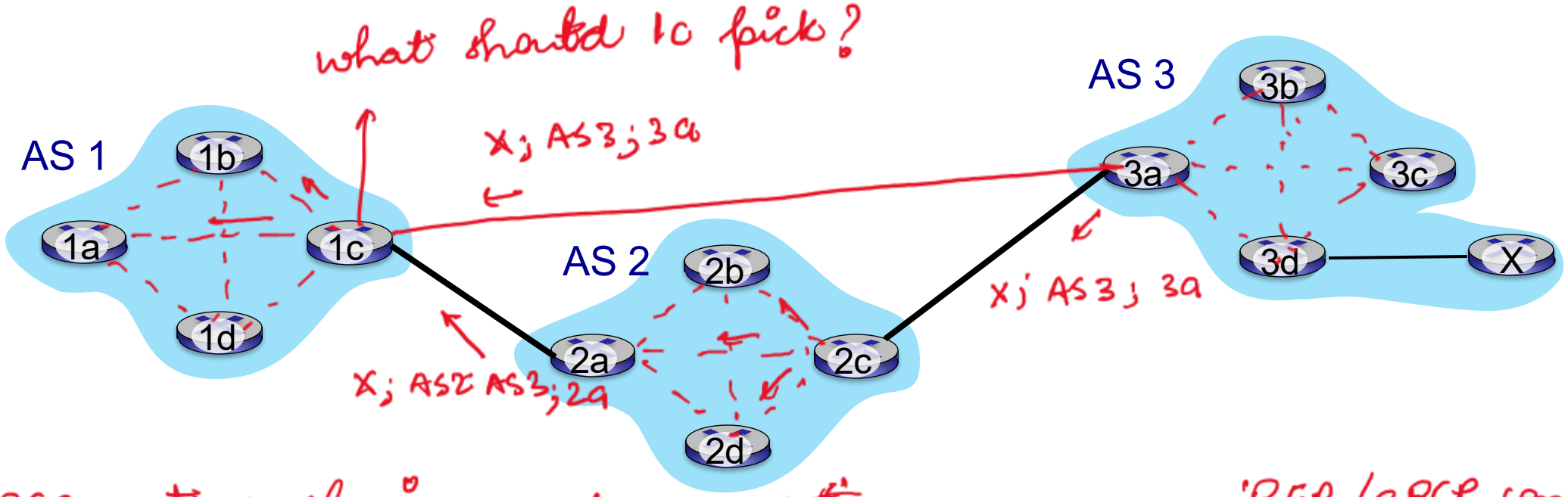
Computer Networks
COL 334/672

BGP and Data Plane

Slides adapted from KR

Sem 1, 2024-25

Inter-domain Routing Protocol: BGP



(1). BGP routers sharing route advertisements over iBGP / eBGP connections

(2). Advertisement : prefix; Path attributes → {AS path, next hop}

(3). Key question : How to decide among multiple advertisements

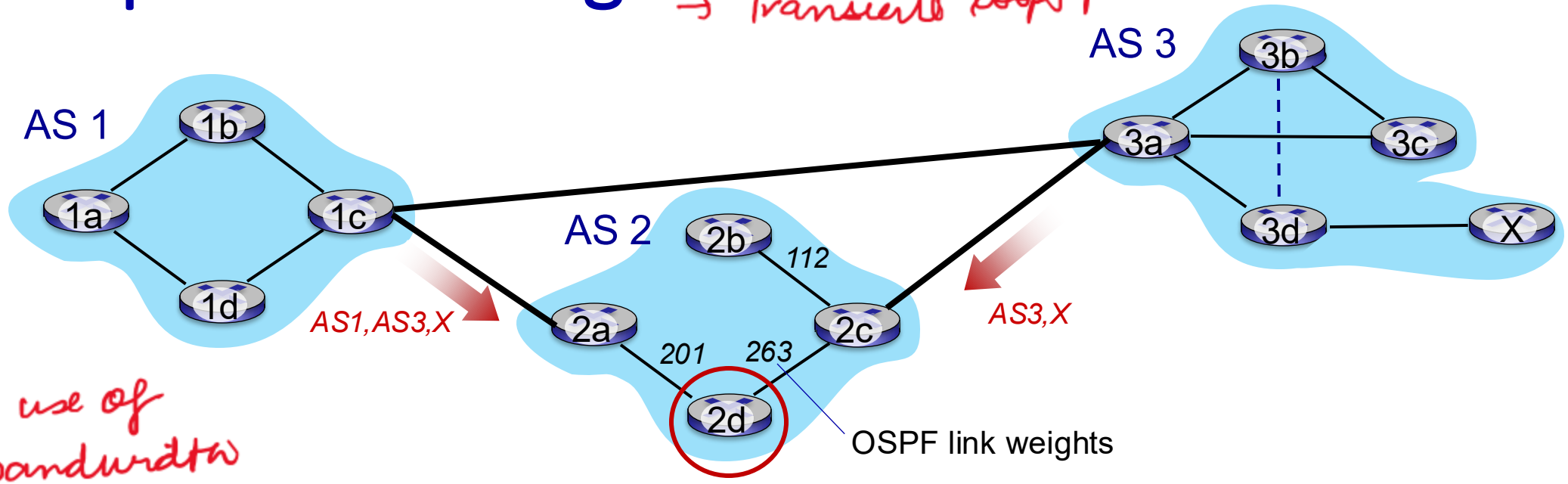
option #(1) Select the path will least AS hops
(proxy for performance)

Other criteria?

Hot potato routing

Because it is a path-vector protocol; there are no routing loops

→ Transient loops possible



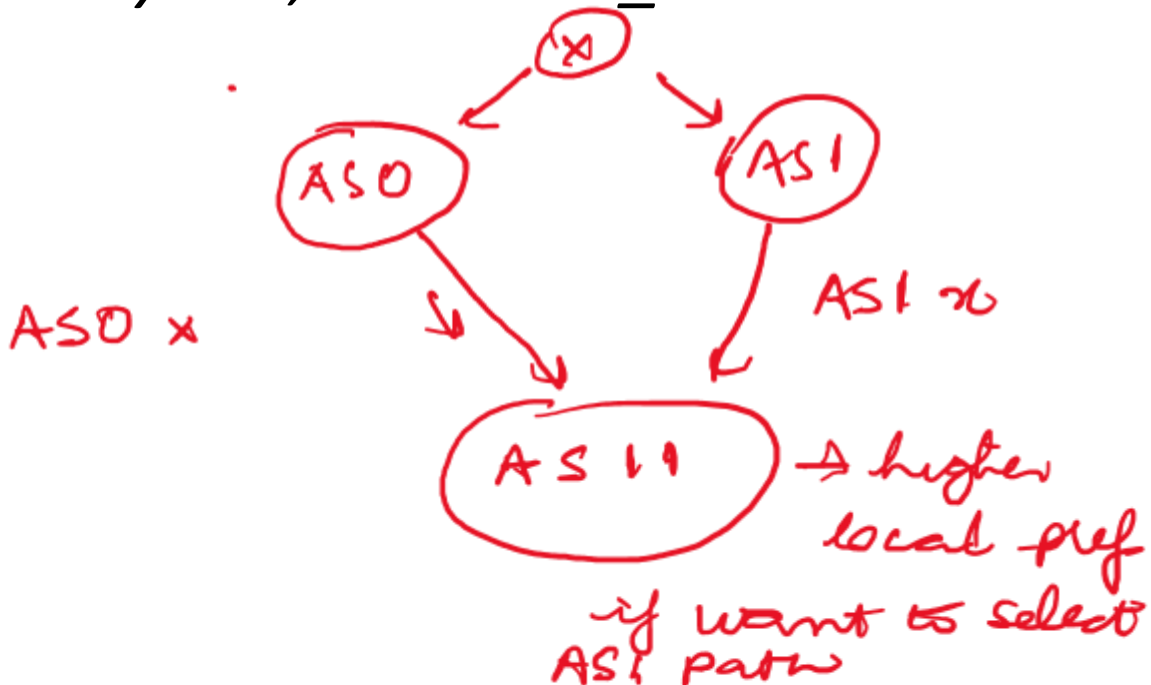
Least use of my bandwidth

- 2d learns (via iBGP) it can route to X via 2a or 2c
- hot potato routing: choose local gateway that has least *intra-domain* cost (e.g., 2d chooses 2a, even though more AS hops to *X*): don't worry about inter-domain cost!

to next hop

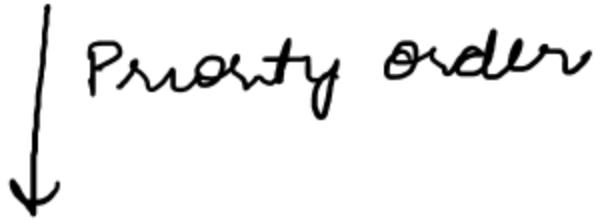
Inter-AS Routing: Policies

- *If the route to destination X is learnt from Mumbai gateway, set local_pref = 200, if the same route is learnt from Singapore, set local_pref = 100*
- *For prefix X, increase local_pref when learned from ISP-A so most outbound traffic goes through ISP-A*
- *If a route is learned over the high-capacity link, set LOCAL_PREF = 150*



BGP route selection

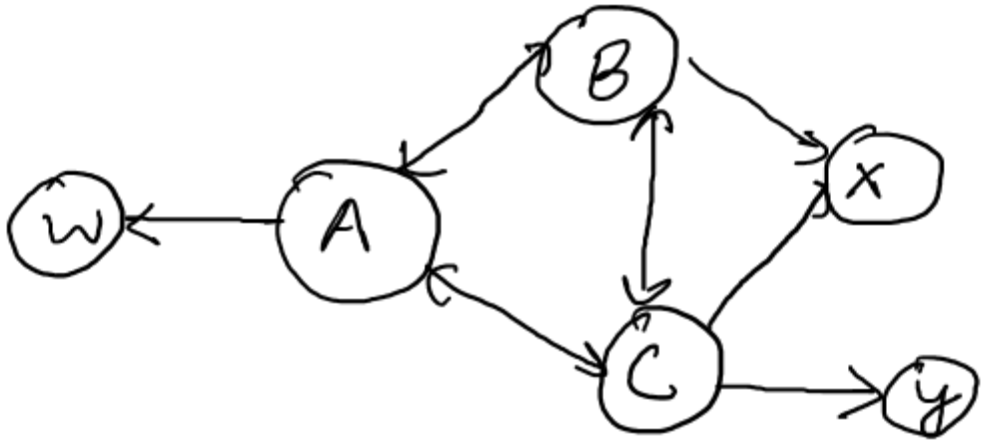
- Router may learn about more than one route to destination AS, selects route based on:
  1. local preference value attribute: policy decision
  2. shortest AS-PATH
  3. closest NEXT-HOP router: hot potato routing
  4. additional criteria



BGP: achieving policy via advertisements

provider → customer

peer ⇔ peer

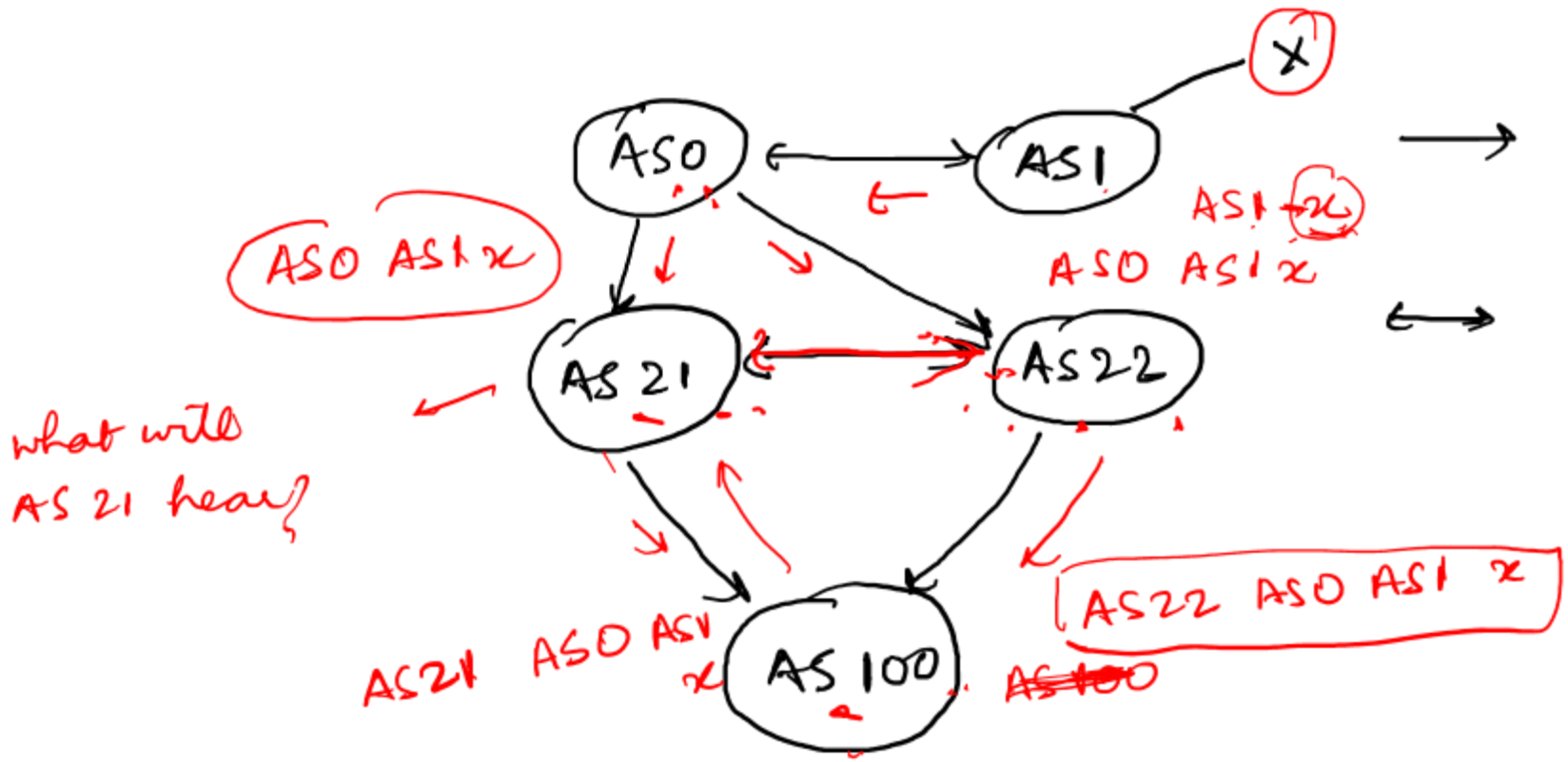


Gao Rexford Rules

Heard from	Announce To
Customer	Everyone
Provider	?
Peer	?

ISP only wants to route traffic to/from its customer networks (does not want to carry transit traffic between other ISPs – a typical "real world" policy)

- A advertises path Aw to B and to C
- B *chooses not to advertise* BAw to C!
  - B gets no "revenue" for routing CBAw, since none of C, A, w are B's customers
  - C does *not* learn about CBAw path
- C will route CAw (not using B) to get to w


X
AS0
AS1
AS21
AS22
AS100
AS0 AS1 x
AS1 x
AS0 AS1 x
what will AS 21 hear?
AS21 AS0 AS1 x
AS22 AS0 AS1 x
AS100
provider - customer link
peer - peer link
X AS21 AS100 AS22 AS0 AS1 x

Routing: Summary

Routing Table

- Intra-domain routing and inter-domain routing
- Intra-domain routing
  - Distance vector (e.g., RIP, EIGRF)
  - Link state (e.g., OSPF)
- Inter-domain routing
  - Focus more on policy than performance
  - Border Gateway Protocol (BGP)
- All examples of per-router control plane or a distributed control plane

Software-defined N/w → SDN

↓

Centralized control plane

Router architecture overview

high-level view of generic router architecture: