Computer Networks
COL 334/672

Routing algorithms

Tarun Mangla

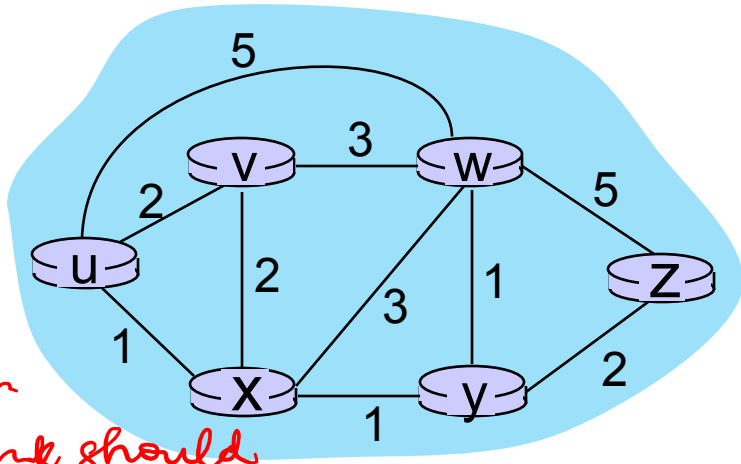
Slides adapted from KR

Sem 1, 2024-25

Moodle Quiz 3 caputdraconis

Recap

- Network layer: transports segment from sending host to receiving host
- Two important network functions:
  - *Forwarding* – move packets from input to appropriate output
  - *Routing* -- determine route taken by packets from source to destination
- Routing algorithms
  - **Goal:** Find "shortest" path from sender to receiver
  - Intra-domain routing protocol
    - Distance vector routing
    - Link state routing



② Stable to network changes

③ Utilization of link should be optimal

④ Fairness

① Shortest
② Stable
③ Optimal Utilization
④ Fairness

Distance Vector Routing

Bellman Ford Equation: $D_x(y) \leftarrow min_v\{c_{x,v} + D_v(y)\}$ for each node $y \in N$

Routing Table at A

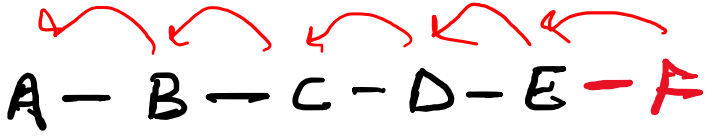
Dst	Cost	Nxt hop
B	1	B
C	2	B

It #1: A sends (A, 0)
A hears B: (B, 0)

It #2: A sends (A, 0), (B, 1)
A hears (B, 0), (C, 1)

It #3: A sends (A, 0), (B, 1), (C, 2)
A hears . . .

Good News Travels Fast, Bad News Travels Slow!



- Assume a new node F comes up in the network
- How long does it take for the A to update their routing table?

5 iterations

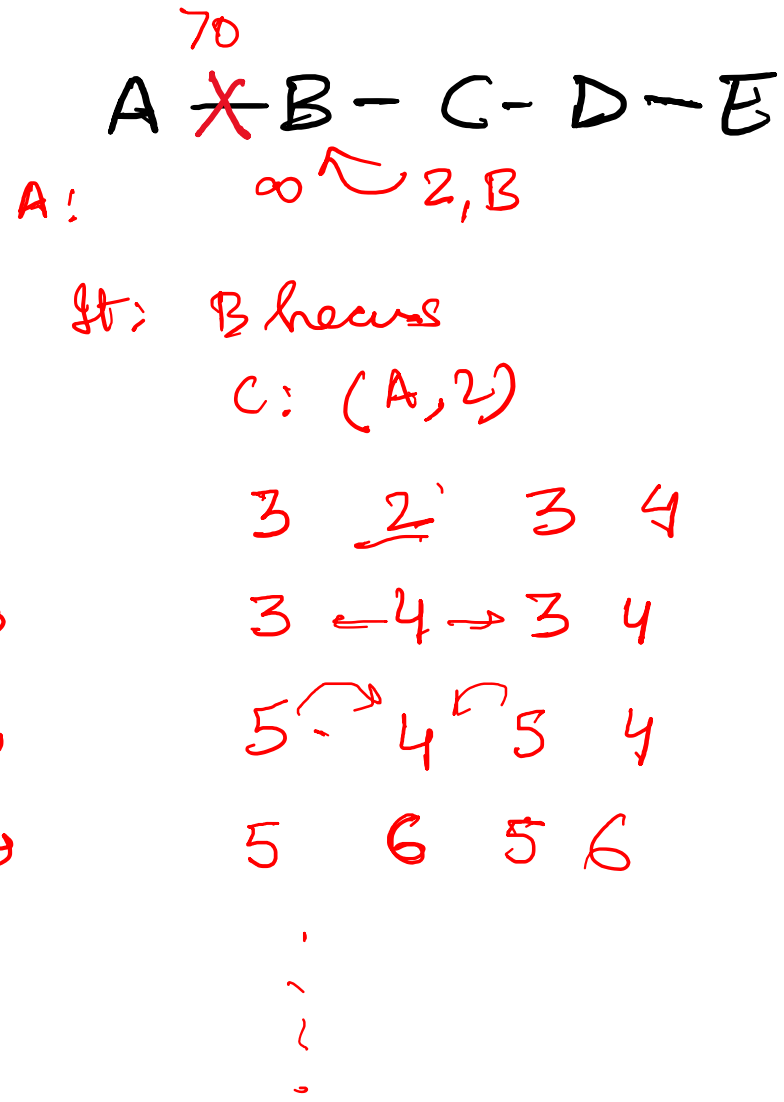
- In general, good news spreads at rate of one hop per exchange

Maximum time : Diameter of the network

  - What is the maximum time it can take?
- What happens in case of link failure?

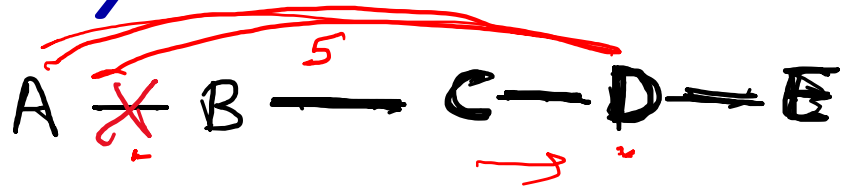
Good News Travels Fast, Bad News Travels Slow!

- Assume the A-B link goes down
- How does the routing table gets updated at B?
- At other nodes?



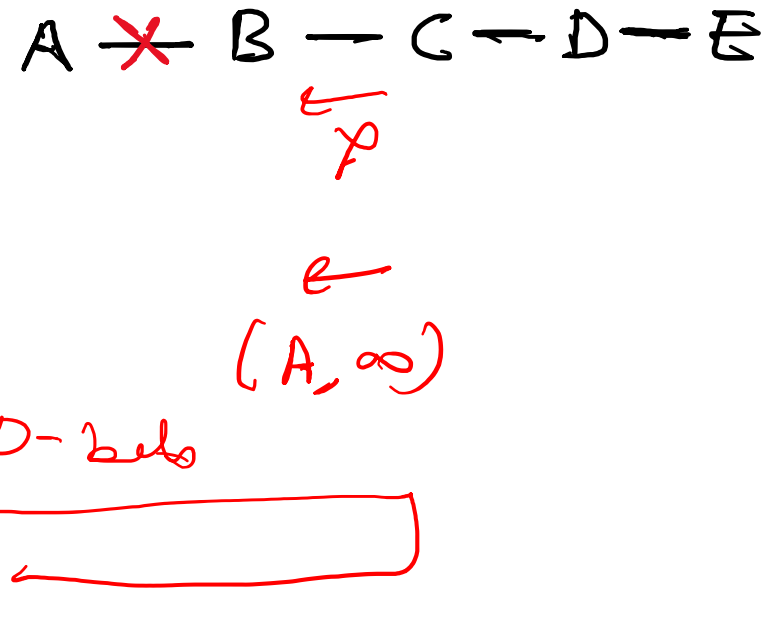
How to Handle *Count to Infinity* Problem?

- Split horizon
  - Don't announce the route back to the next hop



How to Handle *Count to Infinity* Problem?

- Split horizon
  - Don't announce the route back to the next hop
- Split Horizon Poison reverse
  - Announce an infinite distance to destination to the next hop
  - Converges faster
  - Does it always work?

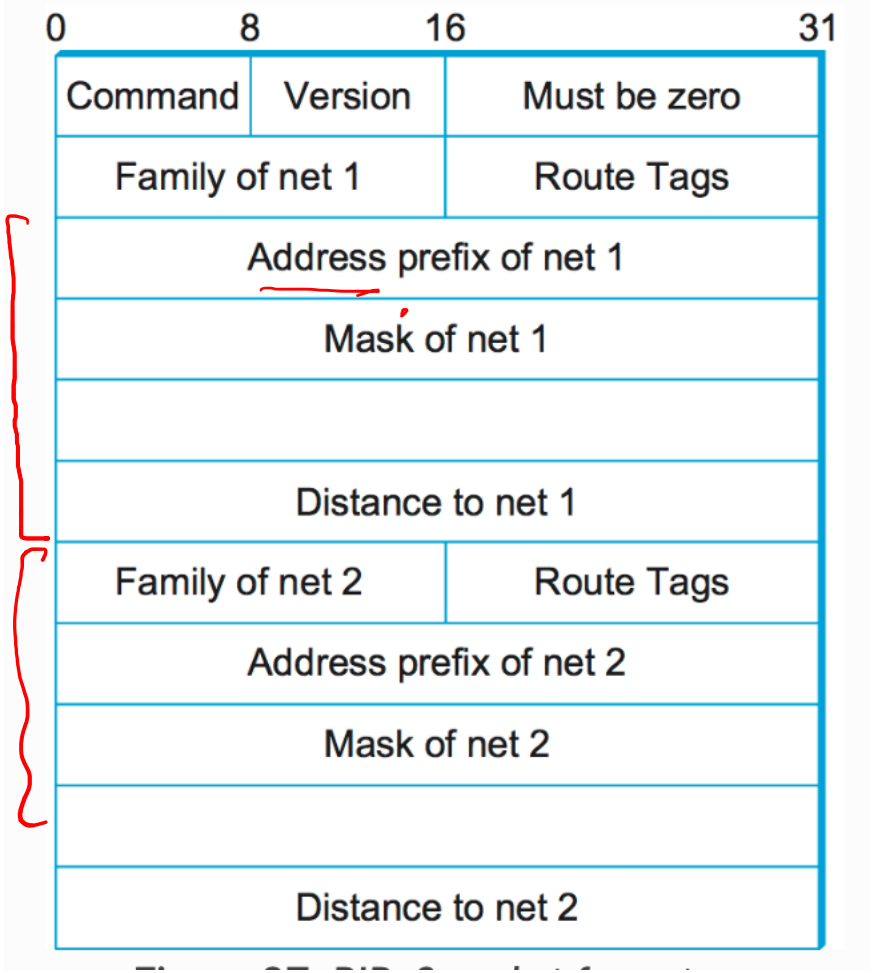


How to Handle *Count to Infinity P*roblem?

- Split horizon
  - Don’t announce the route back to the next hop
- Poison reverse
  - Announce to all nodes that the distance to the node has changed
- Make infinity smaller
  - Routing Information Protocol (RIP) used a maximum length of 15
  - Doesn’t work for cases when length is greater than 15

How to Handle *Count to Infinity* Problem?

- Split horizon
  - Don't announce the route back to the next hop
- Poison reverse
  - Announce to all nodes that the distance to the node has changed
- Make infinity smaller
  - Routing Information Protocol (RIP) used a maximum length of 15
  - Doesn't work for cases when length is greater than 15

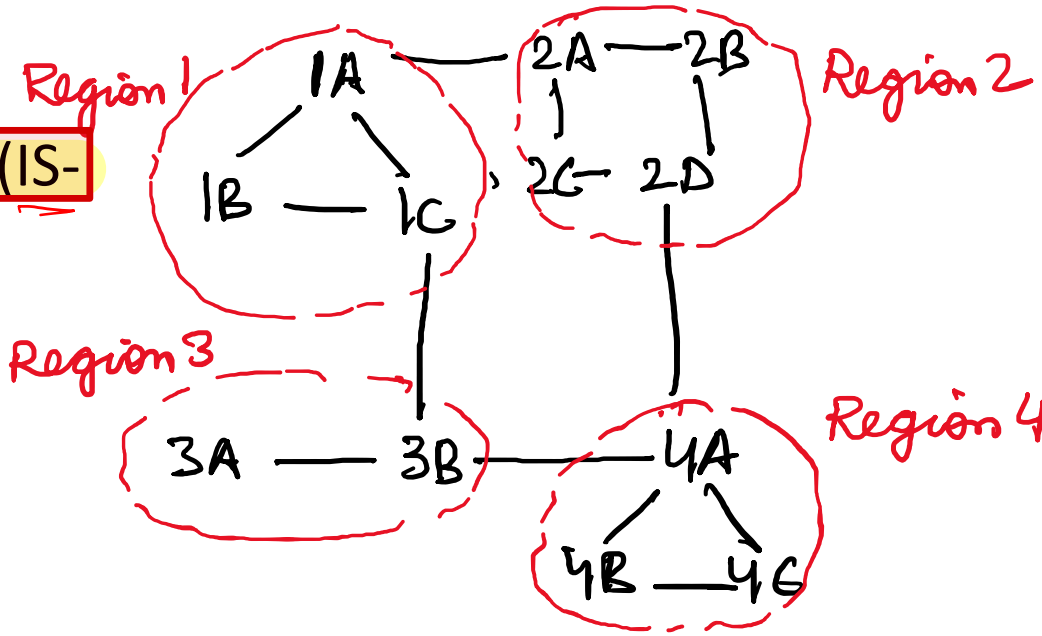


RIPv2 Protocol Message Format

Does count to infinity problem occur in link state routing?

Link State Routing

- Two link state routing protocols
  - Intermediate System to Intermediate System (IS-IS)
  - Open Shortest Path First (OSPF)
- How does OSPF handle large networks?
  - Routing table in routers grow
  - Leads to memory and CPU issues
  - Use hierarchical routing
- How many entries in routing table of 1A?



Attendance