

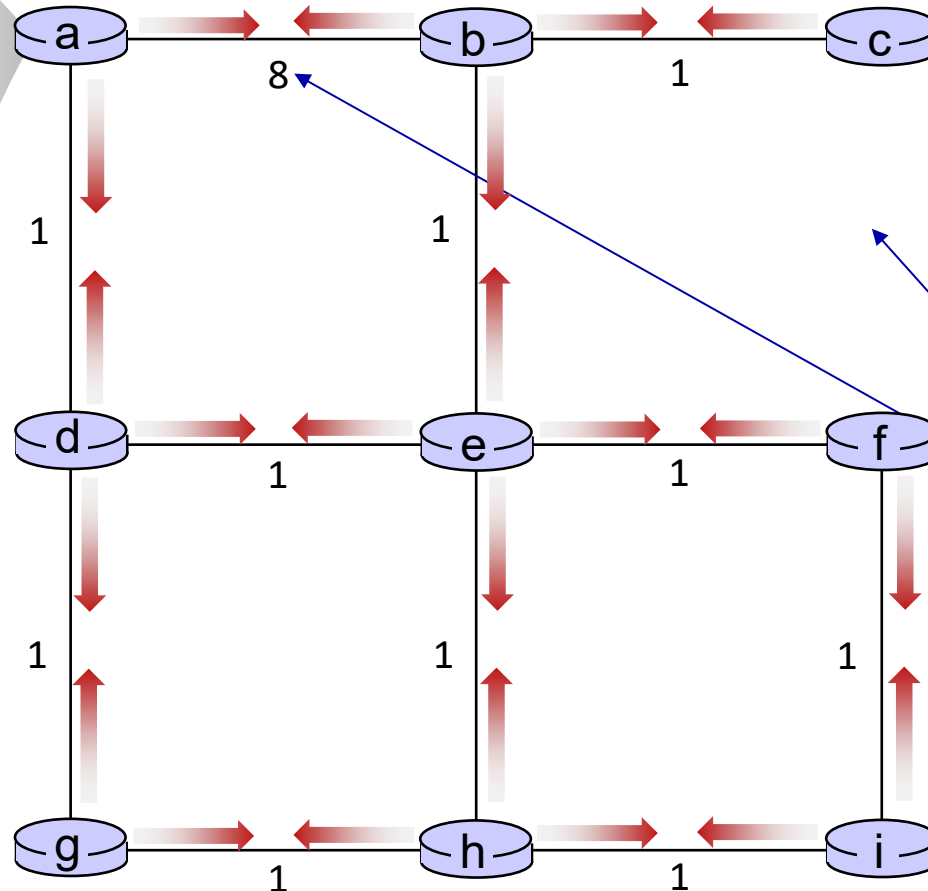
Distance vector: example



t=0

- All nodes have distance estimates to nearest neighbors (only)
- All nodes **send** their local **distance vector to their neighbors**

DV in a:
$D_a(a)=0$
$D_a(b)=8$
$D_a(c)=\infty$
$D_a(d)=1$
$D_a(e)=\infty$
$D_a(f)=\infty$
$D_a(g)=\infty$
$D_a(h)=\infty$
$D_a(i)=\infty$



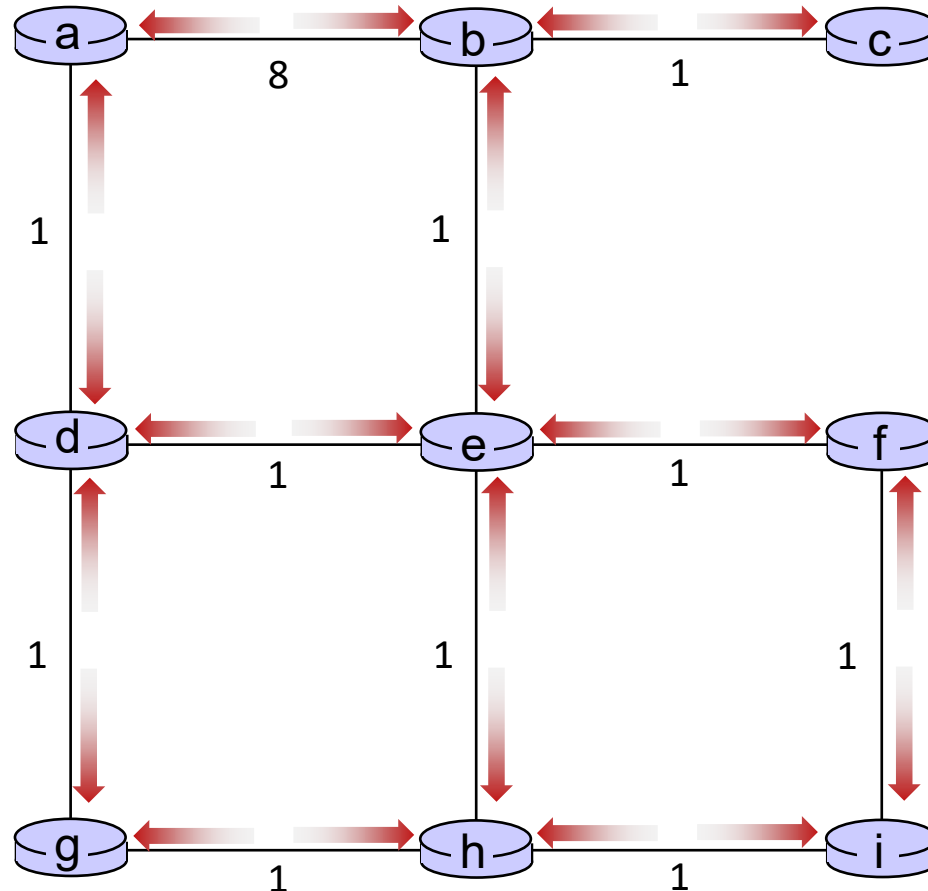
Distance vector example: iteration



t=1

All nodes:

- receive distance vectors from neighbors
- compute their new local distance vector
- send their new local distance vector to neighbors



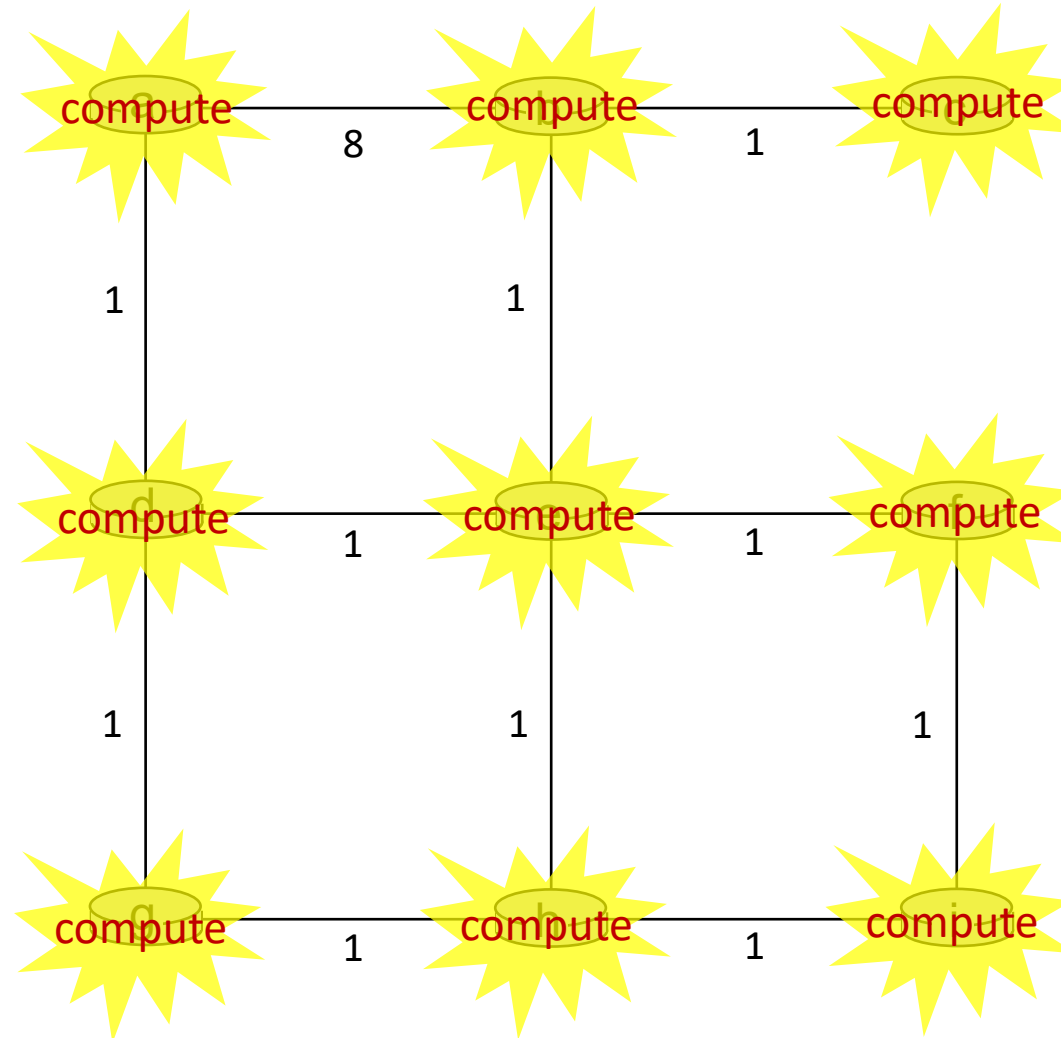
Distance vector example: iteration



t=1

All nodes:

- receive distance vectors from neighbors
- **compute their new local distance vector**
- send their new local distance vector to neighbors



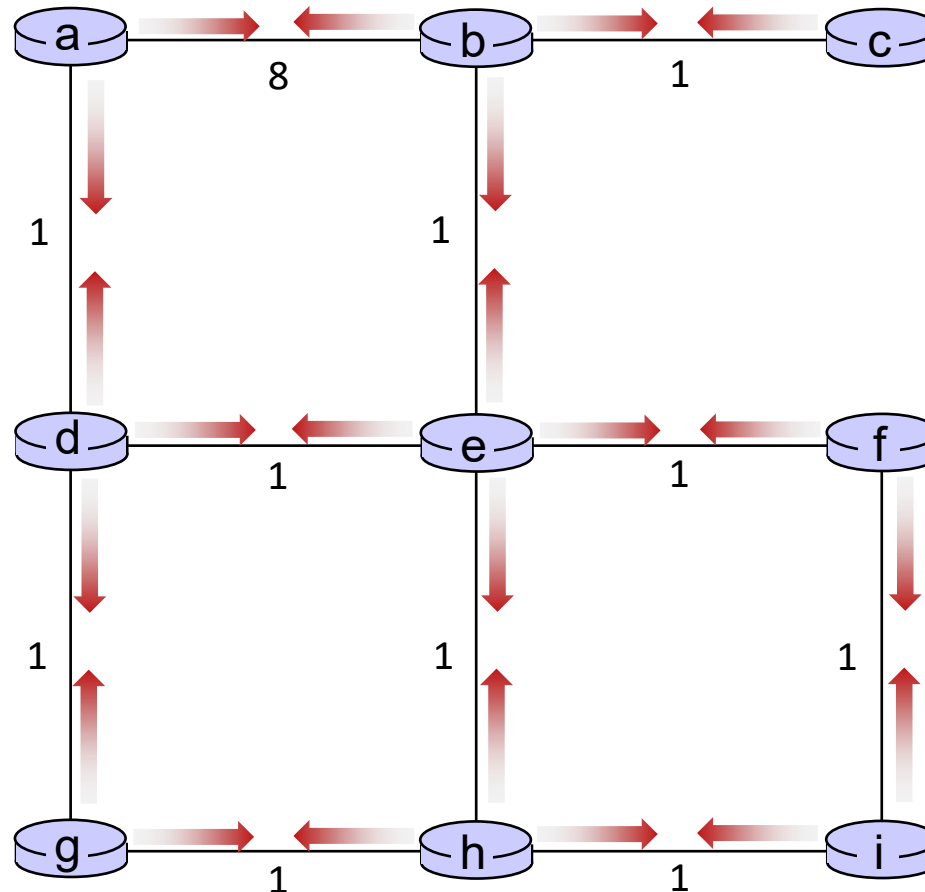
Distance vector example: iteration



t=1

All nodes:

- receive distance vectors from neighbors
- compute their new local distance vector
- send their new local distance vector to neighbors



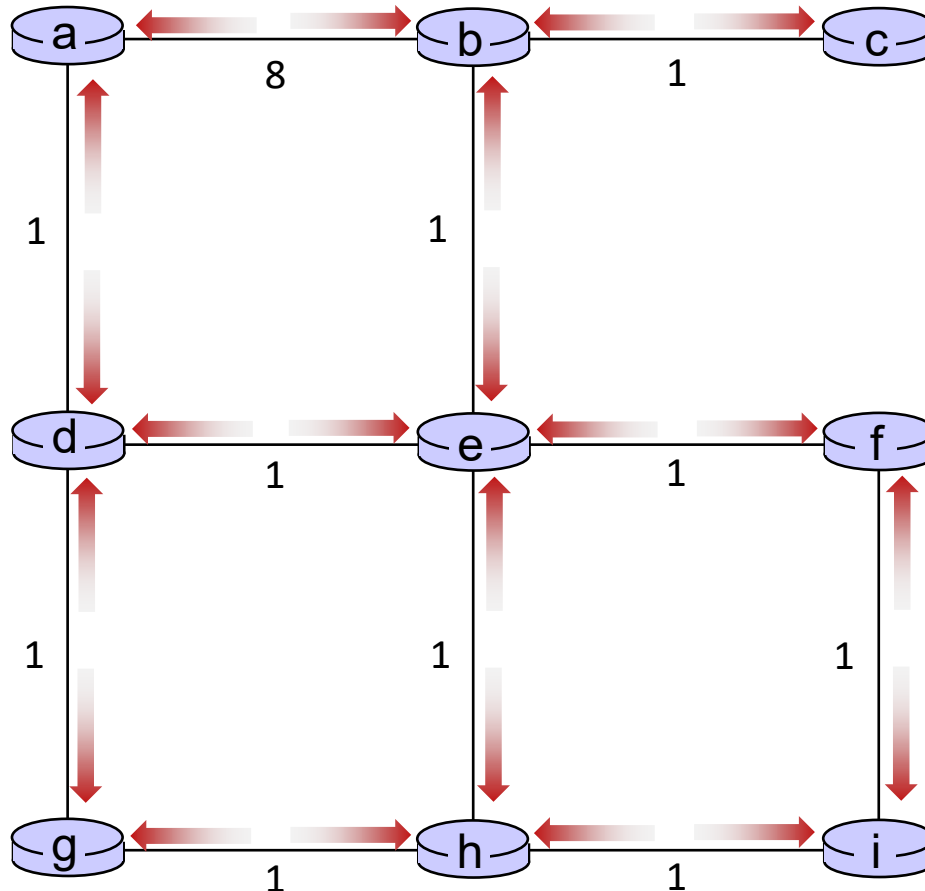
Distance vector example: iteration



t=2

All nodes:

- receive distance vectors from neighbors
- compute their new local distance vector
- send their new local distance vector to neighbors



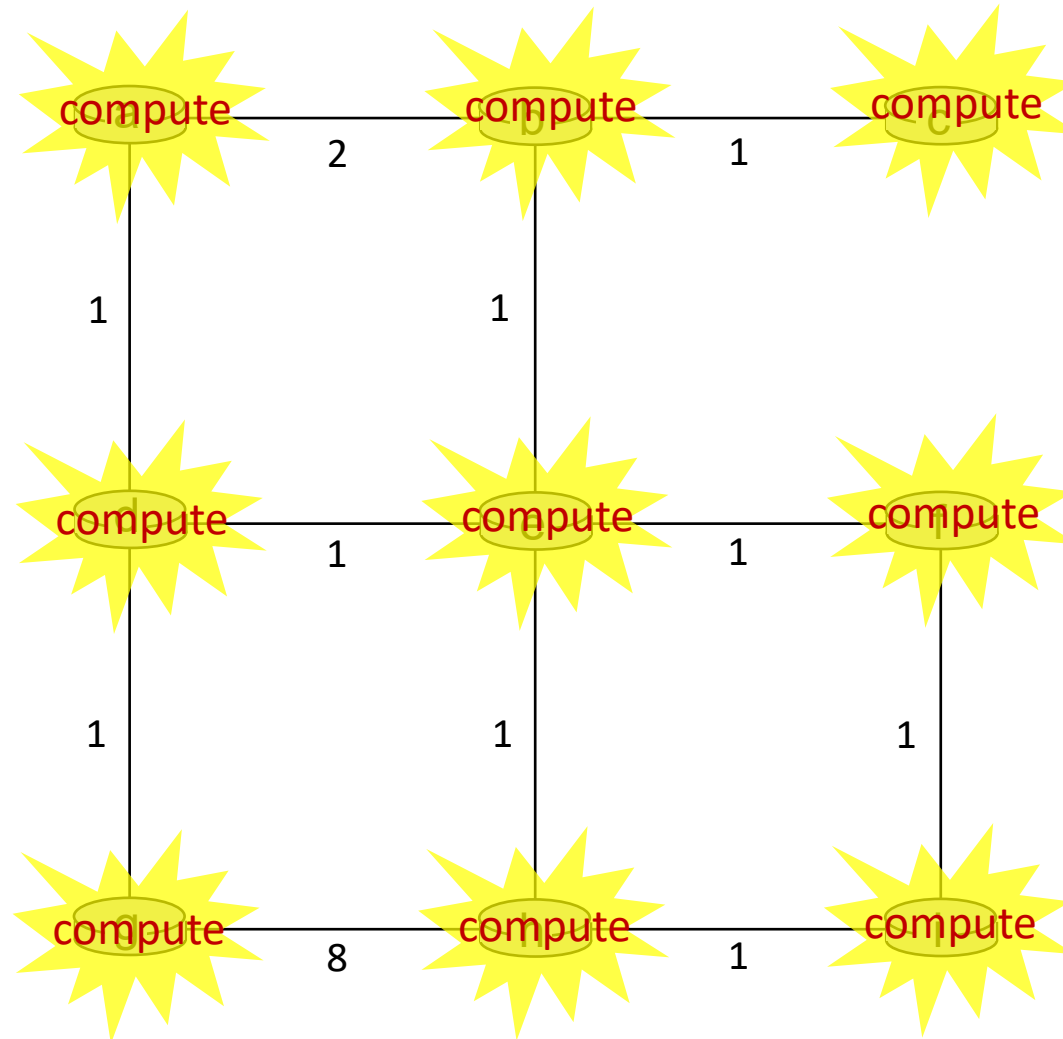
Distance vector example: iteration



t=2

All nodes:

- receive distance vectors from neighbors
- compute their new local distance vector
- send their new local distance vector to neighbors



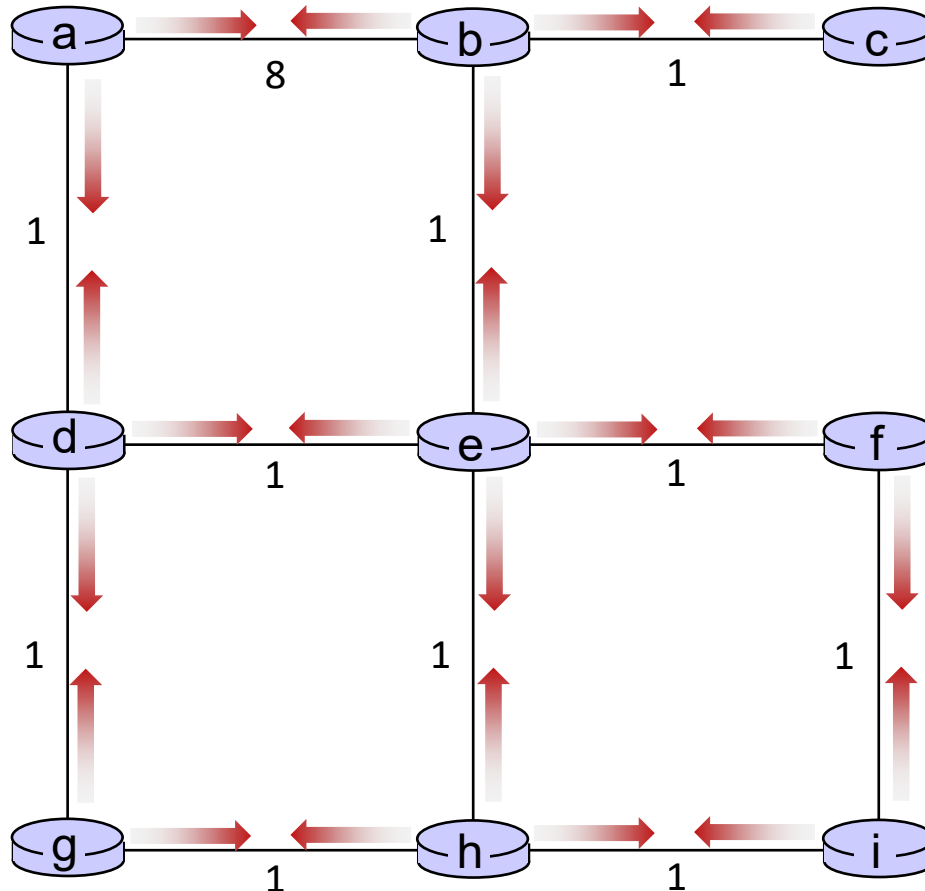
Distance vector example: iteration



t=2

All nodes:

- receive distance vectors from neighbors
- compute their new local distance vector
- send their new local distance vector to neighbors



Distance vector example: iteration

.... and so on

Let's next take a look at the iterative *computations* at nodes

Distance vector exam.



t=1

- b receives DVs from a, c, e

DV in a:

$D_a(a)=0$
 $D_a(b)=8$
 $D_a(c)=\infty$
 $D_a(d)=1$
 $D_a(e)=\infty$
 $D_a(f)=\infty$
 $D_a(g)=\infty$
 $D_a(h)=\infty$
 $D_a(i)=\infty$

DV in b:

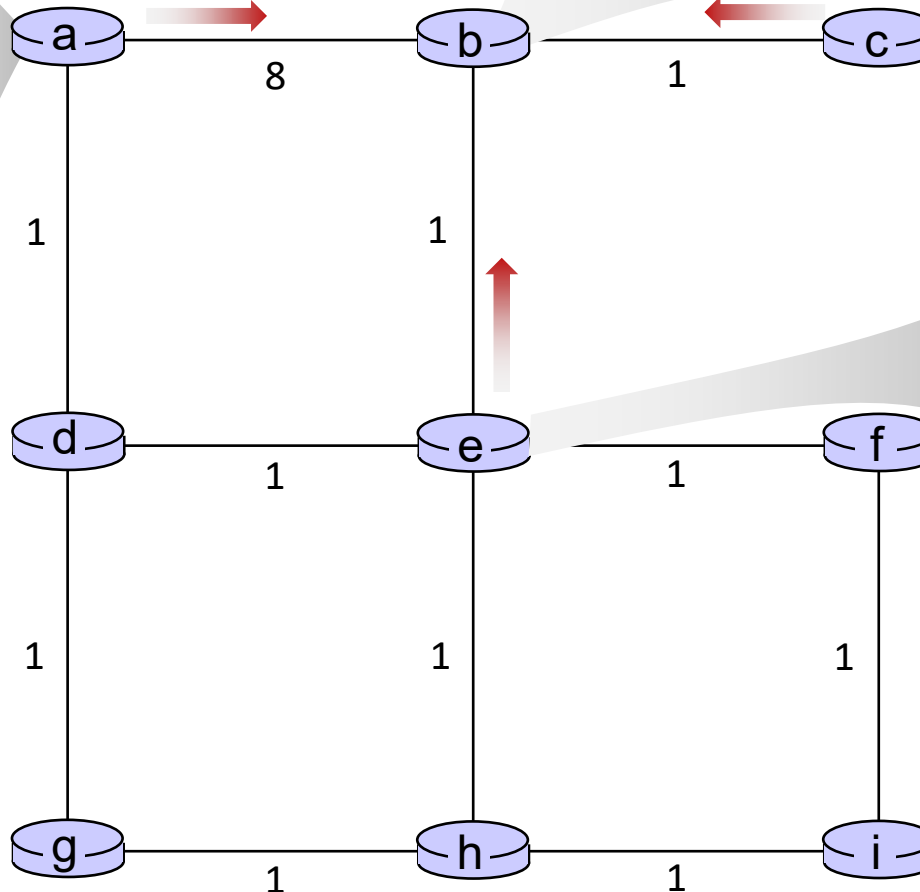
$D_b(a)=8$ $D_b(f)=\infty$
 $D_b(c)=1$ $D_b(g)=\infty$
 $D_b(d)=\infty$ $D_b(h)=\infty$
 $D_b(e)=1$ $D_b(i)=\infty$

DV in c:

$D_c(a)=\infty$
 $D_c(b)=1$
 $D_c(c)=0$
 $D_c(d)=\infty$
 $D_c(e)=\infty$
 $D_c(f)=\infty$
 $D_c(g)=\infty$
 $D_c(h)=\infty$
 $D_c(i)=\infty$

DV in e:

$D_e(a)=\infty$
 $D_e(b)=1$
 $D_e(c)=\infty$
 $D_e(d)=1$
 $D_e(e)=0$
 $D_e(f)=1$
 $D_e(g)=\infty$
 $D_e(h)=1$
 $D_e(i)=\infty$



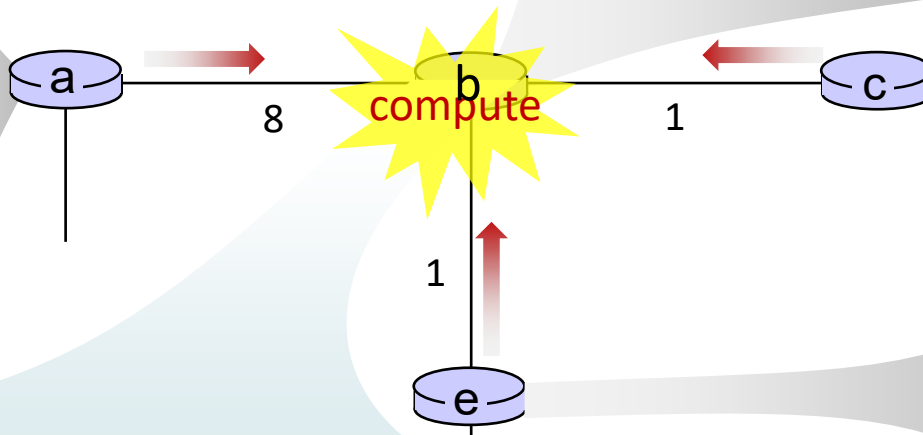
Distance vector exam.



t=1

- b receives DVs from a, c, e, computes:

DV in a:
$D_a(a)=0$
$D_a(b)=8$
$D_a(c)=\infty$
$D_a(d)=1$
$D_a(e)=\infty$
$D_a(f)=\infty$
$D_a(g)=\infty$
$D_a(h)=\infty$
$D_a(i)=\infty$



DV in b:	
$D_b(a)=8$	$D_b(f)=\infty$
$D_b(c)=1$	$D_b(g)=\infty$
$D_b(d)=\infty$	$D_b(h)=\infty$
$D_b(e)=1$	$D_b(i)=\infty$

DV in c:
$D_c(a)=\infty$
$D_c(b)=1$
$D_c(c)=0$
$D_c(d)=\infty$
$D_c(e)=\infty$
$D_c(f)=\infty$
$D_c(g)=\infty$
$D_c(h)=\infty$
$D_c(i)=\infty$

DV in e:
$D_e(a)=\infty$
$D_e(b)=1$
$D_e(c)=\infty$
$D_e(d)=1$
$D_e(e)=0$
$D_e(f)=1$
$D_e(g)=\infty$
$D_e(h)=1$
$D_e(i)=\infty$

$$D_b(a) = \min\{c_{b,a} + D_a(a), c_{b,c} + D_c(a), c_{b,e} + D_e(a)\} = \min\{8, \infty, \infty\} = 8$$

$$D_b(c) = \min\{c_{b,a} + D_a(c), c_{b,c} + D_c(c), c_{b,e} + D_e(c)\} = \min\{\infty, 1, \infty\} = 1$$

$$D_b(d) = \min\{c_{b,a} + D_a(d), c_{b,c} + D_c(d), c_{b,e} + D_e(d)\} = \min\{9, \infty, 2\} = 2$$

$$D_b(e) = \min\{c_{b,a} + D_a(e), c_{b,c} + D_c(e), c_{b,e} + D_e(e)\} = \min\{\infty, \infty, 1\} = 1$$

$$D_b(f) = \min\{c_{b,a} + D_a(f), c_{b,c} + D_c(f), c_{b,e} + D_e(f)\} = \min\{\infty, \infty, 2\} = 2$$

$$D_b(g) = \min\{c_{b,a} + D_a(g), c_{b,c} + D_c(g), c_{b,e} + D_e(g)\} = \min\{\infty, \infty, \infty\} = \infty$$

$$D_b(h) = \min\{c_{b,a} + D_a(h), c_{b,c} + D_c(h), c_{b,e} + D_e(h)\} = \min\{\infty, \infty, 2\} = 2$$

$$D_b(i) = \min\{c_{b,a} + D_a(i), c_{b,c} + D_c(i), c_{b,e} + D_e(i)\} = \min\{\infty, \infty, \infty\} = \infty$$

DV in b:	
$D_b(a)=8$	$D_b(f)=2$
$D_b(c)=1$	$D_b(g)=\infty$
$D_b(d)=2$	$D_b(h)=2$
$D_b(e)=1$	$D_b(i)=\infty$

Distance vector exam.



t=1

- c receives DVs from b

DV in a:

$D_a(a)=0$
 $D_a(b)=8$
 $D_a(c)=\infty$
 $D_a(d)=1$
 $D_a(e)=\infty$
 $D_a(f)=\infty$
 $D_a(g)=\infty$
 $D_a(h)=\infty$
 $D_a(i)=\infty$

DV in b:

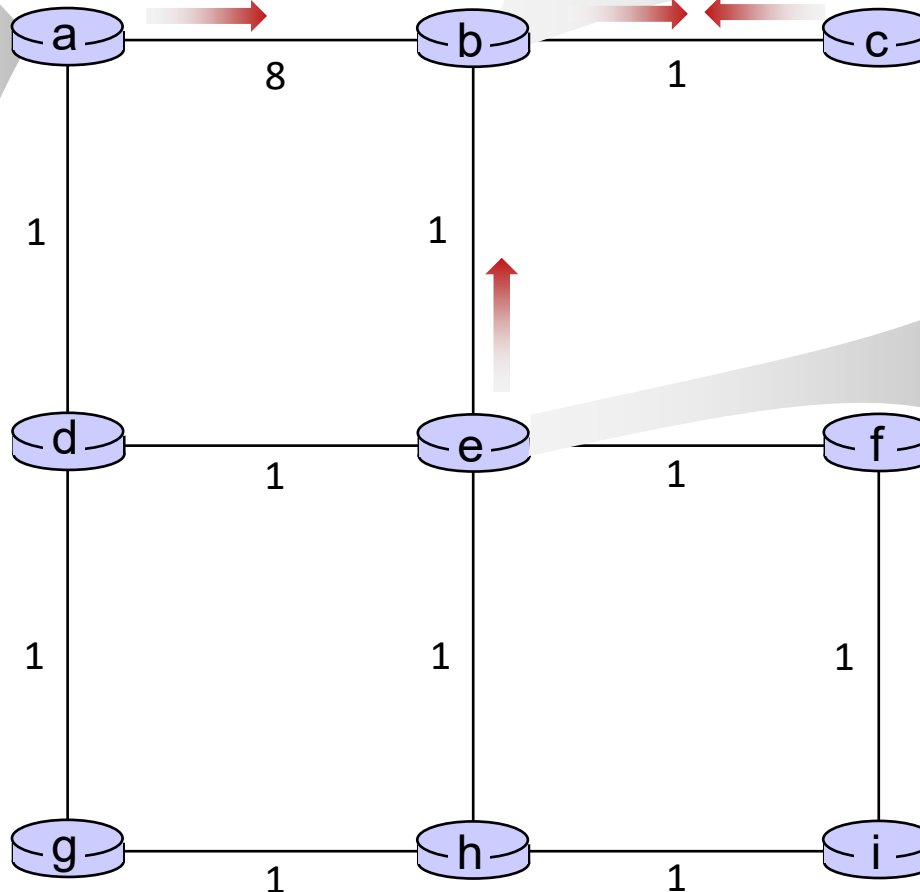
$D_b(a)=8$ $D_b(f)=\infty$
 $D_b(c)=1$ $D_b(g)=\infty$
 $D_b(d)=\infty$ $D_b(h)=\infty$
 $D_b(e)=1$ $D_b(i)=\infty$

DV in c:

$D_c(a)=\infty$
 $D_c(b)=1$
 $D_c(c)=0$
 $D_c(d)=\infty$
 $D_c(e)=\infty$
 $D_c(f)=\infty$
 $D_c(g)=\infty$
 $D_c(h)=\infty$
 $D_c(i)=\infty$

DV in e:

$D_e(a)=\infty$
 $D_e(b)=1$
 $D_e(c)=\infty$
 $D_e(d)=1$
 $D_e(e)=0$
 $D_e(f)=1$
 $D_e(g)=\infty$
 $D_e(h)=1$
 $D_e(i)=\infty$



Distance vector exam,

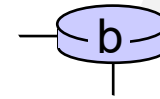


t=1

- c receives DVs from b computes:

$$\begin{aligned}
 D_c(a) &= \min\{c_{c,b} + D_b(a)\} = 1 + 8 = 9 \\
 D_c(b) &= \min\{c_{c,b} + D_b(b)\} = 1 + 0 = 1 \\
 D_c(d) &= \min\{c_{c,b} + D_b(d)\} = 1 + \infty = \infty \\
 D_c(e) &= \min\{c_{c,b} + D_b(e)\} = 1 + 1 = 2 \\
 D_c(f) &= \min\{c_{c,b} + D_b(f)\} = 1 + \infty = \infty \\
 D_c(g) &= \min\{c_{c,b} + D_b(g)\} = 1 + \infty = \infty \\
 D_c(h) &= \min\{c_{c,b} + D_b(h)\} = 1 + \infty = \infty \\
 D_c(i) &= \min\{c_{c,b} + D_b(i)\} = 1 + \infty = \infty
 \end{aligned}$$

DV in b:	
$D_b(a) = 8$	$D_b(f) = \infty$
$D_b(c) = 1$	$D_b(g) = \infty$
$D_b(d) = \infty$	$D_b(h) = \infty$
$D_b(e) = 1$	$D_b(i) = \infty$



compute

DV in c:
$D_c(a) = \infty$
$D_c(b) = 1$
$D_c(c) = 0$
$D_c(d) = \infty$
$D_c(e) = \infty$
$D_c(f) = \infty$
$D_c(g) = \infty$
$D_c(h) = \infty$
$D_c(i) = \infty$

DV in c:
$D_c(a) = 9$
$D_c(b) = 1$
$D_c(c) = 0$
$D_c(d) = \infty$
$D_c(e) = 2$
$D_c(f) = \infty$
$D_c(g) = \infty$
$D_c(h) = \infty$
$D_c(i) = \infty$

Distance vector exam,



t=1

- e receives DVs from b, d, f, h

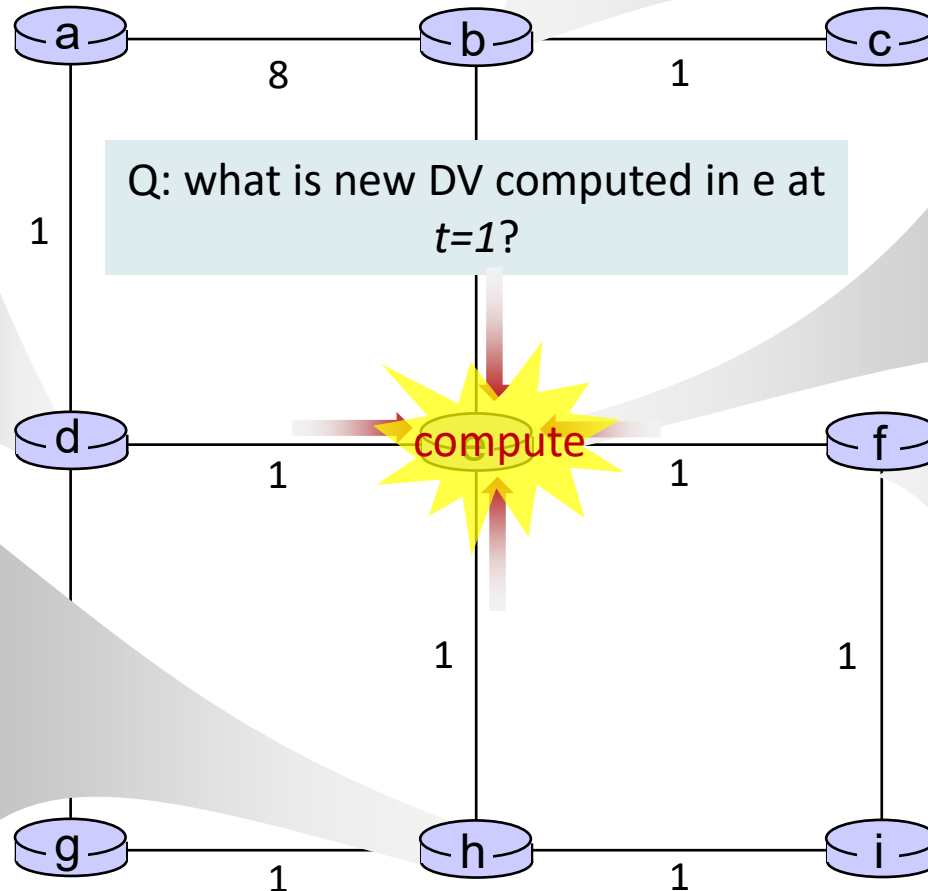
DV in d:
$D_d(a) = 1$
$D_d(b) = \infty$
$D_d(c) = \infty$
$D_d(d) = 0$
$D_d(e) = 1$
$D_d(f) = \infty$
$D_d(g) = 1$
$D_d(h) = \infty$
$D_d(i) = \infty$

DV in h:
$D_h(a) = \infty$
$D_h(b) = \infty$
$D_h(c) = \infty$
$D_h(d) = \infty$
$D_h(e) = 1$
$D_h(f) = \infty$
$D_h(g) = 1$
$D_h(h) = 0$
$D_h(i) = 1$

DV in b:	
$D_b(a) = 8$	$D_b(f) = \infty$
$D_b(c) = 1$	$D_b(g) = \infty$
$D_b(d) = \infty$	$D_b(h) = \infty$
$D_b(e) = 1$	$D_b(i) = \infty$

DV in e:
$D_e(a) = \infty$
$D_e(b) = 1$
$D_e(c) = \infty$
$D_e(d) = 1$
$D_e(e) = 0$
$D_e(f) = 1$
$D_e(g) = \infty$
$D_e(h) = 1$
$D_e(i) = \infty$

DV in f:
$D_f(a) = \infty$
$D_f(b) = \infty$
$D_f(c) = \infty$
$D_f(d) = \infty$
$D_f(e) = 1$
$D_f(f) = 0$
$D_f(g) = \infty$
$D_f(h) = \infty$
$D_f(i) = 1$



Distance vector: state information diffusion

Iterative communication, computation steps diffuses information through network:

-  $t=0$ c's state at $t=0$ is at c only
-  $t=1$ c's state at $t=0$ has propagated to b, and may influence distance vector computations up to **1** hop away, i.e., at b
-  $t=2$ c's state at $t=0$ may now influence distance vector computations up to **2** hops away, i.e., at b and now at a, e as well
-  $t=3$ c's state at $t=0$ may influence distance vector computations up to **3** hops away, i.e., at b,a,e and now at c,f,h as well
-  $t=4$ c's state at $t=0$ may influence distance vector computations up to **4** hops away, i.e., at b,a,e, c, f, h and now at g,i as well

