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
<table>
<thead>
<tr>
<th></th>
<th>Router a</th>
<th>Via i</th>
<th>Router i</th>
<th>Via j</th>
<th>Router b</th>
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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

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<tr>
<td>d - x</td>
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<tr>
<td>e - x</td>
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Now x goes down

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Count to infinity $\infty$

Number of exchanges depends on definition of infinity