

Distance Vector Algorithm – Problems, Solutions and a Standard

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Recap

- Nodes exchange with their neighbors their current routing table information (destination, estimated cost)
- On receipt of a message, nodes update cost to destination based on Bellman-ford equation
- Messages sent periodically as well as when table changes

Reference Node C

D	C	H
A	5	A
B	3	B
D	4	D

Routing Table of C
(1)

To	A
A	0
B	1
C	5

Message from A
C to A: C = 5

D	C	H
A	5	A
B	3	B
D	4	D

Routing Table of C

D	C	H
A	5	A
B	3	B
D	4	D

Routing Table of C
(2)

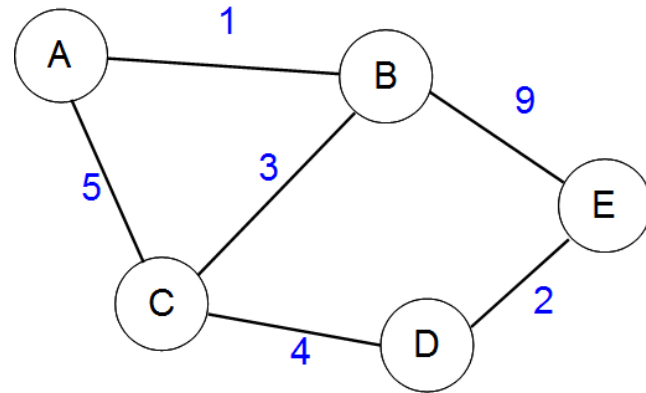
To	B
A	1
B	0
C	3
E	9

Message from B
C to B: C = 3

D	C	H
A	4	B
B	3	B
D	4	D
E	12	B

Routing Table of C

Example



D	C	H
A	4	B
B	3	B
D	4	D
E	12	B

Routing Table of C
(3)

To	D
C	4
D	0
E	2

Message from D
C to D: C = 4

D	C	H
A	4	B
B	3	B
D	4	D
E	6	D

Routing Table of C

Every path has its puddle!

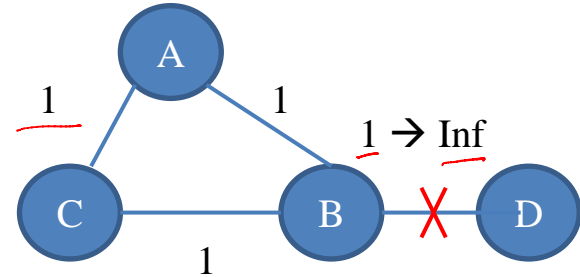
Counting to Infinity

Distance to Node D

Mesg.	A	B	C
	2,B	∞ , -	2,B
B \rightarrow A	∞ , -	∞ , -	2,B
C \rightarrow A	3,C	∞ , -	2,B
B \rightarrow C	3,C	∞ , -	∞ , -
A \rightarrow B	3,C	4,A	∞ , -
C \rightarrow A	∞ , -	4,A	∞ , -
B \rightarrow C	∞ , -	4,A	5,B
A \rightarrow B	∞ , -	∞ , -	5,B

PERIODIC
UPDATE

Algo introduces loops when network topology changes



each thinks there is a path to D via some other node, and it keeps on going on till infinity

State maintained by nodes A, B and C

Partial Solutions

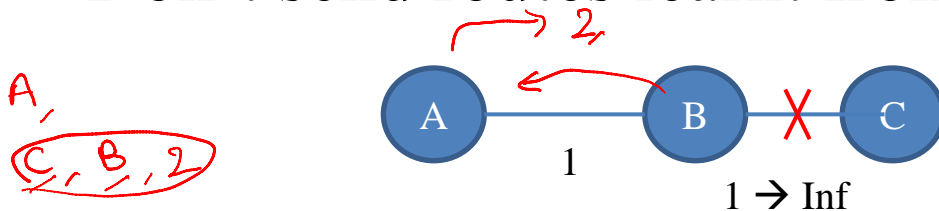
- Make infinity small

- Use for example 16 to represent infinity (assumes max no of hops under 16)
- Bounds time it takes to count to infinity

↗ hop count cost metric = hop count

- Split horizon

- Don't send routes learnt from a neighbor back to it



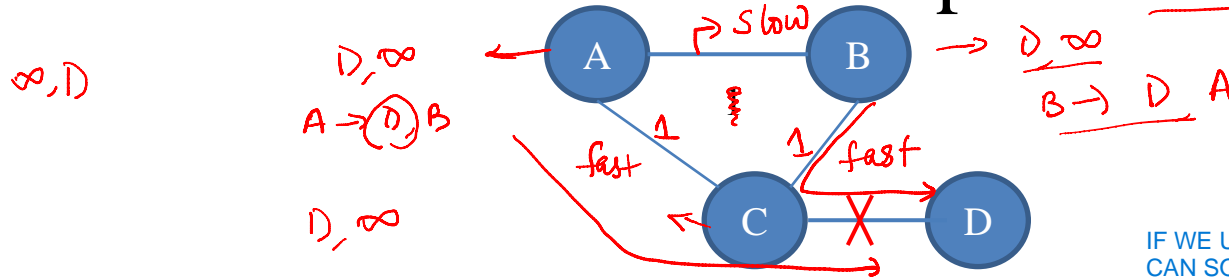
Partial Solutions

- Split horizon with poison reverse

- Send routes learnt from a neighbor back to it but with infinite cost



- Split horizon with and without poison reverse



A,B send each other periodic updates, but they go slowly .. and reach B,A slowly

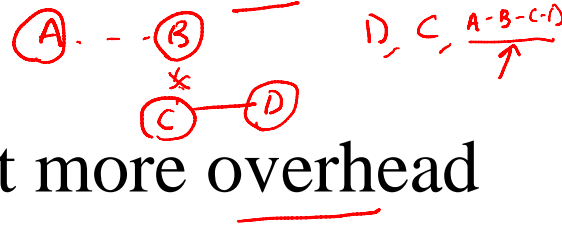
↗ table exchange

IF WE USE POISON REVERSE, THEN WE CAN SOLVE THIS ABOVE PROBLEM with 1 table exchange itself

- Both don't work for loops with more than 2 nodes

Partial Solutions

- Hold-Down Timer: Wait some time before propagating link failure
after hearing abt inf, and next hear abt some other value .. dont immediately change inf to that value
 - Slows down convergence
- Path-vector routing is a variation of distance-vector
 - Each node sends to its neighbors not just the cost, but the entire path to the destination
 - Avoids the looping problem of DV but more overhead



RIP

- Routing Information Protocol (RIP) is a standard that implements DV routing
- One of the oldest DV based protocol
 - Popular once, not used much due to convergence problems
↳ size

RIP Features

it is running as a application layer process and port 520

- Uses UDP and work over reserved port 520
- Period updates sent every 30 sec
- Supports multiple address families
- Cost of a link is 1 (finds minimum hop route)
- 16 represents infinity, *split horizon, hold-down timer*
- RIP can run only on very small networks

RIPv1 Packet Format

→ R₁ C₁ (NH₁)

0	Command <i>request/reply</i>	Version	Reserved <i>—</i>	31
	Family of Net 1 <i>→ IP</i>		Reserved <i>—</i>	
	Address of Net 1 (IP Address) <i>5x4 classful</i>			
	Reserved <i>—</i>			
	Reserved <i>for extra addressing formats</i>			
	Distance to Net 1			
	Family of Net 2		Reserved	
	Address of Net 2 (IP Address)			
	Reserved			
	Reserved			
	Distance to Net 1			

→ IP Prefix (NH₁)
Route

Reserved fields are set to all zero

$\left. \begin{matrix} IPF_1 \\ R \end{matrix} \right\} \left. \begin{matrix} IPF_2 \\ R \end{matrix} \right\} \left. \begin{matrix} IPF_3 \\ R \end{matrix} \right\}$
 $\begin{matrix} 1 \\ 0 \\ 1 \end{matrix}$
 $\begin{matrix} IPF_1 & 0 \\ IPF_2 & 0 \\ IPF_3 & 1 \end{matrix}$

1 to 25 sets of entries, each entry is 20 bytes

classless

Summary

- Distance vector is a distributed, dynamic algorithm
- Exchanges information locally to determine routes
- Suffers from poor convergence, routing loops
- RIP is a standard that implements the DV protocol
 - Handles above problems via (split horizon, hold-down timer and using a value of 16 to represent infinity)
- Better approach: Link-state routing