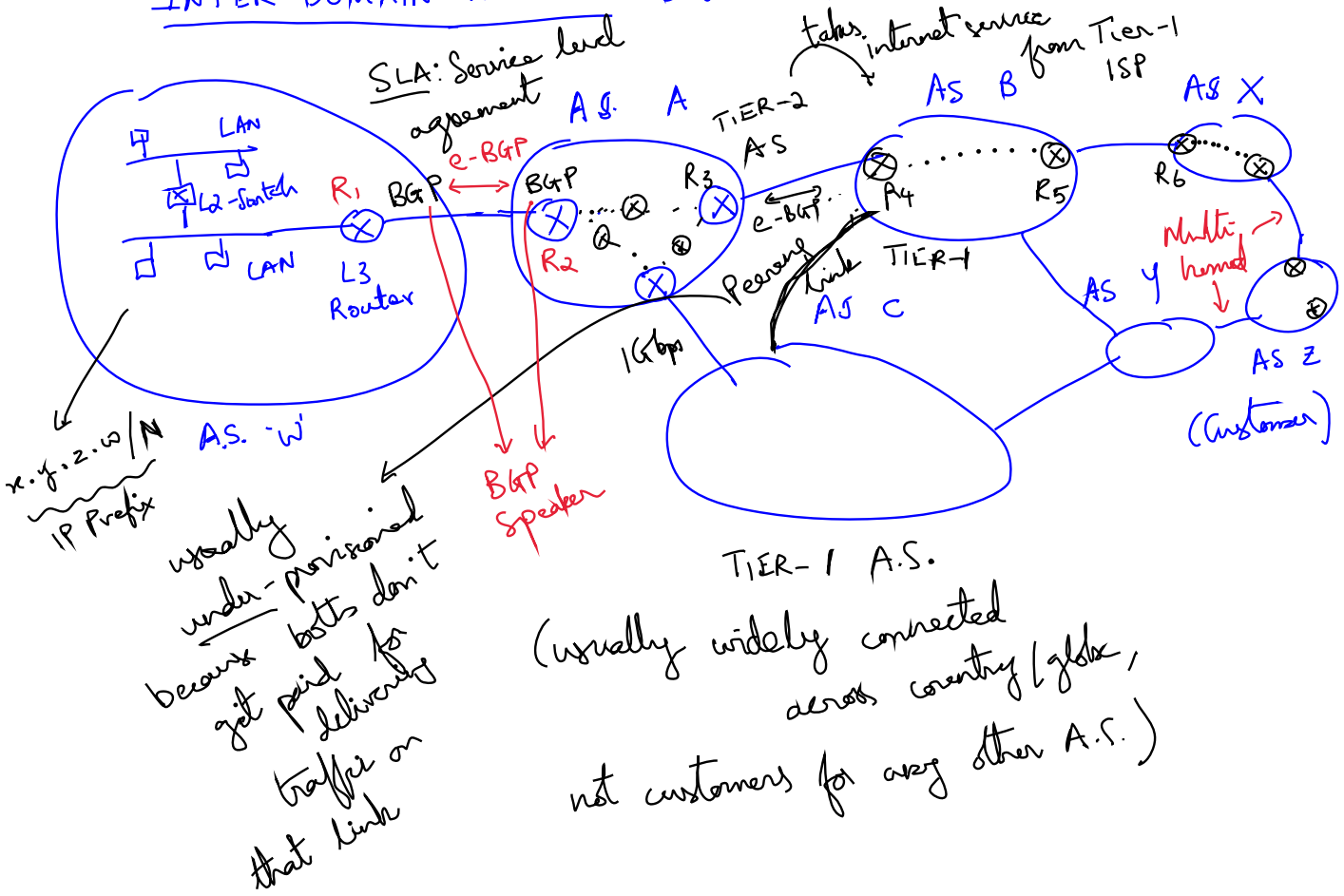
BGP: Border Gateway Protocol

INTER-DOMAIN ROUTING: Between ASes



TIER-1 A.S.

(usually widely connected across country/globe, not customers for any other A.S.)

e-BGP $R_1 \rightarrow R_2$: $x.y.z.w/N$ (Prefix) | W (A.S_Path) | attributes } BGP advertisement

i-BGP

e-BGP $R_3 \rightarrow R_4$: $x.y.z.w/N$ (Prefix) | A-W (Path) | attributes

e-BGP $R_5 \rightarrow R_6$: $x.y.z.w/N$ (Prefix) | B-A-W | attrib

means: if R_6 gives R_5 an IP pkt with DST IP matching prefix, then it will definitely route it along AS path B-A-W.

B does not have to tell C: that there is

a path B-A

or B-A-

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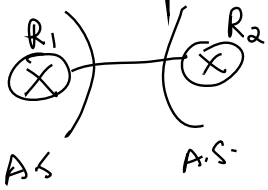
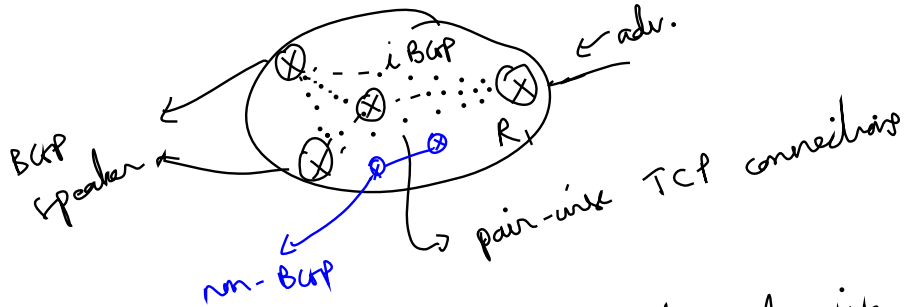
e-BGP: Protocol between BGP speakers in different (neighboring) ASes

TCP port 179



i-BGP. Protocol between BGP speakers within same A.S.



IGP: Interia Gateway Protocol (Intra-domain routing)

LSR, DV

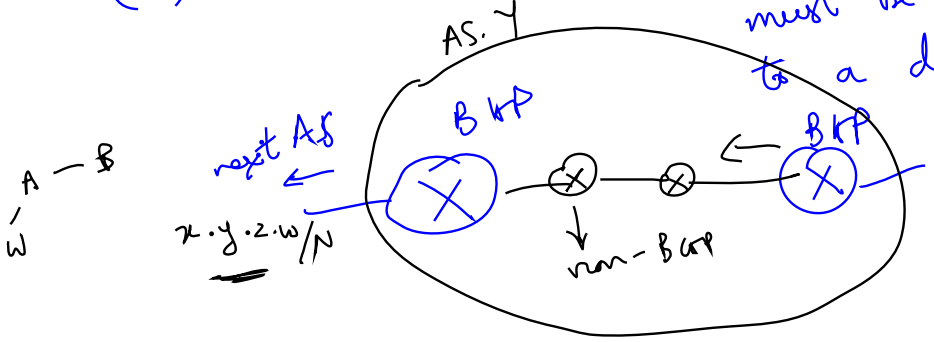
steps to decide BGP paths

(i) e-BGP speakers learn AS-paths from neighbouring routers in other ASes

(ii) e-BGP nodes share learned information via iBGP with other BGP speakers in own AS

(iii) BGP speakers select routes to various IP prefixes

(iv) Insert chosen routes into IGP (since all routers must be able to forward pkts to a destination IP)



(v) eBGP speakers can advertise newly created routes to neighboring ASes

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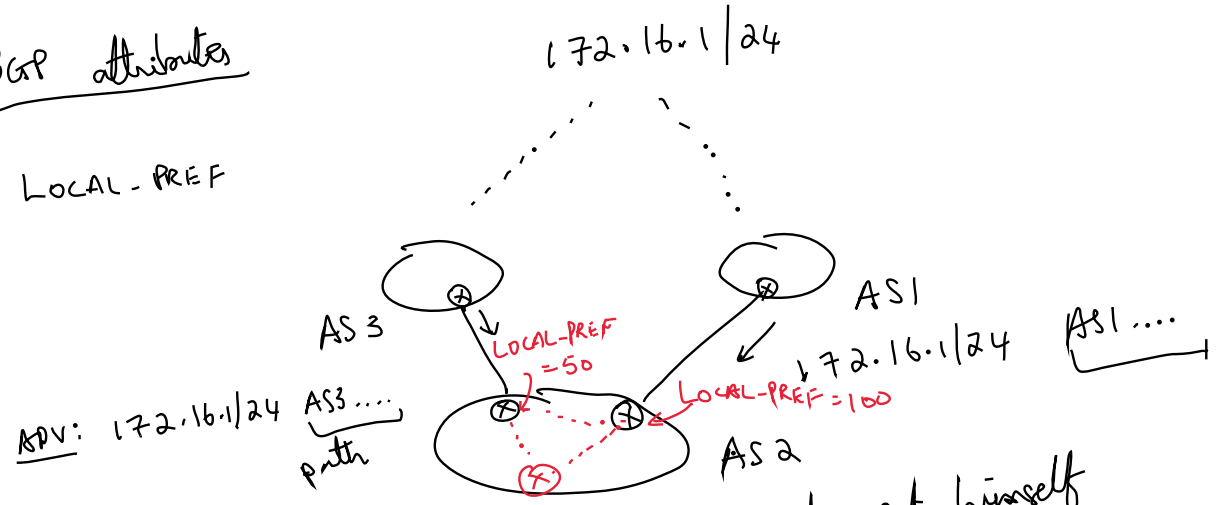
BGP attributes

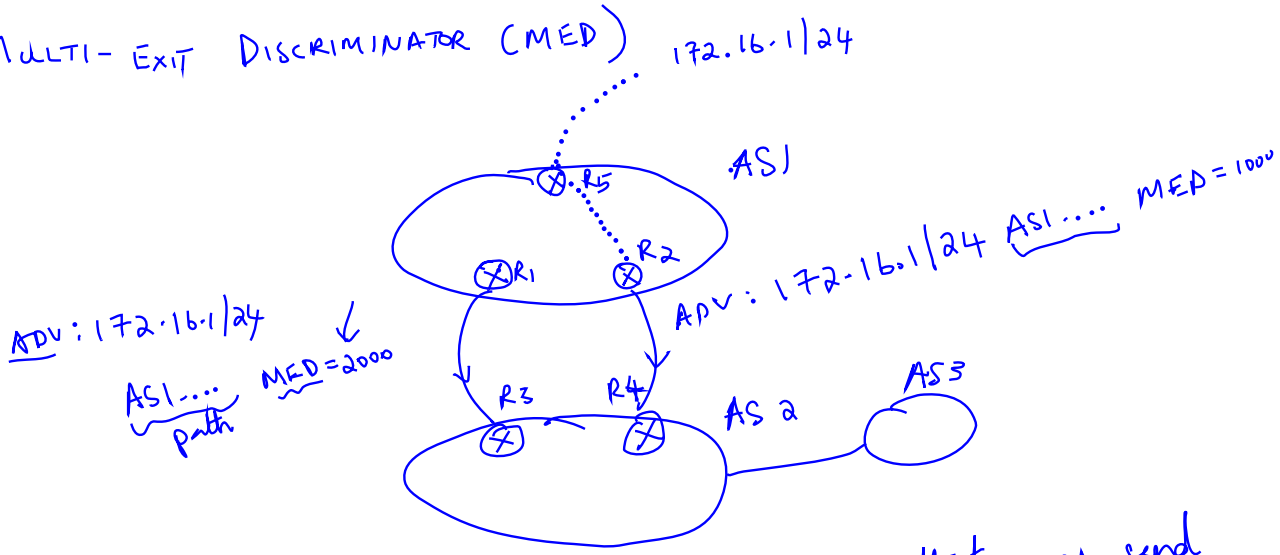
(i) LOCAL-PREF



Admin. of AS2 adds adds local-pref himself

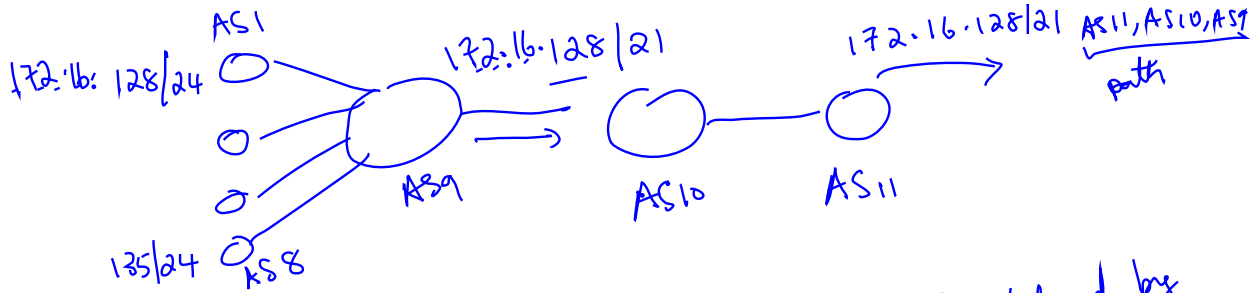
Higher LOCAL-PREF => more preferable path

(ii) MULTI-EXIT DISCRIMINATOR (MED)

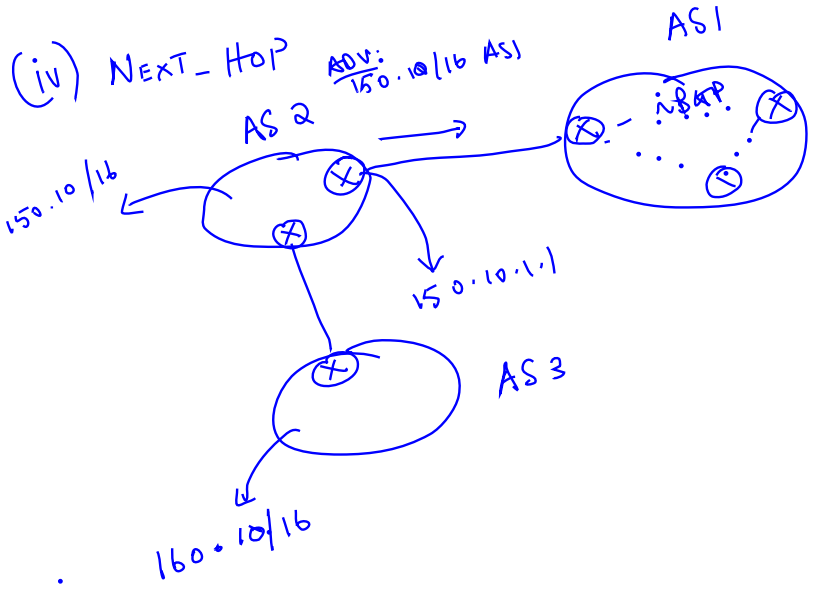


Means: AS1 is telling AS2: I prefer that you send me pkts for 172.16.1/24 on link R4-R2 (lower MED)

(iii) AS-Path: List of AS numbers all the way to the destination with that IP prefix
↳ whoever first adv. that IP prefix



(iv) NEXT-HOP



INFO AS1 has (shared by i-BGP)

150.10/16 AS2 150.10.1.1

NEXT-HOP

IP address of 1st. router in next AS.

16.10/16 AS2, AS3 150.10.1.1

path NextHop

RULES TO CHOOSE ROUTES

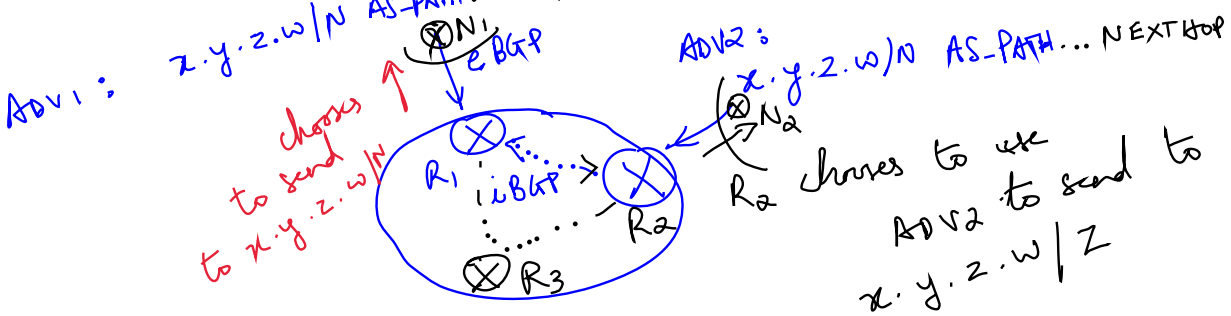
EACH BGP speaker decides which AS-route to use among many available for the same prefix

a) Use route with largest LOCAL-PREF

b) Choose path with shortest AS-PATH (# Ases on path)

c) Choose path with lowest MED

d) Choose path learned over eBGP over path learned by iBGP



e) Choose path with lowest IGP metric to Next_Hop

Suppose $dist(R_3, N_2) > dist(R_3, N_1)$

$\Rightarrow R_3$ chooses ADV 1

HOT-POTATO ROUTING

f) Use ROUTER ID (lowest router ID among all BGP speakers who have sent those ADV)

ROUTER_ID = highest IP address on router