Network Routing: II

Lecture 19
6.02 Fall 2010
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• Link-state routing
• Routing “around” failures: HELLO protocol & periodic advertisements/integration
• Things that can go wrong: routing loops

Link-State Routing

- Advertisement step:
  - Information about its links to its neighbors
  - Neighbors re-send on their links → flooding
  - Result: Each node discovers map of the network
- Integration: Each node runs the same shortest path algorithm over its map
  - If each node implements computation correctly and each node has the same map, then routing tables will be correct

Link-State Advertisements and Flooding

- Periodically send LSA (Link-State Advertisement)
  - [Node, seq#, [(nbr1, linkcost1), (nbr2, linkcost2), ...]] to all neighbors
- If seq > last_heard:
  - save seq, LSA; rebroadcast LSA to neighbors
  - LSAs aren’t sent reliably (i.e., no ACKs/retries)
  - Periodic messages handle dynamism: state in each node is “soft” and times out if not refreshed

Distance Vector: Pros and Cons

- Simple protocol
- Works well for small networks
- Works only on small networks

Distance Vector Cons (Cont.)

- Solving counting to infinity problem needs “infinity” to be small
  - Otherwise, convergence time too long
- One approach: split horizon advertisements
  - Don’t advertise route to X if you got the installed route from X
  - Better still, advertise a cost of INFINITY to whoever advertised the route to you (so there’s no chance they will use the route you advertise)

Integration Step: Dijkstra’s Algorithm (Example)

Suppose we want to find paths from A to other nodes

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**Path Vector Routing**

- E: l2; cost=2; path=[CE]
- "To reach E, come this way" path = [E]
- E: l2; cost=1; path=[E]

- For each advertisement, run "integration step"
- E.g., pick shortest, cheapest, quickest, etc.
- Ignore advertisements with own address in path vector
- Avoids routing loops that “count to infinity”

**Routing Loop in Link State Protocol**

B to D is via A
Link AD fails
A’s LSA to B is lost
A now uses B to get to D
But B continues to use A
Routing loop!

**Summary**

- The network layer implements the “glue” that achieves connectivity
- Forwarding entails a routing table lookup; the table is built using routing protocol
- Distance-vector protocol: distributes route computation; each node advertises path cost if its best route to neighbors
- Link-state protocol: floods neighbor information; centralizes route computation using shortest-path algorithm at each node