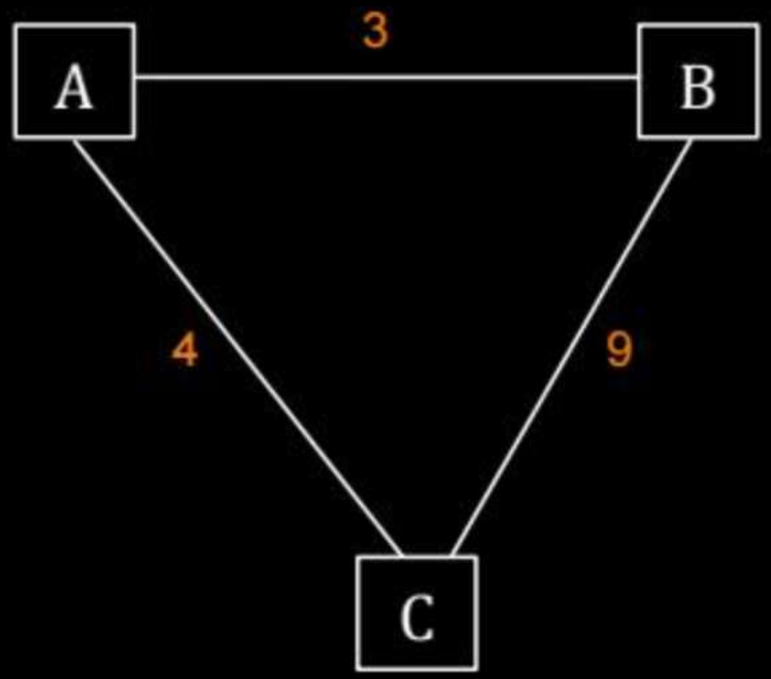
=> Iterative :

→ Process iterate until no new information
[Available to be exchanged between neighbors]

=> Asynchronous

First Round :-

Node	Cost	Via
A	0	A

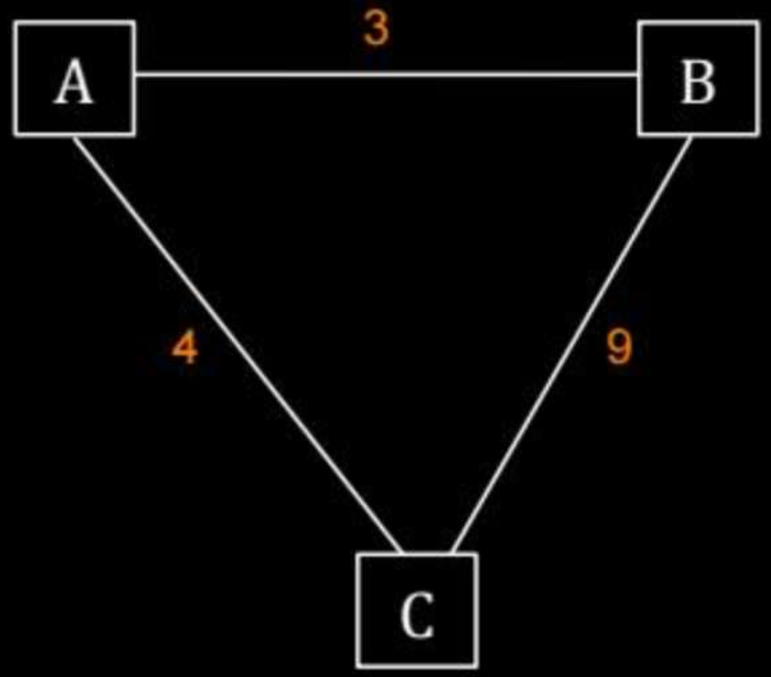


Node	Cost	Via
B	0	B

Node	Cost	Via
C	0	C

Second Round :-

Node	Cost	Via
A	0	A
B	3	B
C	4	C

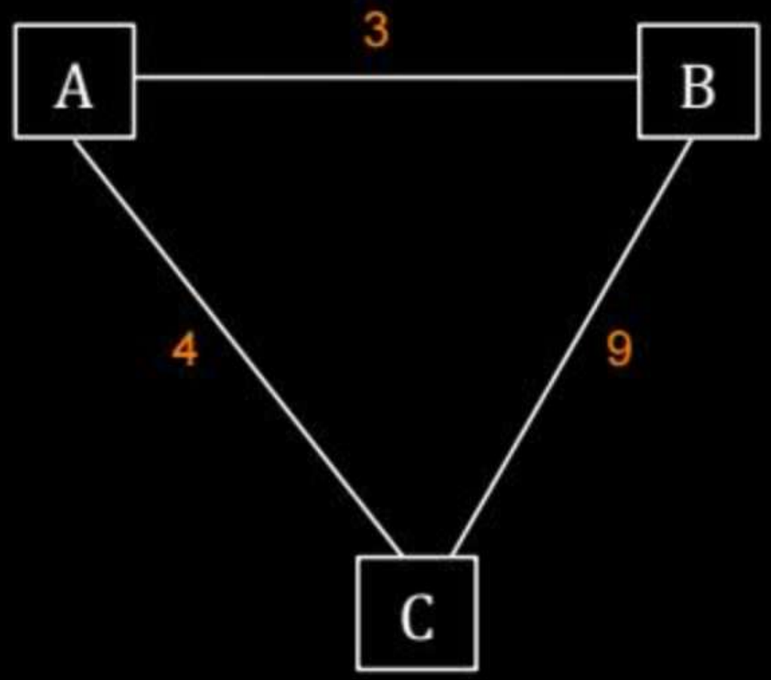


Node	Cost	Via
A	3	A
B	0	B
C	9	C

Node	Cost	Via
A	4	A
B	9	B
C	0	C

Third Round :-

Node	Cost	Via
A	0	A
B	3	B
C	4	C



Node	Cost	Via
A	3	A
B	0	B
C	7	A

Node	Cost	Via
A	4	A
B	7	A
C	0	C

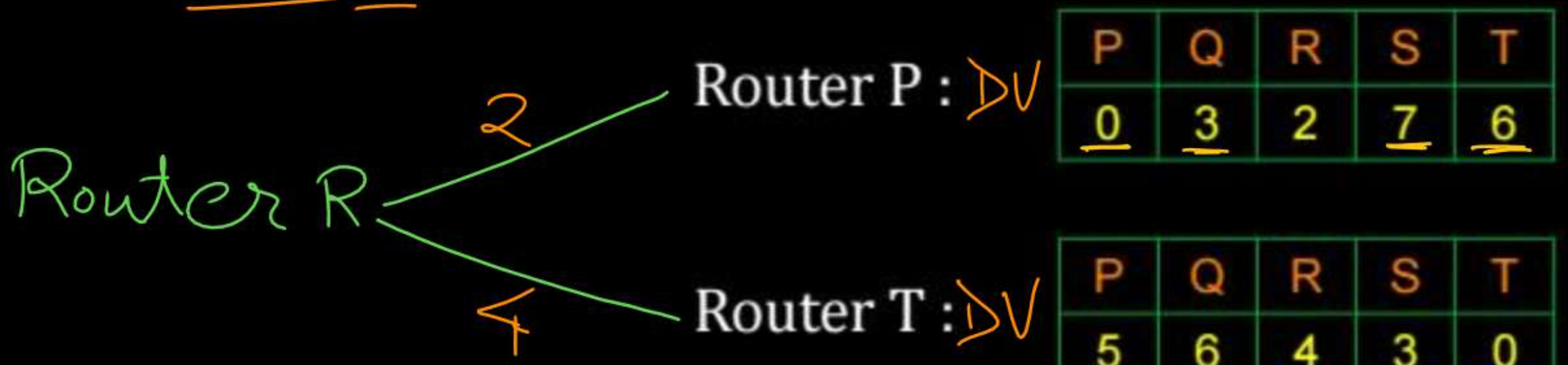
Topic : Distance Vector Routing

→ Each router wait for
either "changes in adjacent link cost"
or "receives new "Distance Vector" estimate from any neighbor"

→ It update its own "Distance Vector" estimate using Bellman-Ford equation

→ if any update in its own "Distance Vector" estimate
then send own updated "Distance Vector" estimate to their neighbors
else "do nothing"

#Q. Consider network of five routers P, Q, R, S and T. Router P and T are direct neighbour of router R with distance 2 and 4 respectively. Consider following is the distance vector of router P and T then calculate distance vector of router R?



P	Q	R	S	T
0	3	2	7	6

P	Q	R	S	T
5	6	4	3	0

Router R : DV

Node	P	Q	R	S	T
Cost	2	5	0	7	4
Via	P	P	R	T	T

#Q. For the network given in the figure below, the routing tables of the four nodes A, E, D and G are shown. Suppose that F has estimated its delay to its neighbors, A, E, D and G as 8, 10, 12 and 6 msecs respectively and updates its routing table using distance vector routing technique.

[GATE-2007]

IIT-K

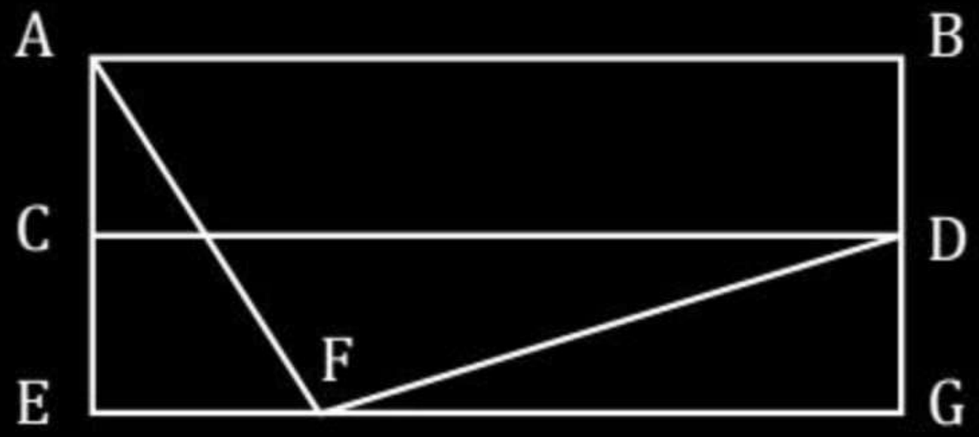
H.W.

Routing Table of A	
A	0
B	40
C	14
D	17
E	21
F	9
G	24

Routing Table of D	
A	20
B	8
C	30
D	0
E	14
F	7
G	22

Routing Table of E	
A	24
B	27
C	7
D	20
E	0
F	11
G	22

Routing Table of G	
A	21
B	24
C	22
D	19
E	22
F	10
G	0



A

A	8
B	20
C	17
D	12
E	10
F	0
G	6

B

A	21
B	8
C	7
D	19
E	14
F	0
G	22

C

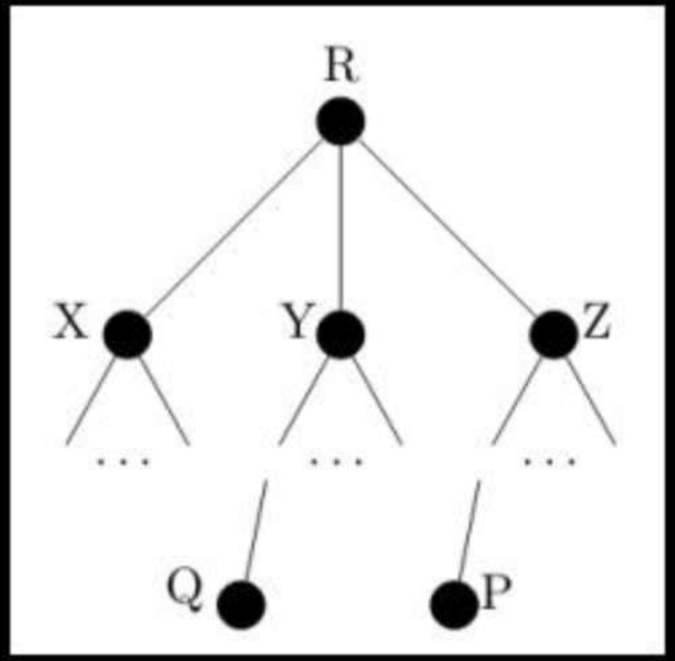
A	8
B	20
C	17
D	12
E	10
F	16
G	6

D

A	8
B	8
C	7
D	12
E	10
F	0
G	6

[MSQ]

#Q. Consider a computer network using the distance vector routing algorithm in its network layer. The partial topology of the network is shown below.



The objective is to find the shortest-cost path from the router R to routers P and Q. Assume that R does not initially know the shortest routes to P and Q. Assume that R has three neighbouring routers denoted as X, Y and Z.

During one iteration, R measures its distance to its neighbours X, Y, and Z as 3, 2 and 5, respectively. Router R gets routing vectors from its neighbours that indicate that the distance to router P from routers X, Y and Z are 7, 6 and 5, respectively. The routing vector also indicates that the distance to router Q from routers X, Y and Z are 4, 6 and 8 respectively. Which of the following statement(s) is/are correct with respect to the new routing table of R, after updation during this iteration?

[GATE-2021]

(A) The distance from R to P will be stored as 10

(B) The distance from R to Q will be stored as 7

(C) The next hop router for a packet from R to P is Y

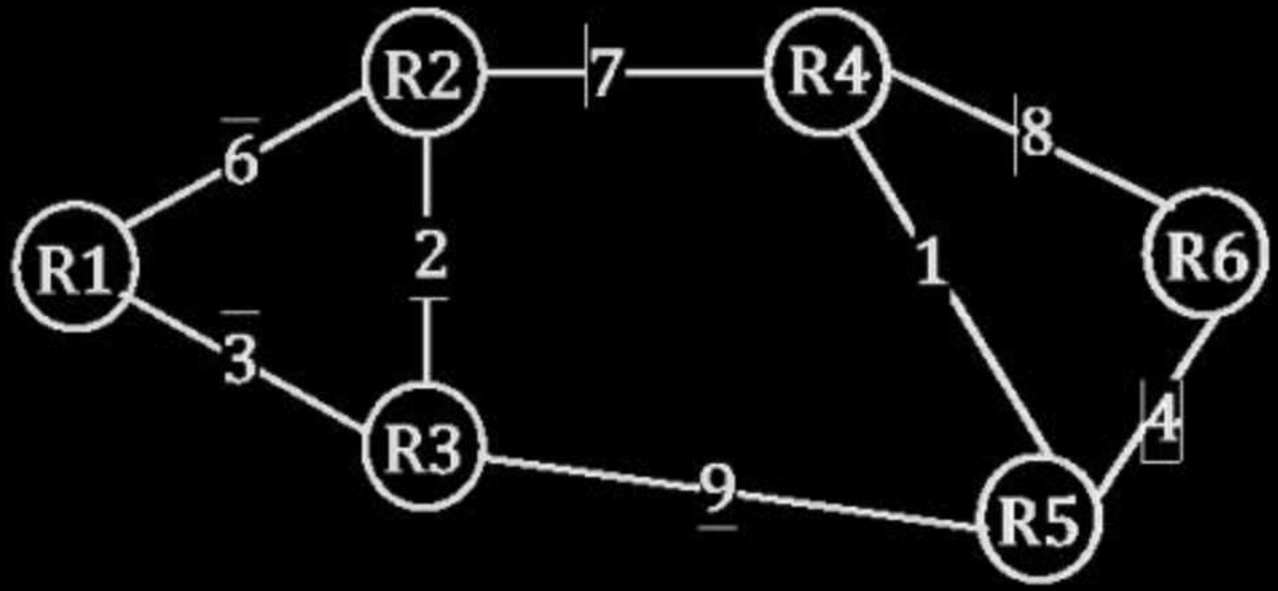
(D) The next hop router for a packet from R to Q is Z

IIT-B

H.W.

Statement for linked question

Consider a network with 6 routers R1 to R6 connected with links having weights as shown in the following diagram:



[MCQ]

#Q. All the routers use the distance vector based routing algorithm to update their routing tables. Each router starts with its routing table initialized to contain an entry for each neighbor with the weight of the respective connecting link. After all the routing tables stabilize, how many links in the network will never be used for carrying any data?

[GATE-2010]

IIT-G
H.W.

(A) 4

(B) 3

(C) 2

(D) 1

[MCQ]

#Q. Suppose the weights of all unused links in the previous question are changed to 2 and the distance vector algorithm is used again until all routing tables stabilize. How many links will now remain unused?

[GATE-2010]

H.W.

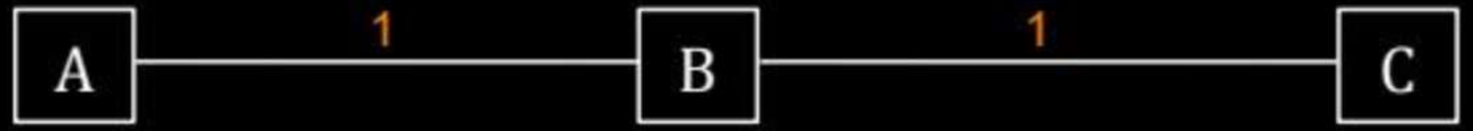
(A) 0

(B) 1

(C) 2

(D) 3

First Round :-



Node	Cost	Via
A	0	A

Node	Cost	Via
B	0	B

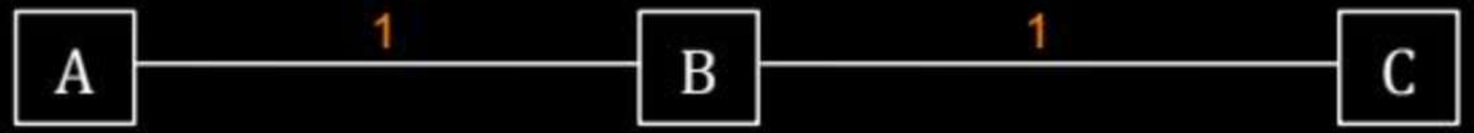
Node	Cost	Via
C	0	C

A	0

B	0

C	0

Second Round :-



Node	Cost	Via
A	0	A
B	1	B

Node	Cost	Via
A	1	A
B	0	B
C	1	C

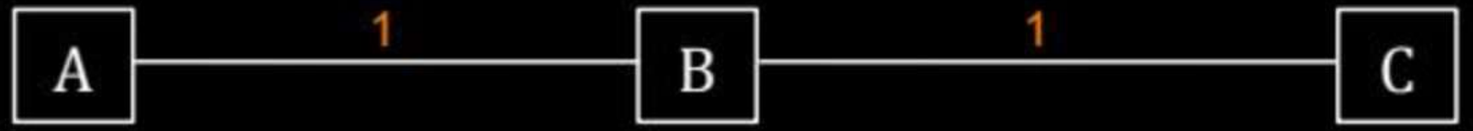
Node	Cost	Via
B	1	B
C	0	C

A	0
B	1

A	1
B	0
C	1

B	1
C	0

Third Round :-



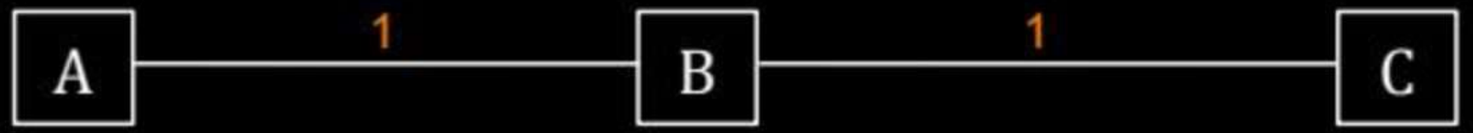
Node	Cost	Via
A	0	A
B	1	B
C	2	B

Node	Cost	Via
A	1	A
B	0	B
C	1	C

Node	Cost	Via
A	2	B
B	1	B
C	0	C

A	0
B	1
C	2

A	2
B	1
C	0



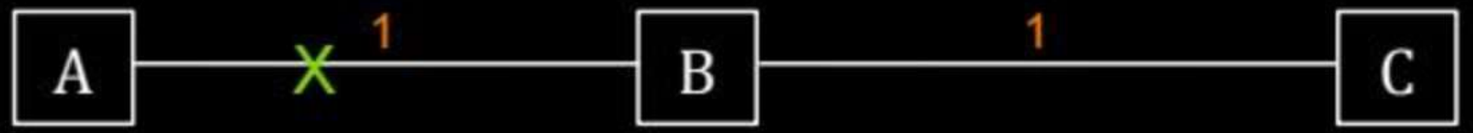
Node	Cost	Via
A	0	A
B	1	B
C	2	B

Node	Cost	Via
A	1	A
B	0	B
C	1	C

Node	Cost	Via
A	2	B
B	1	B
C	0	C

Stablished DV

CASE I :-



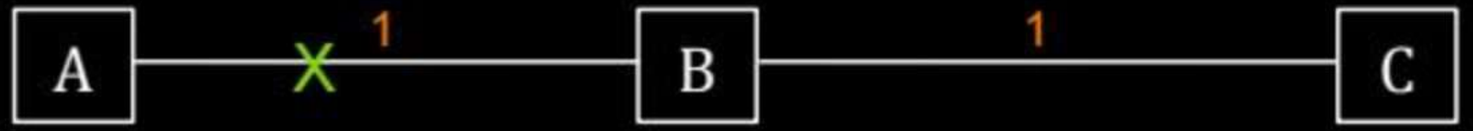
Node	Cost	Via
A	0	A
B	∞	
C	∞	

Node	Cost	Via
A	∞	
B	0	B
C	1	C

Node	Cost	Via
A	2	B
B	1	B
C	0	C

A	∞
B	0
C	1

CASE I :-



Node	Cost	Via
A	0	A
B	∞	
C	∞	

Node	Cost	Via
A	∞	
B	0	B
C	1	C

Node	Cost	Via
A	∞	
B	1	B
C	0	C

A	∞
B	1
C	0

Topic : Distance Vector Routing

→ Problem : May suffer with "Count to infinity" problem
[Link to infinity problem]

2 mins Summary

Topic Distance Vector Routing

THANK - YOU