Distance Vector Routing Algorithm

iterative:

- continues until no nodes exchange info.
- *self-terminating*: no "signal" to stop

asynchronous:

- nodes need *not* exchange info/iterate in lock step!

distributed:

- each node communicates *only* with directly-attached neighbors

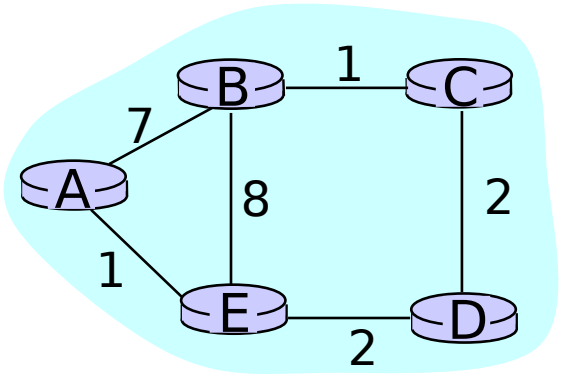
Distance Table data structure

- each node has its own
- row for each possible destination
- column for each directly-attached neighbor to node
- example: in node X, for dest. Y via neighbor Z:

$$D^X(Y,Z) = \text{distance } \textit{from } X \textit{ to } Y, \textit{ via } Z \text{ as next hop}$$

$$= c(X,Z) + \min_w\{D^Z(Y,w)\}$$

Distance Table: example



$$D^E(C,D) = c(E,D) + \min_w\{D^D(C,w)\}$$
$$= 2+2 = 4$$

$$D^E(A,D) = c(E,D) + \min_w\{D^D(A,w)\}$$
$$= 2+3 = 5$$ loop!

$$D^E(A,B) = c(E,B) + \min_w\{D^B(A,w)\}$$
$$= 8+6 = 14$$ loop!

$D^E()$

destination	cost to destination via A	via B	via D
A	1	14	5
B	7	8	5
C	6	9	4
D	4	11	2

Distance table gives routing table

$D^E()$

destination	cost to destination via A	via B	via D
A	1	14	5
B	7	8	5
C	6	9	4
D	4	11	2

destination	Outgoing link to use, cost
A	A,1
B	D,5
C	D,4
D	D,4

Distance table → Routing table

Distance Vector Routing: overview

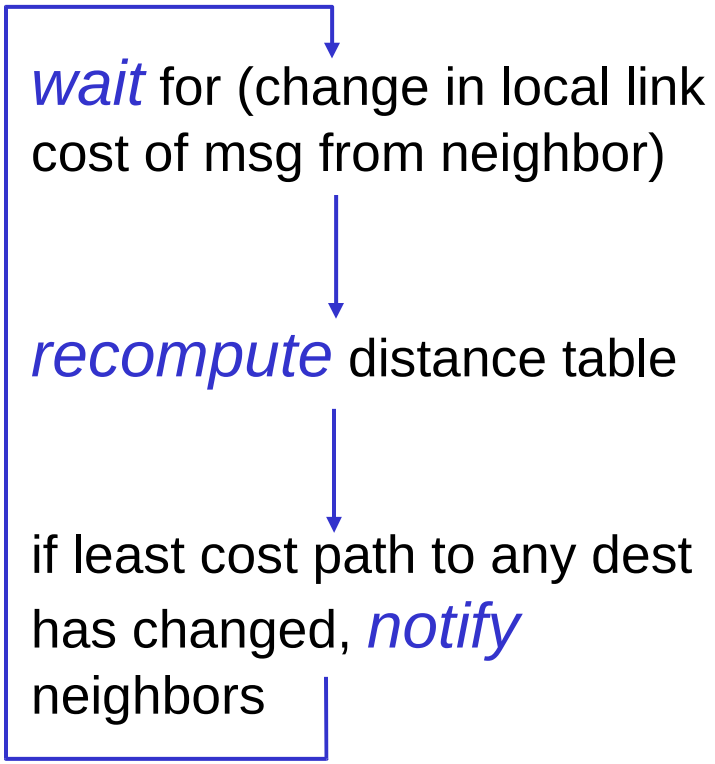
Iterative, asynchronous: each local iteration caused by:

- local link cost change
- message from neighbor: its least cost path change from neighbor

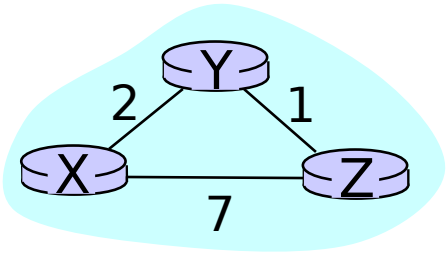
Distributed:

- each node notifies neighbors *only* when its least cost path to any destination changes
  - neighbors then notify their neighbors if necessary

Each node:



Distance Vector Algorithm: example



D^X	cost via Y	cost via Z
dest Y	2	∞
dest Z	∞	7

D^Y	cost via X	cost via Z
dest X	2	∞
dest Z	∞	1

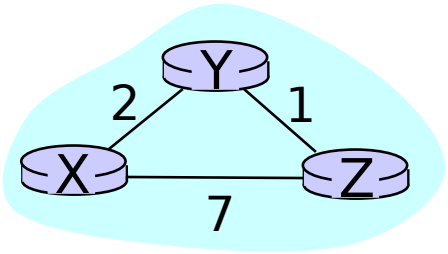
D^Z	cost via X	cost via Y
dest X	7	∞
dest Y	∞	1

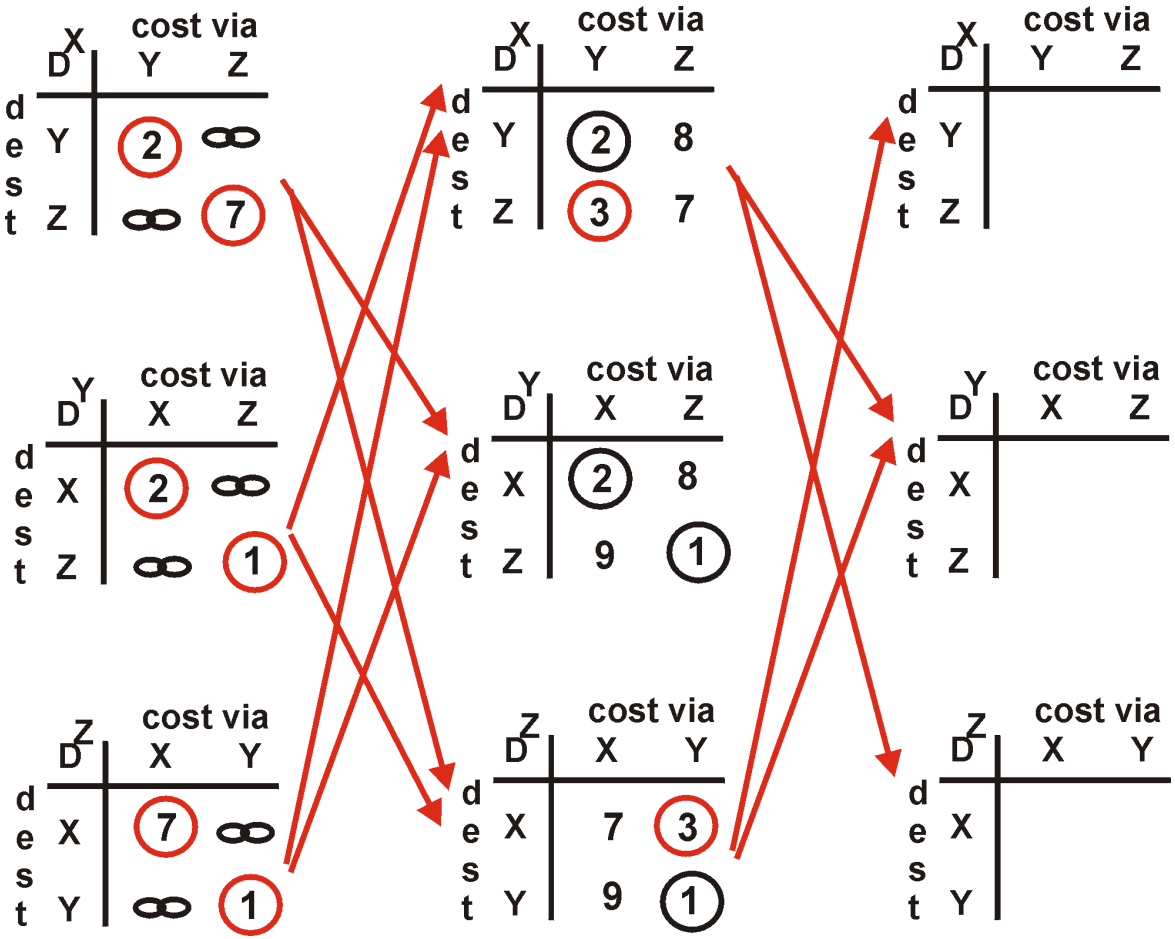
D^X	cost via Y	cost via Z
dest Y	2	8
dest Z	3	7

$$D^X(Y,Z) = c(X,Z) + \min_w\{D^Z(Y,w)\}$$
$$= 7+1 = 8$$

$$D^X(Z,Y) = c(X,Y) + \min_w\{D^Y(Z,w)\}$$
$$= 2+1 = 3$$

Distance Vector Algorithm: example

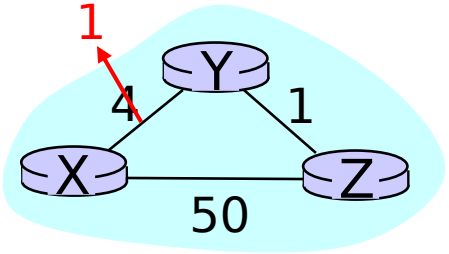




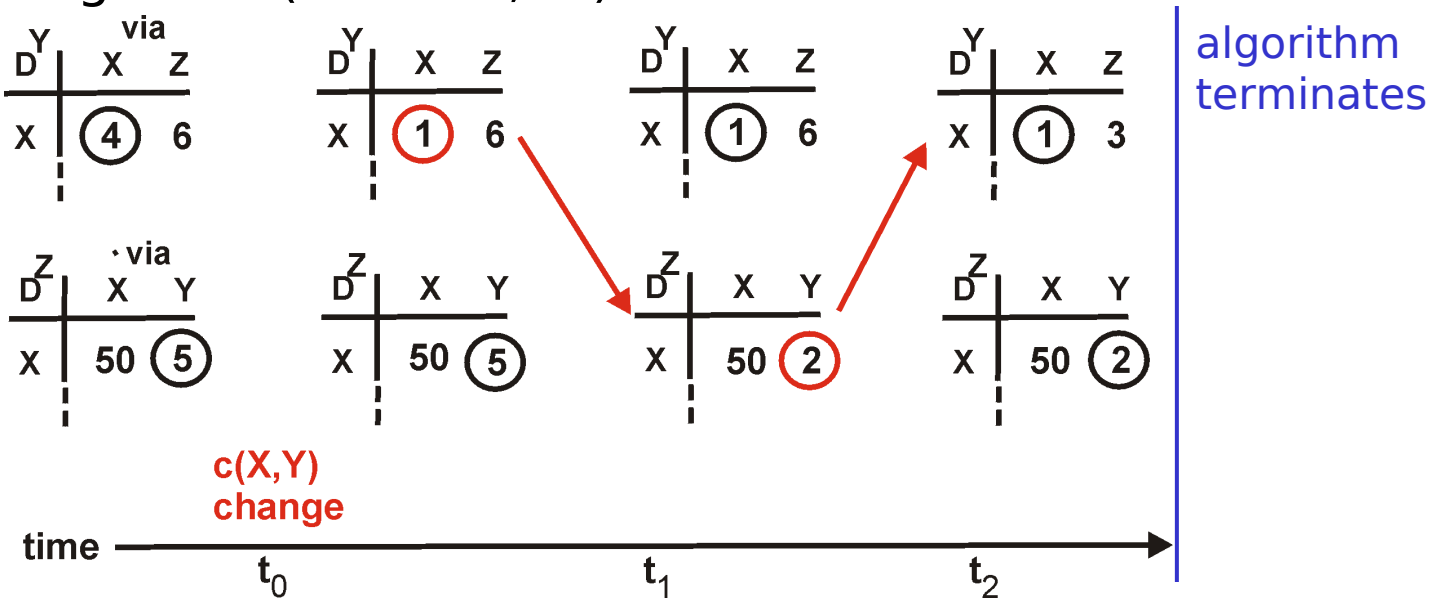
Distance Vector: link cost changes

Link cost changes:

- node detects local link cost change
- updates distance table (line 15)
- if cost change in least cost path, notify neighbors (lines 23,24)



"good news travels fast"



Distance Vector: link cost changes

Link cost changes:

- good news travels fast
- bad news travels slow - "count to infinity" problem!