Analysis Of Computer Network Routing Algorithms

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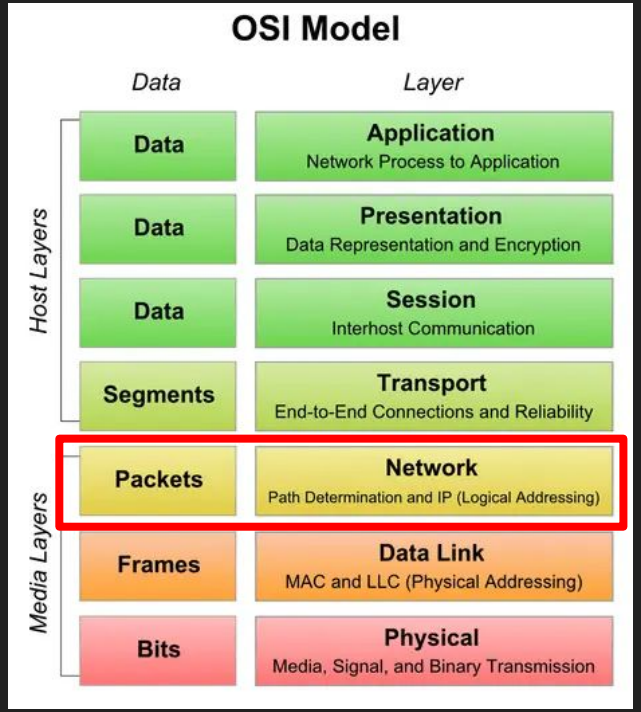
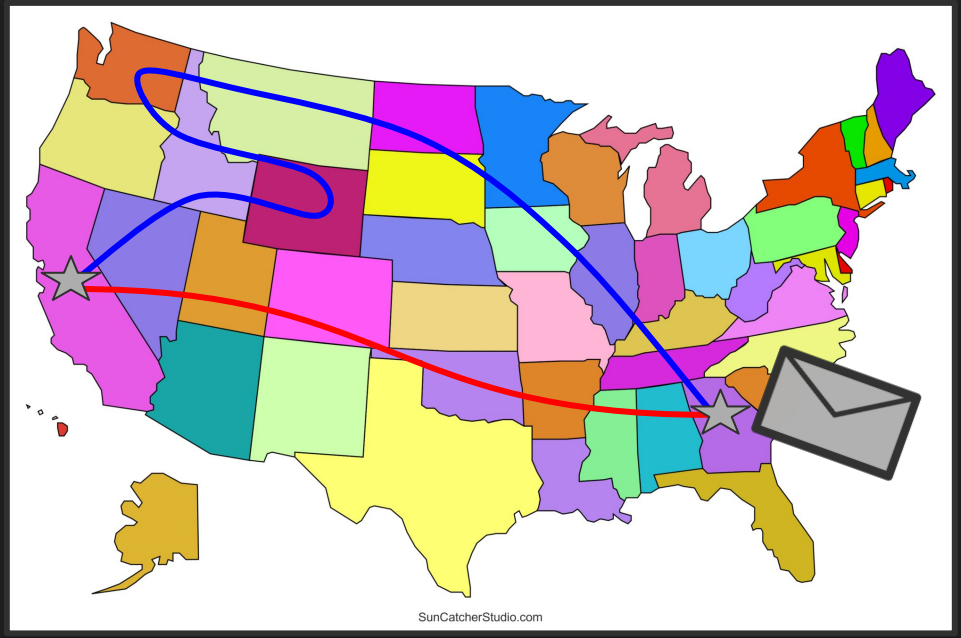
What does Routing have to do with Computer Networks?

- Determines how packets are moved between computers and routers
- Has a **source** and **destination**
- A part of the Network Layer of the OSI Model
    - Layer 3



A simple analogy to routing

How would you send mail from Georgia to California?



Types of Routing Algorithms

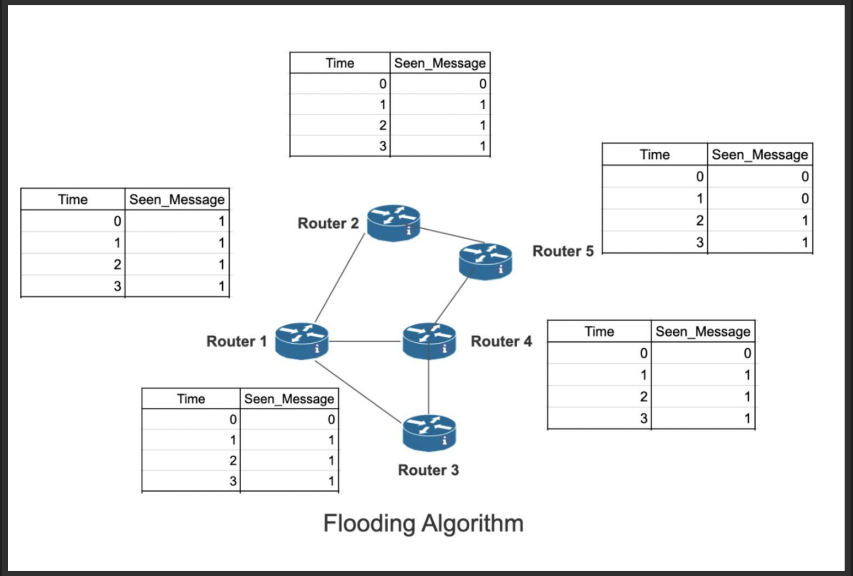
1. Adaptive
    a. Considers changes in network topology
        i. Hot Potato Routing
        ii. Backwards Learning (In paper)
2. Non-Adaptive
    a. Decides algorithm at boot time
        i. Flooding Algorithm
        ii. Random Walk Algorithm (In paper)
3. Hybrid
    a. A mix of both!
        i. Link State Algorithm
        ii. Distance Vector Algorithm

Hot Potato Routing

- Adaptive Routing
- Get the packet out as quickly as possible by putting it on the shortest queue out
- Deflection:
  - Packet going non-optimal path
  - Conflict resolution
    - Minimal Advance
    - Weakly Stable
    - Stable
    - Maximum Advance
  - Livelock

Flooding Algorithm

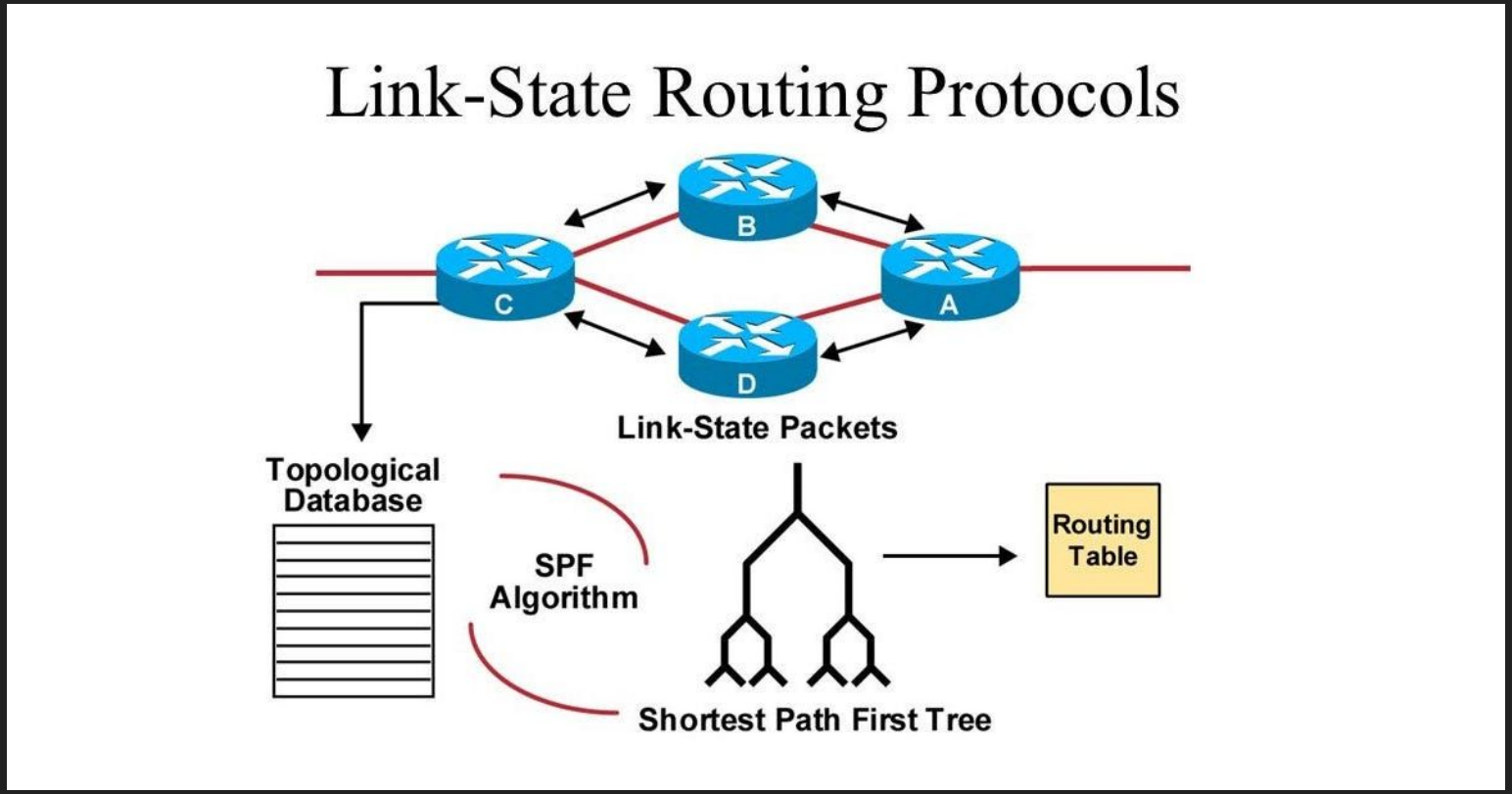
- Non-Adaptive
- Every router that receives a packet sends to all their neighbors
  - “Floods the network”
- Similar to Breadth First Search
  - Explores all routers at the present depth before moving on
- Optimizations?
  - Bit state
  - Hop count



Link State Algorithm

- The LSA is a hybrid routing algorithm
- Discovers network topology by collecting info about neighboring routers and the links between them
- Link State Advertisement: floods network with packets containing information about itself and its neighbors
- Each router builds a database from the packets received
- Information in this database is utilized to calculate and create a routing table (important for considering how packets are routed)
    - Application of Dijkstra’s Algorithm for pathfinding
- Update propagation: Monitors network topology for changes, if there are, Link State Advertisement are recreated and flood the network

Link State Routing Protocol



Distance Vector Algorithm

- Same as the **Bellman-Ford Algorithm**
  - Uses Bellman-Ford Equation:

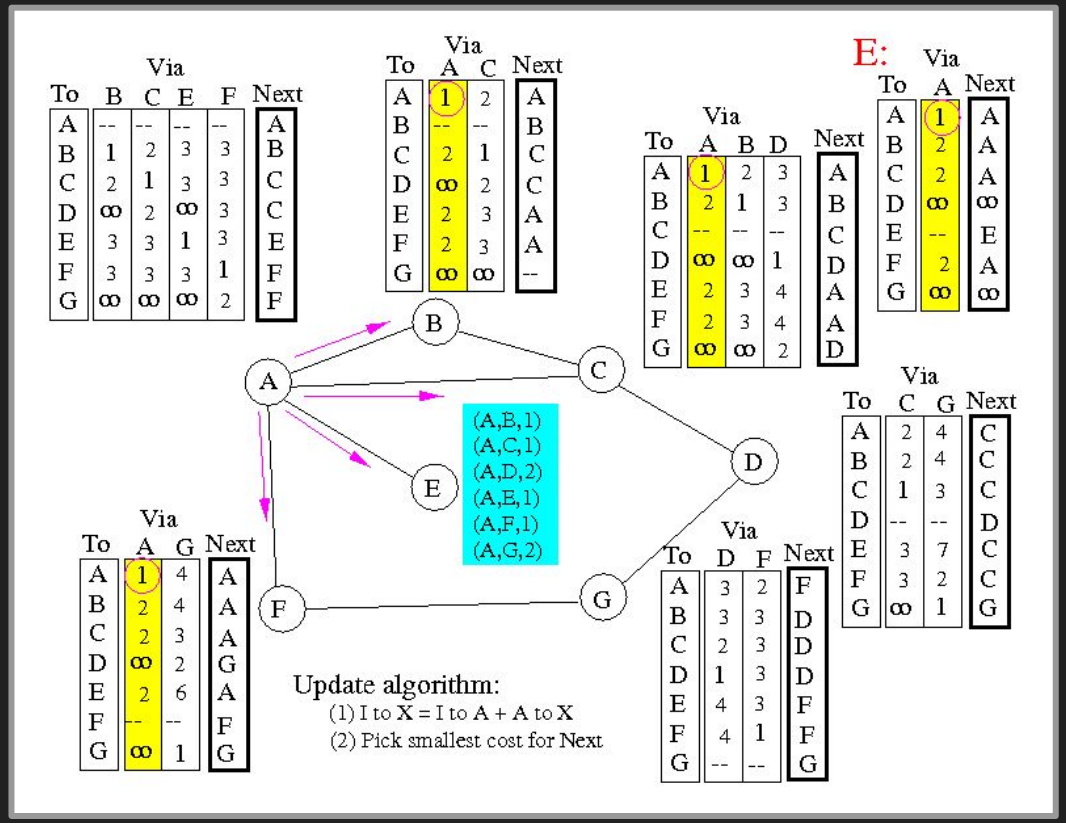
$$D_x(y) = \min_v\{c_{x,v} + Dv(y)\}$$

$\min_v$: min taken over all neighbors v of x

$c_{x,v}$: is the direct cost from x to v
$D_v(y)$: v's estimated least-cost-path cost to y

- Every router has its own Distance Vector Table
  - Has distance from itself to every other router
  - Shares distance vector table with its neighbors

Distance Vector Table



Georgia Tech's ISP