# Routing Algorithms

- Adaptive algorithm:
  - Reflect change in topology
  - Get information locally from adjacent routers
- Non Adaptive Algorithm
  - Static routers
  - Downloaded to routers when network is booted
- Routing:
- Principle of Optimality:
  - If router I on optimal path from router I to K then optimal path from J to K also on same route!

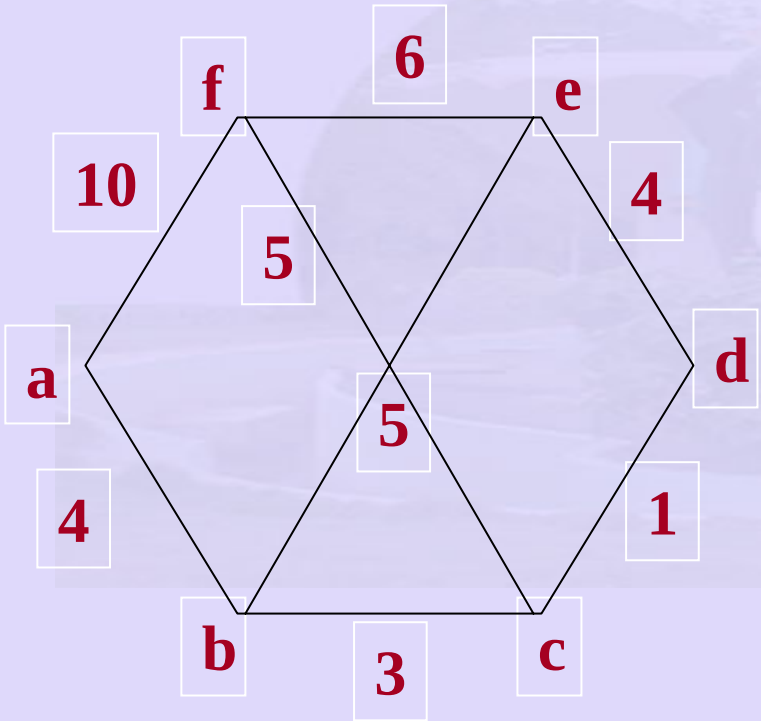
# Routing Algorithms(Static)

- Set of all optimal routes from: Source to a given destination
  - A sink tree!
- Goal of routing algorithm find sink trees that are there!
- Shortest Path Routing:
  - Dijkstra
  - Uses topology
  - Greedy approach
  - Possible shorter path of equal length – need not be unique

# Static Routing Algorithms

- Shortest path routing
  - To send a packet from one node to another find the shortest path between the pair of nodes
- Multipath Routing
  - Multiple paths from Node a to node b.
  - Randomly choose one of the paths

# Dijkstra (example)




**Shortest path from**

**A→D is via b and c**

# Multipath Routing

- Forward traffic based on – a random number
- Example:Path from a to d
  - via b: 0.0 - 0.65
  - via f: 0.65 -1.0
- Packet for d from a:
  - Generate a random number r:
  - If $0 < r \leq 0.65$, choose b
  - otherwise choose f

# Multipath Routing

- Advantages:
  - Reliability
  - disjoint entries
  - multiple routes possible

# Static Routing

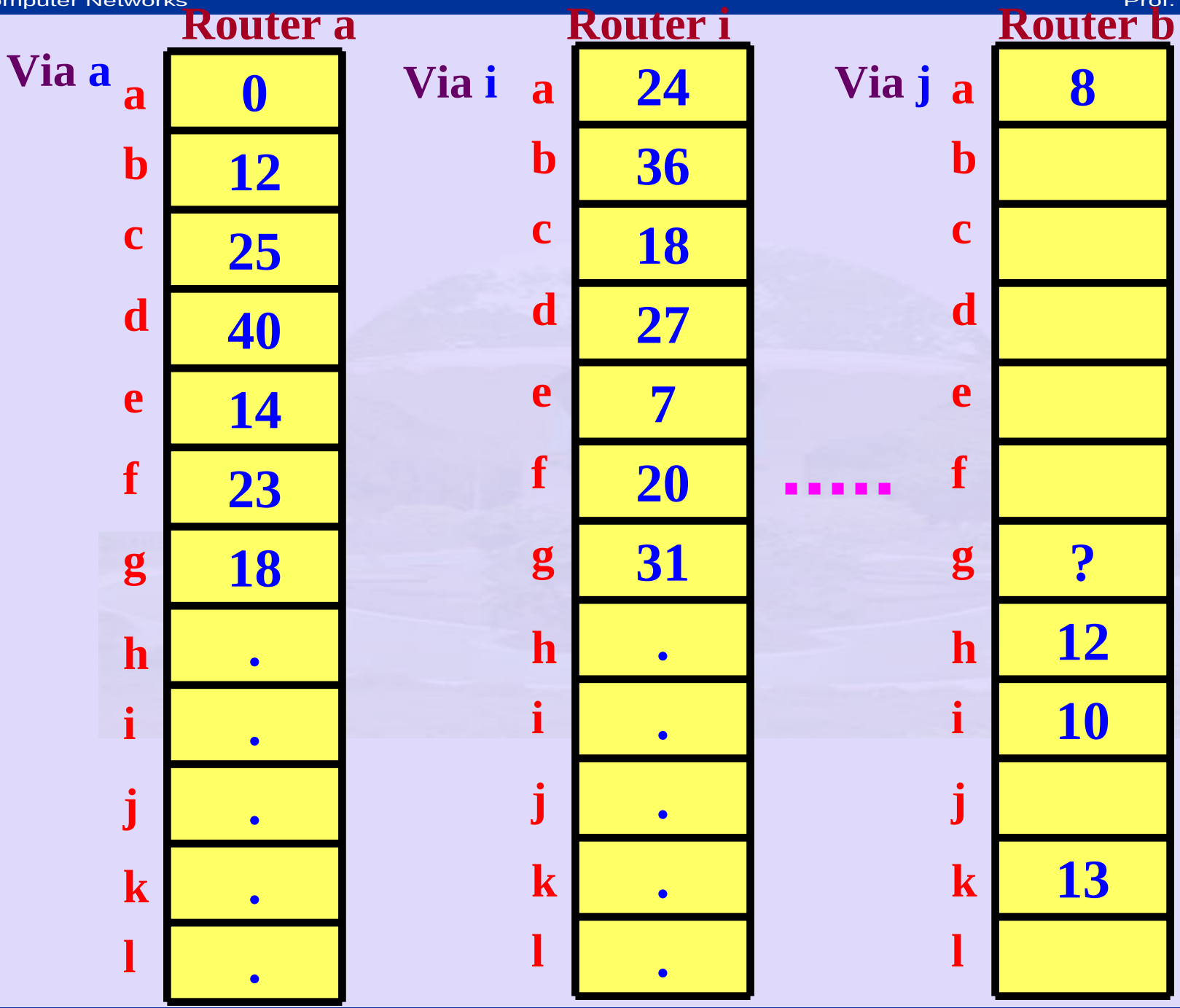
- Disadvantages:
  - SSSP and Multipath:
    - Require complete knowledge of Network topology to make a good decision.
- Hot potato routing
  - Forward on to shortest Queue (defined by hopcount)
  - Use hot potato with static routing
  - rank = Shortest Queue + shortest path

# Distance Vector Routing

- Distance Vector Routing:
- (Distributed Bellman Ford, Fulkerson)
  - Each router maintain a table:
  - destination, estimated cost, link, hop count, time delay in ms, queue length, …
  - Updated by exchanging information between router - ICMP

# Dynamic Routing

- Distributed Routing:
  - Dynamic routing
  - Changing topology of the network
  - Need to recompute route continuously

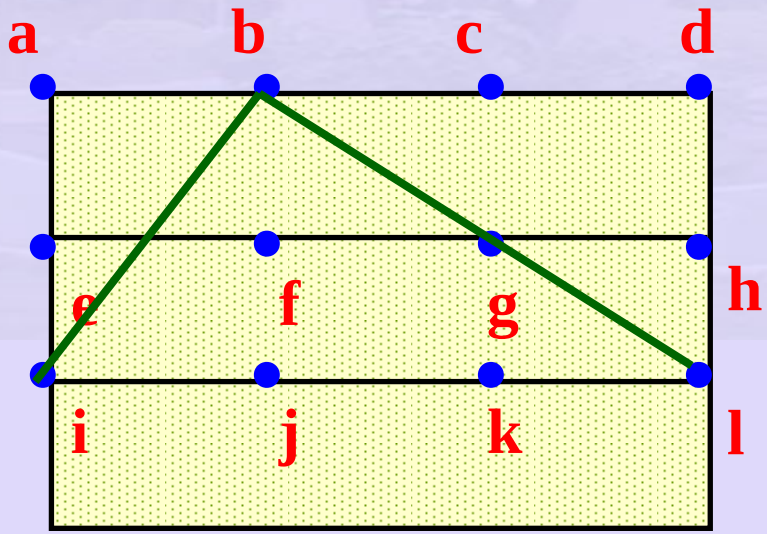

Router a
Via a
a 0
b 12
c 25
d 40
e 14
f 23
g 18
h .
i .
j .
k .
l .
Router i
Via i
a 24
b 36
c 18
d 27
e 7
f 20
g 31
h .
i .
j .
k .
l .
Router b
Via j
a 8
b
c
d
e
f
g ?
h 12
i 10
j
k 13
l
.....

# Distance Vector Routing

- Compute route from b to g
- via a – 8 + 18
- via i – 10 +31
- so update route to g to 26

# Distance Vector Routing

- Example: b wants to update its information



# Issues: Count to infinity

Initially

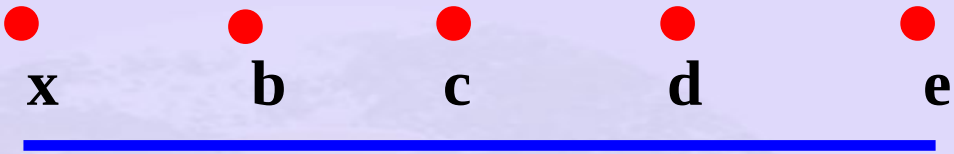
b – x 1

c – x 2

d – x 3

e – x 4

Now x goes down




| | b | c | d | e |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| 1 exchange | 3 | 2 | 3 | 4 |
| 2 exchange | 3 | 1 | 3 | 4 |
| | 5 | 4 | 5 | 4 |
| | 5 | 6 | 5 | 6 |
| | 7 | 6 | 7 | 6 |
| | 7 | 8 | 7 | 8 |
| | | | ⋮ | |
| Count to infinity → | | | ∞ | |

**Number of exchanges depends on definition of infinity**