EECS 489 - Winter 2024

Discussion 9

Assignment 3 is out!

- **Due Date: Wednesday, March 27th @ 11:59 pm EDT**
- Reminder: Groups have late days across Assignments 2-4
- Make sure to run your code in the VM
  - Only need mininet for this assignment

Today

- Routing Refresher
- AS’s, BGP (Practice Questions)

Routing Refresher

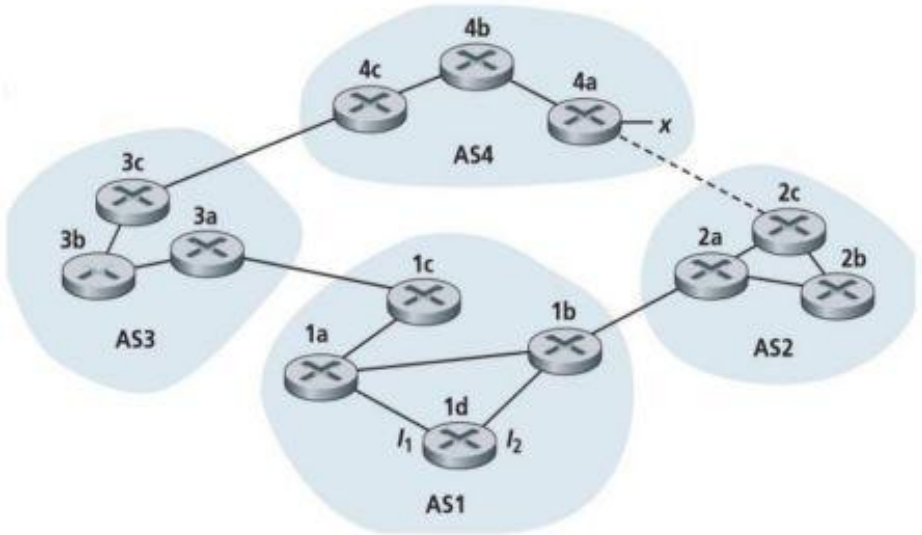
- Intra-Domain Routing (IGP = Interior Gateway Protocol)
  - Open Shortest Path First (OSPF)
    - Link-State
  - Routing Information Protocol (RIP)
    - Distance-Vector
- Inter-Domain Routing (BGP = Border Gateway Protocol)
  - eBGP = external BGP
  - iBGP = internal BGP

Routing Refresher: Attributes

Priority	Rule	Remarks
1	LOCAL PREF	Pick highest LOCAL PREF
2	ASPATH	Pick shortest ASPATH length
3	MED	Lowest MED preferred
4	eBGP > iBGP	Did AS learn route via eBGP (preferred) or iBGP?
5	iBGP Path	Lowest IGP cost to next hop (egress number)
6	Router ID	Smallest next-hop router's IP address as tie-breaker

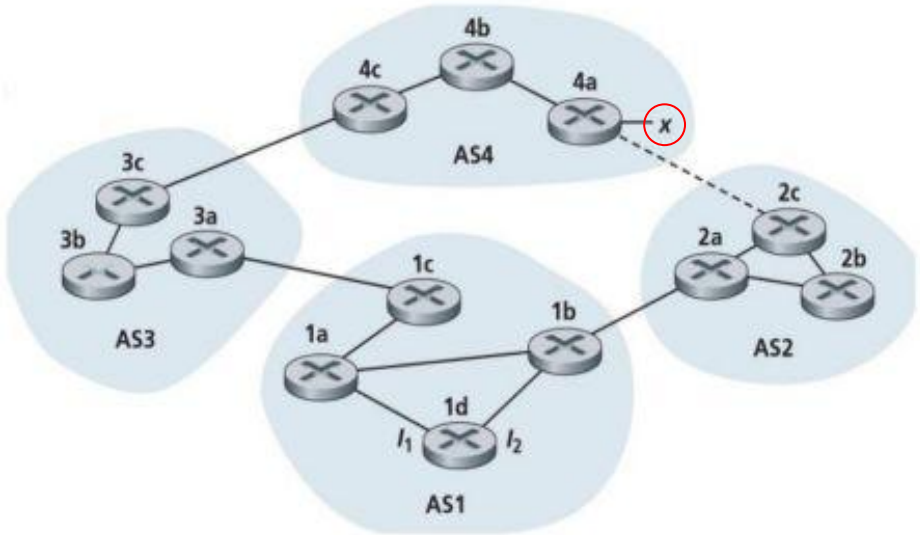
Q1: AS Protocols and Routers

- In the given network, suppose AS2 and AS3 are running OSPF for their intra-AS routing protocol. Suppose AS1 and AS4 are running RIP for their intra-AS routing protocol.



Q1: AS Protocols and Routers

- Suppose eBGP and iBGP are used for the inter-AS routing protocol, and there is no physical link between AS2 and AS4. Assume every link in an AS has the same cost.
  - Router 3c learns about prefix x from which routing protocol?
  - Router 3a learns about prefix x from which routing protocol?
    Router 1c learns about prefix x from which routing protocol?



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  - Router 3a learns about prefix x from which routing protocol? iBGP
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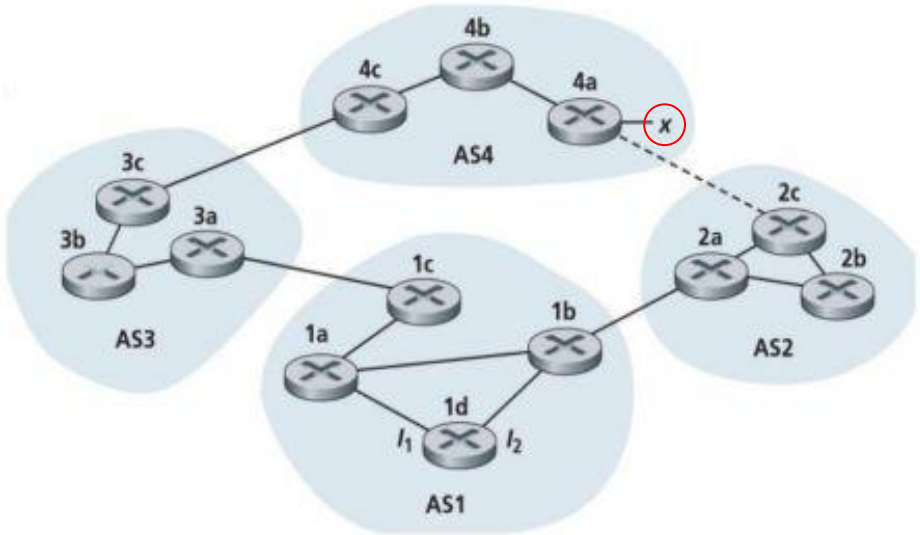
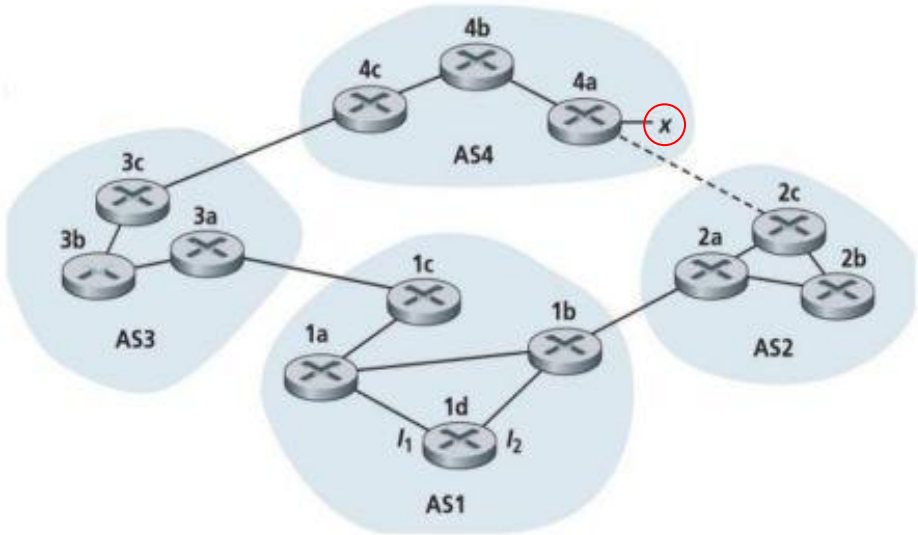


Q1: AS Protocols and Routers

- Once router 1d learns about x it will put an entry (x, l) in its forwarding table.
- Will l be equal to l1 or l2 for this entry?
- Now suppose that there is a physical link between AS2 and AS4, shown by the dotted line. Suppose router 1d learns that x is accessible via AS2 as well as via AS3. Will l be set to l1 or l2?
- Now suppose there is another AS, called AS5, which lies on the path between AS2 and AS4. Suppose router 1d learns that x is accessible via AS2, AS5, AS4 as well as AS3, AS4. Will l be set to l1 or l2?



Q1: AS Protocols and Routers

- Once router 1d learns about x it will put an entry (x, l) in its forwarding table.
- Will l be equal to l1 or l2 for this entry? l1
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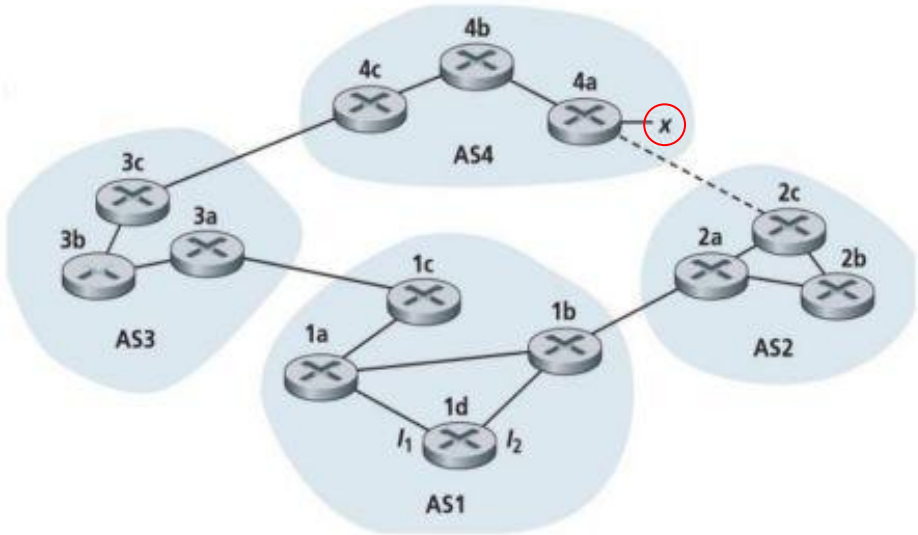

Q2: AS Domain/Relationships

- Suppose AS X and AS Z are not directly connected but instead are connected by AS Y. Further suppose that X has a peering agreement with Y, and that Y has a peering agreement with Z. Draw the relationship graph like the the ones in the lecture slides. Can X and Z communicate with each other?

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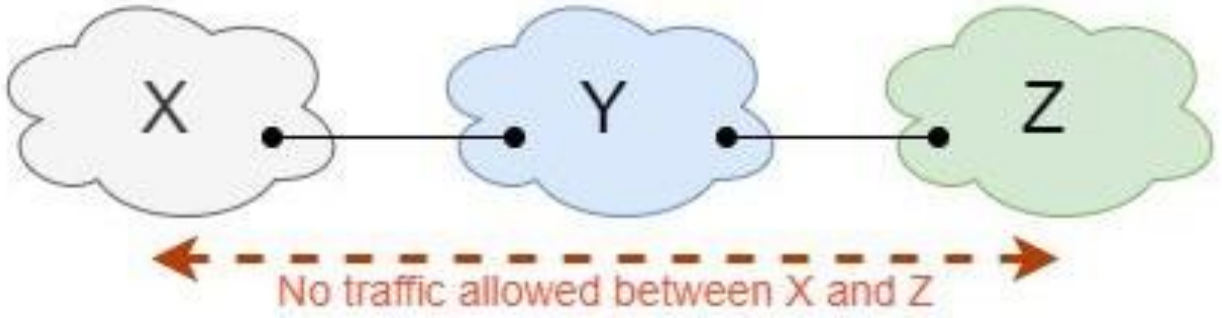
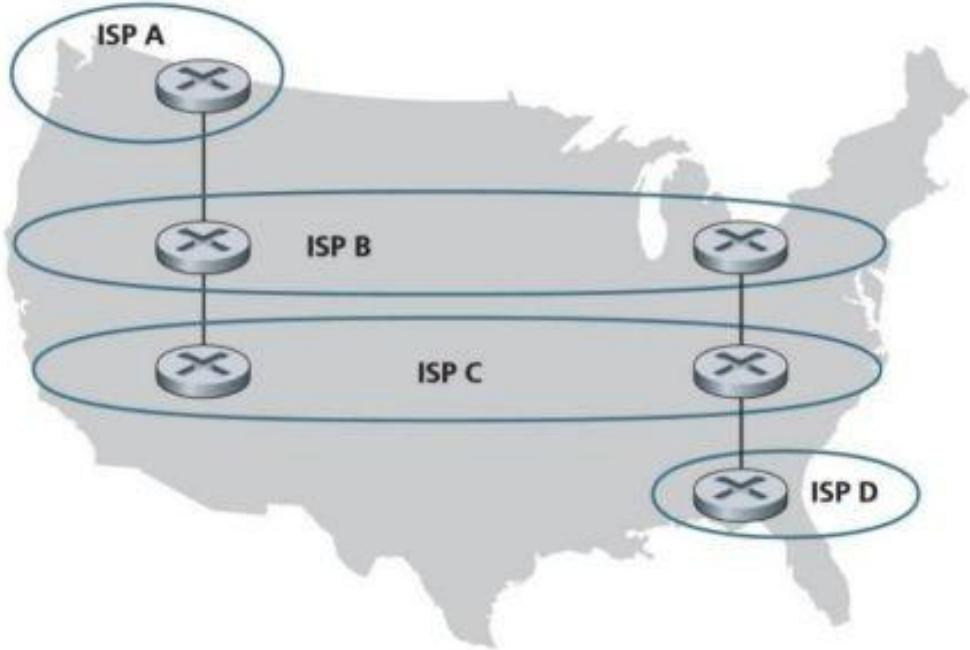


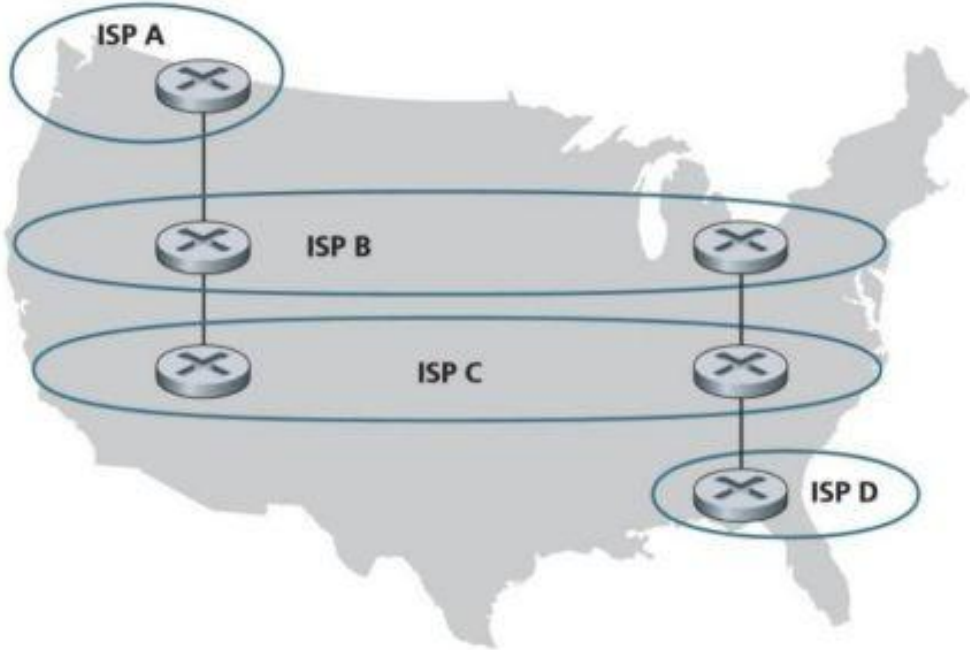
Q3: ISPs

- In the given network, ISP B provides national backbone service to regional ISP A. ISP C provides national backbone service to regional ISP D. Each ISP consists of one AS. B and C peer with each other in two places using BGP. Consider traffic going from A to D. B would prefer to handle that traffic over to C on the West Coast (so that C would have to absorb the cost of carrying the traffic cross-country), while C would prefer to get the traffic via its East Coast peering point with B (so B would have carried the traffic across the country).



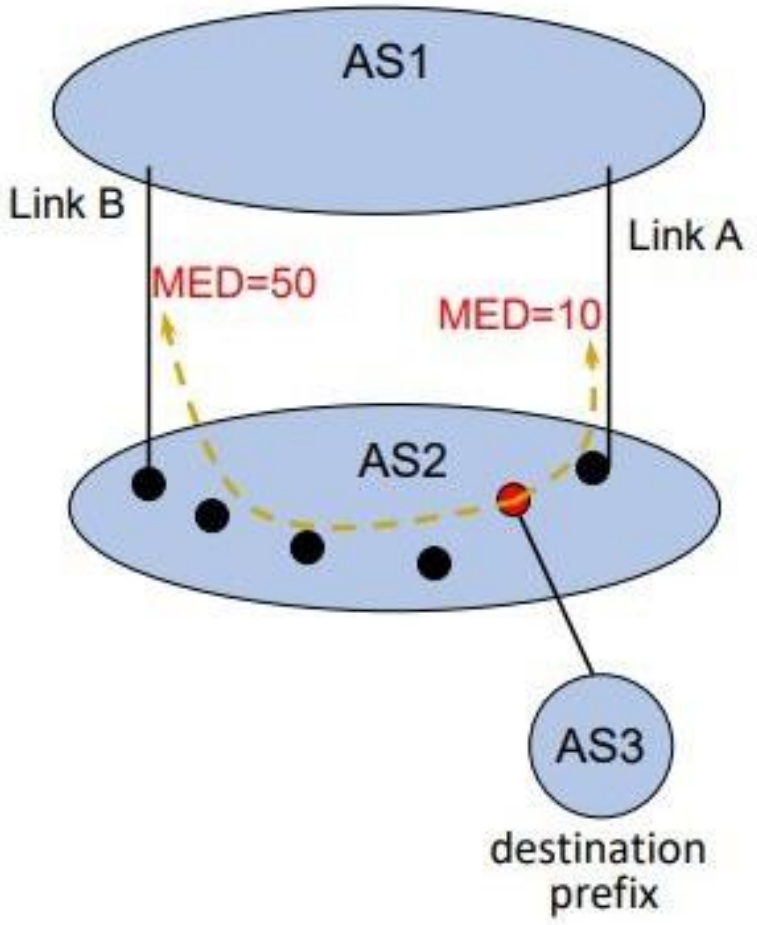
Q3: ISPs

- What BGP mechanism might C use so that B would hand over A-to-D traffic at its East Coast peering point?



MED

- Multi-exit discriminator (MED) is used when ASes are interconnected via 2 or more links; it specifies how close a prefix is to the link it is announced on
- Lower is better
- AS that announces a prefix sets MED
- AS receiving the prefix (optionally!) uses MED to select link



Wrap-Up

- Thanks for coming!
- Continue working on Assignment 3!