Computer Network Protocols
Network Layer (Part 1)
Lesson 2

كلية المستقبل الجامعة
قسم هندسة تقنيات الحاسوب
المرحلة الرابعة

By

Dr. Layth Abdulkareem Hassnawi

Dynamic Routing Algorithm

We will study two type of dynamic routing algorithm, these are:

1. Distance Vector Routing.

2. Link state routing.

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Distance Vector Routing

- Distance Vector routing is **intra-domain** protocols, **inside** Autonomous system, but not between Autonomous system.
- Distance-vector routing is based on the **least-cost** goal.
- Distance Vector developed by **Bellman-Ford** algorithm.
- Bellman **equation** is used to find the **least** cost (**shortest distance**) between a source and destination.
- A **distance vector routing algorithm** operates by having each router **maintain a table** (i.e., a **vector**) giving the best known distance to each destination.
- These tables are **updated by exchanging** information with the neighbor's router. Every router knows the **best link** to reach each destination.
- Distance Vector router **tells ONLY neighbors** about ALL routes
- **RIP** based on distance vector routing, each router **shares**, **at regular intervals**, its knowledge about entire AS with its neighbor.
- It is so **slow** and does not take **Bandwidth** into consideration when choose the root.

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Distance Vector Routing (Initialization)

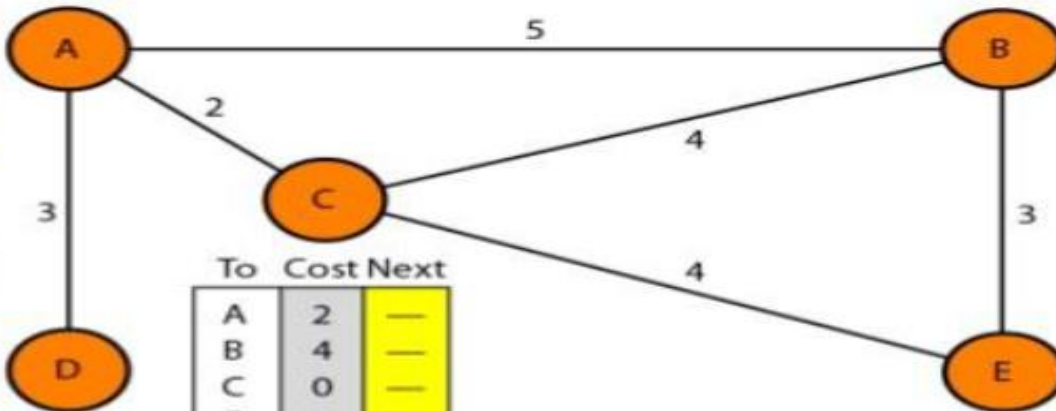*Ex/Update Router A using Distance vector algorithm.*

Initialization of tables in distance vector routing (DVR)

A's table

To	Cost	Next
A	0	—
B	5	—
C	2	—
D	3	—
E	∞	

B's table

To	Cost	Next
A	5	—
B	0	—
C	4	—
D	∞	
E	3	—

D's table

To	Cost	Next
A	3	—
B	∞	
C	∞	
D	0	—
E	∞	

C's table

To	Cost	Next
A	2	—
B	4	—
C	0	—
D	∞	
E	4	—

E's table

To	Cost	Next
A	∞	
B	3	B
C	4	C
D	∞	
E	0	D

Links: A—B = 5, A—C = 2, C—B = 4, A—D = 3, C—E = 4, B—E = 3

Distance Vector Routing (Updating)

To	Cost
A	2
B	4
C	0
D	∞
E	4

Received from C

To	Cost	Next
A	4	C
B	6	C
C	2	C
D	∞	C
E	6	C

A's modified table

Compare

To	Cost	Next
A	0	—
B	5	—
C	2	—
D	3	—
E	∞	

A's old table

To	Cost	Next
A	0	—
B	5	—
C	2	—
D	3	—
E	6	C

A's new table

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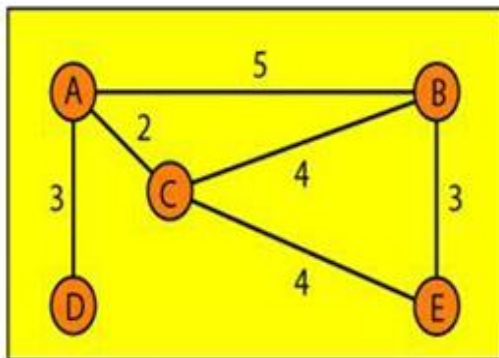
Distance Vector Routing

Distance vector algorithm

Bellman-Ford equation (dynamic programming)

let

$d_x(y) :=$ cost of least-cost path from x to y
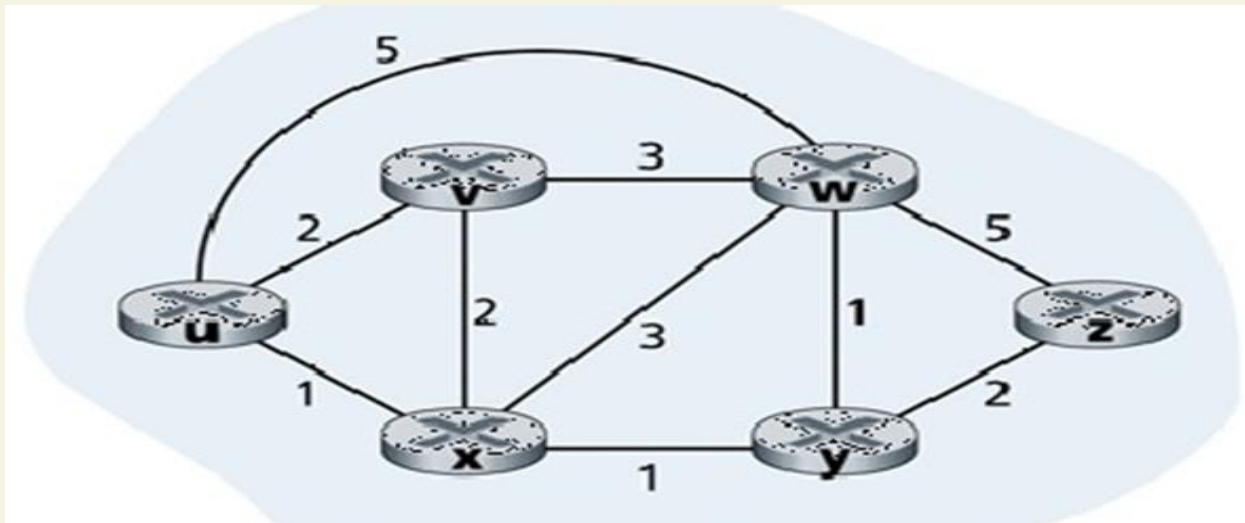
Then

$$d_x(y) = min \{c(x,v) + d_v(y) \}$$

cost from neighbor v to destination y

cost to neighbor v

min taken over all neighbors v of x

Distance Vector Routing Example

Consider the following network, using Bellman-Ford equation. Calculate routing graph abstraction cost (shortest path) from U to Z

$$Distance\,_u^z = min\,\{cost\,(U,V)\,+\,d_v^{\,z}\,,\,cost\,(U,X)\,+\,d_x^{\,z}\,,\,cost\,(U,W)\,+\,d_w^{\,z}\}$$

$$= min\,\{2\,+5\,,1\,+3\,,5+3\}$$

$$= min\,\{7\,,4\,,8\} = 4$$

Distance Vector Routing

*The primary problem in distance vector that the algorithm often took too **long to converge** after the network topology changed (due to the count-to-infinity problem). Consequently, it was replaced by a new algorithm, now called **link state routing**.*

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End Of Lesson 2

Thanks For Listening