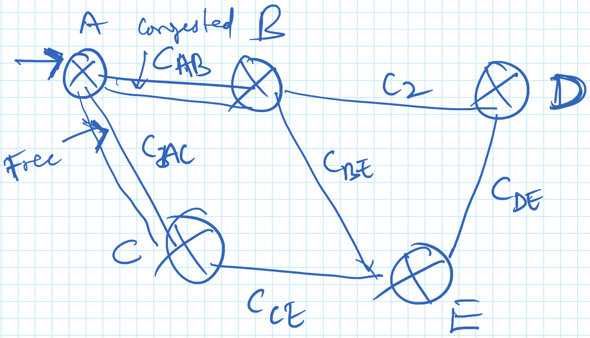
Lecture 19

27 October 2021 17:08

- Recap
  - → IP addressing (Subnet, Subnet add, host add)
  - → NAT (Private IP → Public add using port num)
  - → ICMP (control & signal msg b/w n/w devices)
  - → IPV6 addressing
- Routing protocol fundamental
  - → Link-state protocol
  - → Distance-vector
  - → Hierarchical routing
- Actual internet routing protocols
  - → RIP
  - → BGP
  - → OSPF



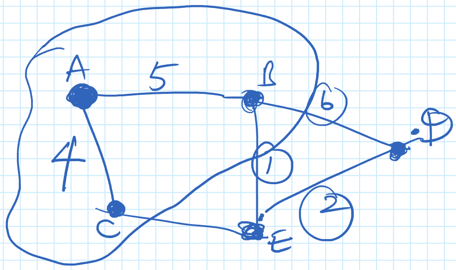
Cost → '1' ✓

→ $\alpha \frac{1}{\text{Congestion}}$ ✓

→

⇓

graph Abstraction



Routing Algo: Path with min sum of costs

Types Routing algo

→ ① Global information → whole n/w topology, costs of all links in n/w

→ (Link-state algo (Di....))

→ ② Decentralized Routing algo.

↓

(Distance-vector algo)

- → knows only neighbouring routers & costs to them.
- → doesn't know costs of other links
- → "Dynamic Programming"

Link-State based algo.

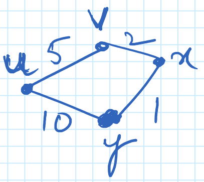
- iterative algo
- After 'k' iterations, the algo will give best path for 'k' destinations

outline

- N' = set of all nodes whose best path is known

Starting node = u.

Eg:-



direct link cost

$C(u,y) = 10$

$D_u(y) = 8 \quad (u \to v \to x \to y)$

Best path cost

$N' = \{u\}$ $\quad D_u(u) = 0$

- for all v, neigh of u:
  do initialize $D_u(v) = 5$ $\quad D(v) = C(u,v).$
  $D_u(y) = 10$
  $D(x) = \infty.$

- loop until N' = whole set of nodes in n/w.
  - Find a vertex 'w' which is not in N' s.t $D(w)$ is the minimum
  - Include it N'.
  - Update the best costs of all neighbours of 'w'.

$\forall v$: v is neigh of w $\quad D(v) = \min\{D(v), D(w) + C(w,v)\}$

Complexity of Link-State algo

n

... of Link State algo

(1) among all W not in N' $\min D(W)$ $\Rightarrow$ $n-1$

n

$\Rightarrow n-1$

next iteration $\Rightarrow n-2$

$\rightarrow n-3$ $\Rightarrow \frac{n(n+1)}{2}$

$\vdots$

0 $\quad O(n^2)$.

Distance vector based routing

- Each node u maintains a vector $d_u(\cdot)$ of length 'N', which is the estimated best cost to all nodes in n/w
- The distance vector is shared with neighbours.
- The estimate of dist. vector is updated using

$$d_u(x) = \min_{w \in N_u} \{ c(u,w) + d_w(x) \}$$

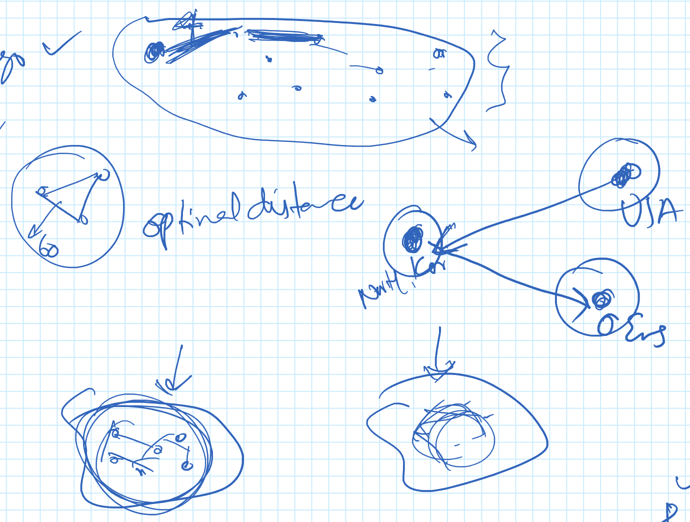
N_u → neigh of 'u'

- Iteratively updated till convergence.

Issues:-
(1) Formation of loops
(2) "Counting to infinity" convergence issue when some cost increases.
(Refer text book for detailed example).

Hierarchical Routing

Link state algo ✓
Distance vector ✓



Issues with scaling link-state & DV. algo. for large n/w

Autonomous systems

RIP, OSPF

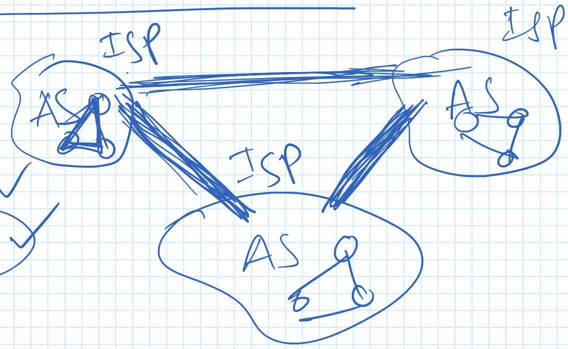
Large n/w

Autonomous systems

RIP, OSPF

Intra-AS routing

Inter AS



LS ✓

DV ✓

BGP ✓ →