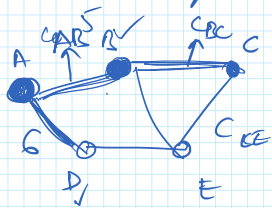


- Recap
 - Link-state routing
 - Distance-vector routing
 - Hierarchical routing algo.
 - Internet routing protocols
 - RIP (Routing Information Protocol)
 - OSPF (Open Shortest Path First algo)
 - BGP (Border gateway Protocol)
- } → Intra-AS routing
 } → Inter-AS routing

- recap

Link-state based algo



Routing algo obj:

finds
 $A \rightarrow C \Rightarrow$ best Cost path.

- Exchange topology

at A:

$N' \rightarrow$ set of all nodes for which best cost known

$$N' = \{A\}$$

$$d(A) = 0 \checkmark$$

$$\Rightarrow d(B) = C_{AB}, d(D) = C_{AD}, d(C) = \infty, d(E) = \infty$$

among all nodes which are not in N' .

Pick node 'w' which has least d .

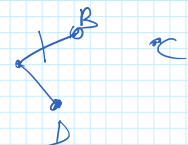
$$\text{Principle } d(C) \leq d(B) + C(B, C)$$

$$\forall V: V \text{ is neigh of } B, \hat{d}(V) = \min \{d(V), d(B) + C(B, V)\}$$

loop back

Distance - vector

$$d_A(C) = \min_{V: V \text{ is neigh of } A} \{d_V(C) + C(V, A)\}$$



$$C \xrightarrow{A} B \Rightarrow 5 \checkmark$$

$$d_C(B) = 5$$

$$\checkmark d_A(B) = \text{going to B via B} \Rightarrow (60 + 0)$$

$$\checkmark \text{going to B via C} \Rightarrow (5 + 1) = 6 \checkmark$$

ALSO = going to D via C

✓ going to D via C $\Rightarrow (5+1)=6$ ✓

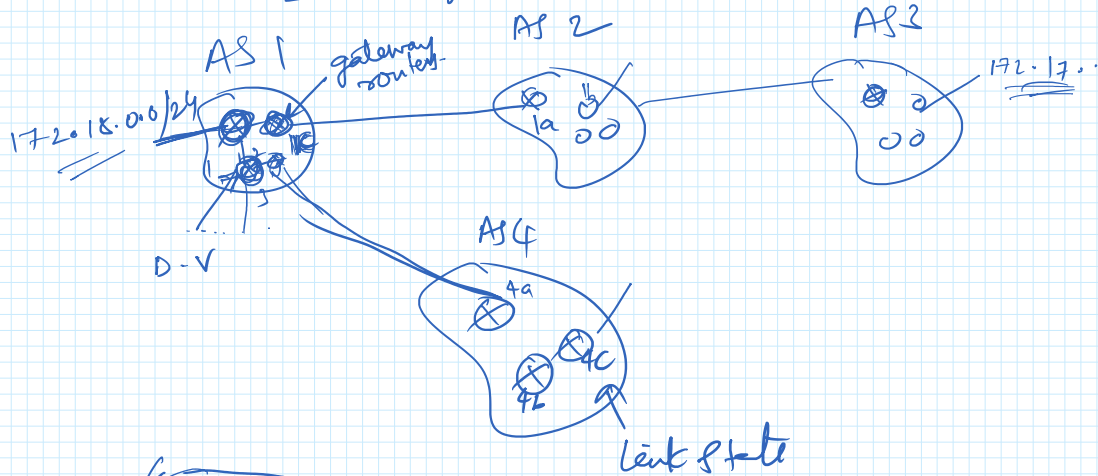
— Poisoned Reverse

$\rightarrow A \rightarrow B \Rightarrow 4 \rightarrow 6$

Hierarchical Routing

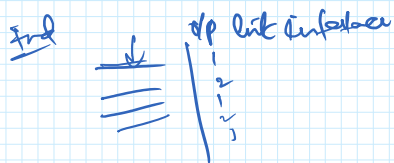
Scaling

- in very large n/w, it is practically infeasible
- Autonomous systems



✓ Intra-AS \rightarrow left for their choice of AS.

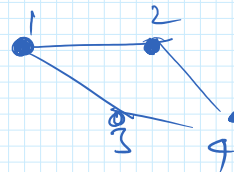
✓ Inter-AS \rightarrow should be same for the whole n/w



Inter-AS

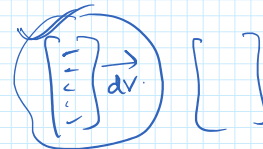
- obtain reachability info from other AS
 - propagate reachability info to all internal routers
- "hot potato"

RIP — } Intra AS routing
OSPF — }



RIP

- Prefixes in routing table ✓
- for every 30 sec. encodes the DV. ✓
- 180 sec. there is no update from any neighbor ✓
- "1" cost for all links
- "dead neighbor"

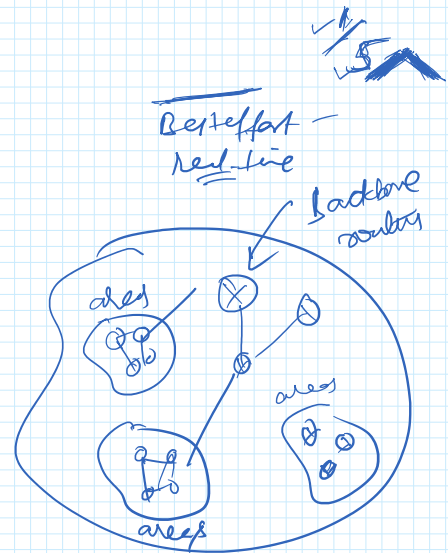


\hookrightarrow "1" cost for all links
 \hookrightarrow router d. \rightarrow UDP $\rightarrow \checkmark$
 \Downarrow dead neigh
 $A \rightarrow C = \# \text{ hops}$

OSPF — link state algo. \rightarrow Intra-AS

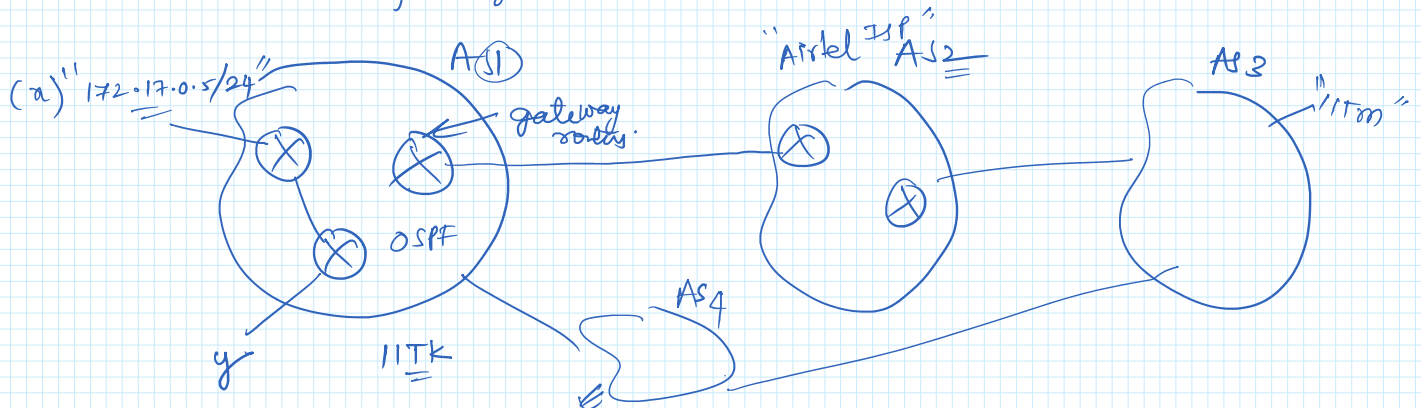
\rightarrow different cost for each link
 \rightarrow T.O.S \rightarrow different cost. metrics.
 \rightarrow Hierarchical OSPF

\downarrow
 within given AS.



BGP (Border Gateway Protocol)

\hookrightarrow Inter A-S routing algorithms used in the Internet.



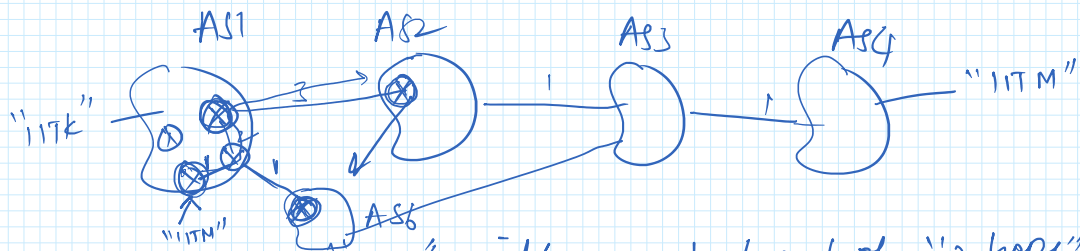
— ASN — Autonomous System numbers.
 \hookrightarrow 32-bit \Leftarrow (16-bit)

BGP

- \rightarrow to talk with neighboring 'AS's to understand what all prefix's it can reach
- \rightarrow Propagate this reachability info to all its internal routers.
- \rightarrow Select which routing path for a given prefix from multiple path choices

BGP \rightarrow 'path-vector' based algo

BGP → "path-vector" based algo



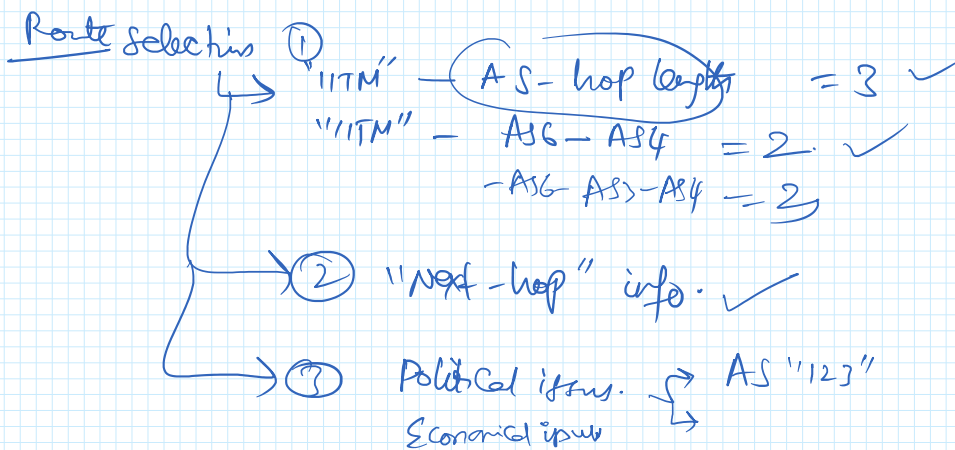
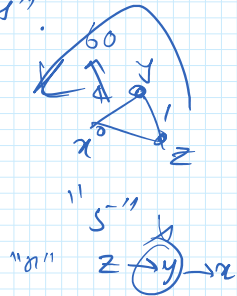
- search "117M" with a best cost of "2 hops".

- "117M" → "AS2-AS3-AS4"

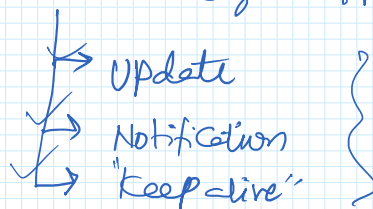
→ looping issues are implicitly solved

path
Attribute

"next hop address".

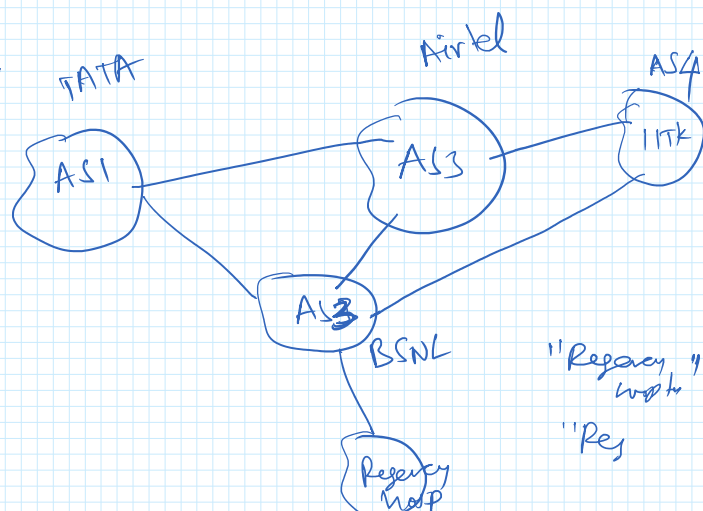


"BGP" protocol → "application-layer" msgs.



HTTP
HTTpprog
HTTppop

BGP route Adv Policy:



"Regency" AS3 -
"Reg" AS4 - AS2

Regen
not

"Reg

AS4 - AS2