Welcome to

CS 3516:
Computer Networks

Prof. Yanhua Li

Time: 9:00am –9:50am M, T, R, and F
Location: AK219
Fall 2018 A-term

Some slides are originally from the course materials of the textbook "Computer Networking: A Top Down Approach", 7th edition, by Jim Kurose, Keith Ross, Addison-Wesley March 2016. Copyright 1996-2017 J.F Kurose and K.W. Ross, All Rights Reserved.

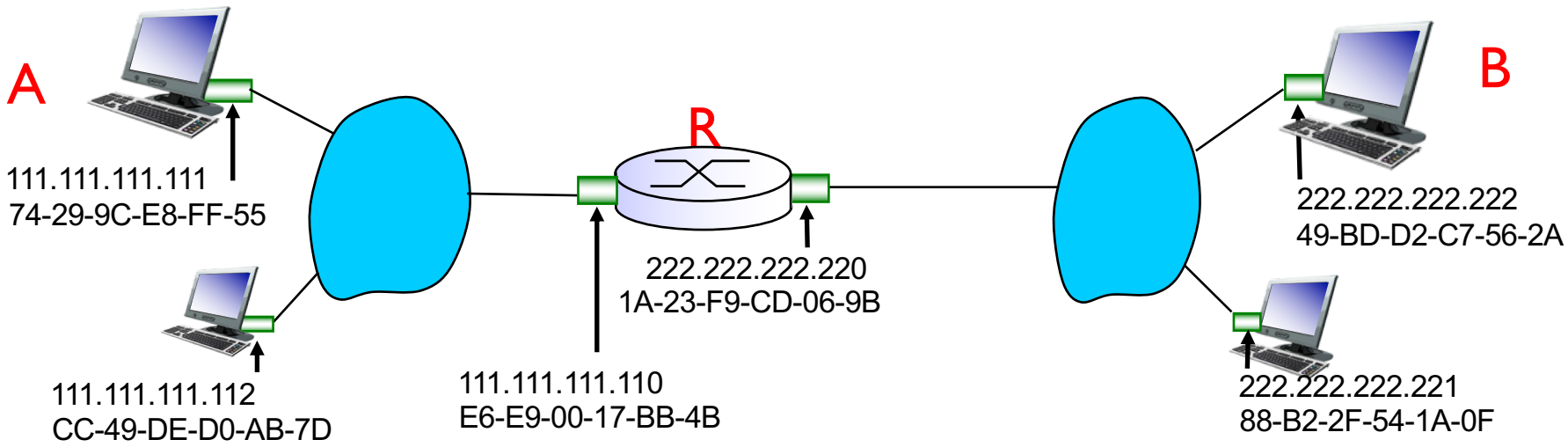
Overview

- Final Exam Review
- Class Review

Addressing: routing to another LAN

walkthrough: send datagram from A to B via R

- focus on addressing – at IP (datagram) and MAC layer (frame)
- assume A knows B's IP address (how?)
- assume A knows IP address of first hop router, R (how?)
- assume A knows R's MAC address (how?)



Overview

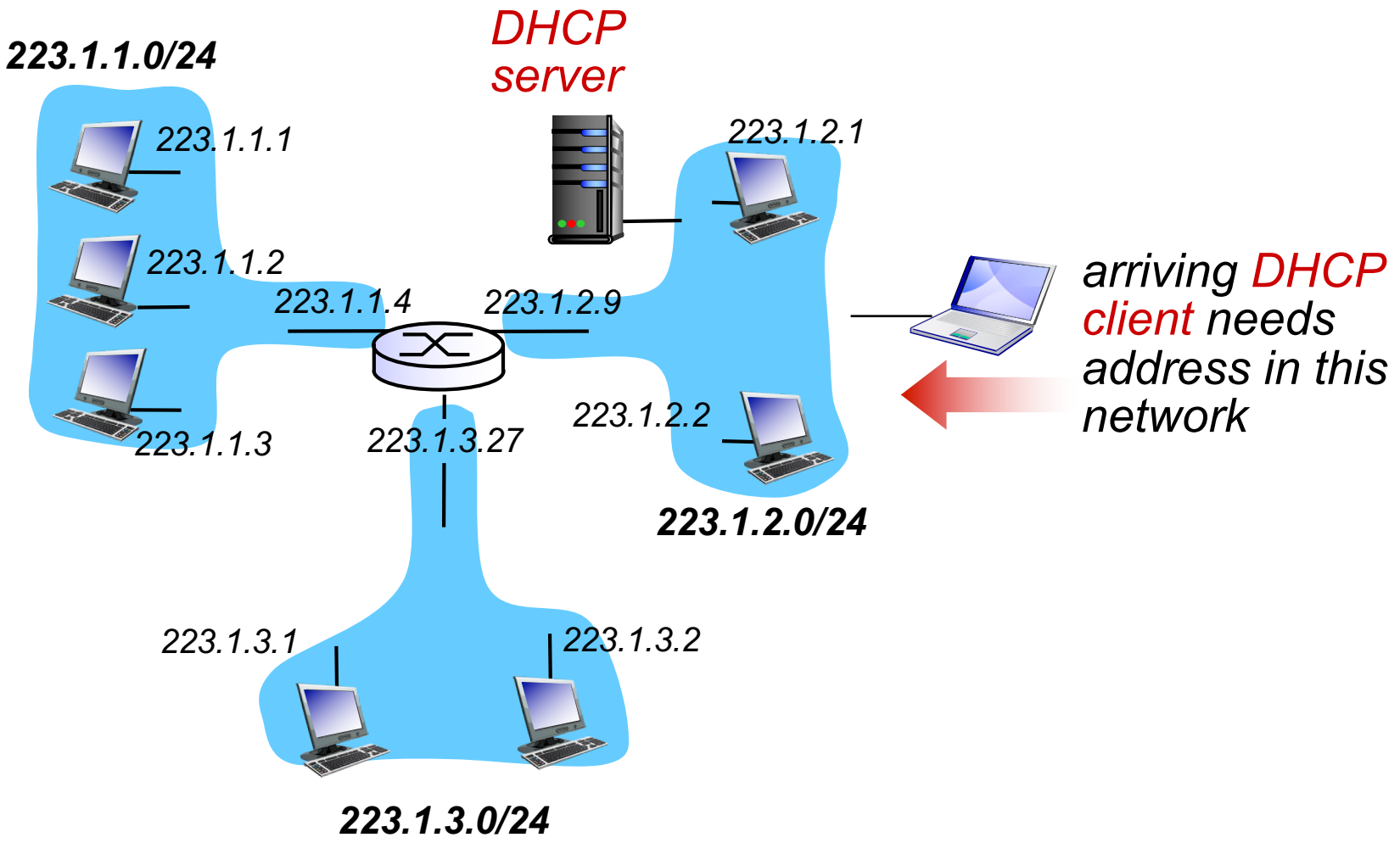
- Final Exam Review
- Class Review

Final Review

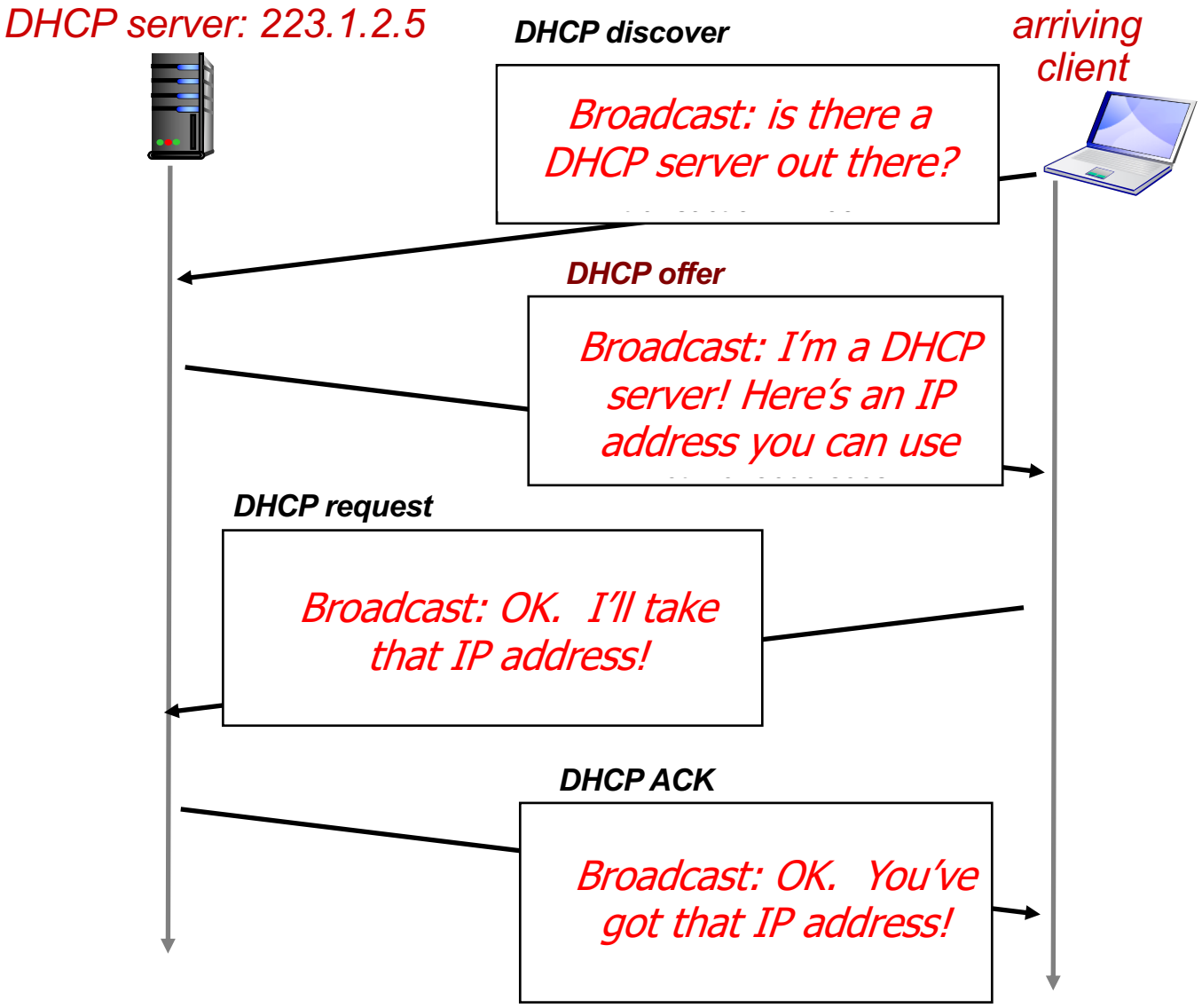
- (1) DHCP
- (2) CSMA/CD
- (3) LS and DV routing
- (4) LS and DV routing
- (5) IPv4 classful addressing
- (6) LS and DV routing
- (7) Inter-AS routing and BGP

- *(1) 7 questions*
- *(2) 32 points + 2 bonus points*
- *(3) Q1-4: Small*
- *(4) Q5-7: bigger questions*

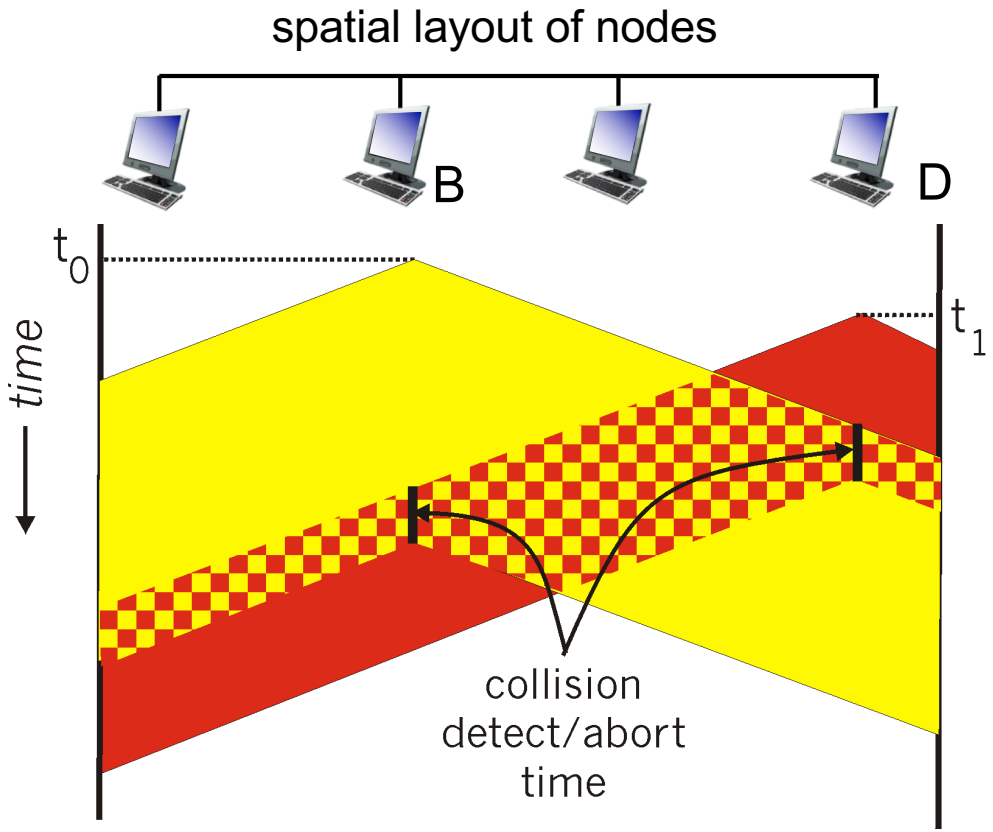
DHCP client-server scenario



DHCP client-server scenario



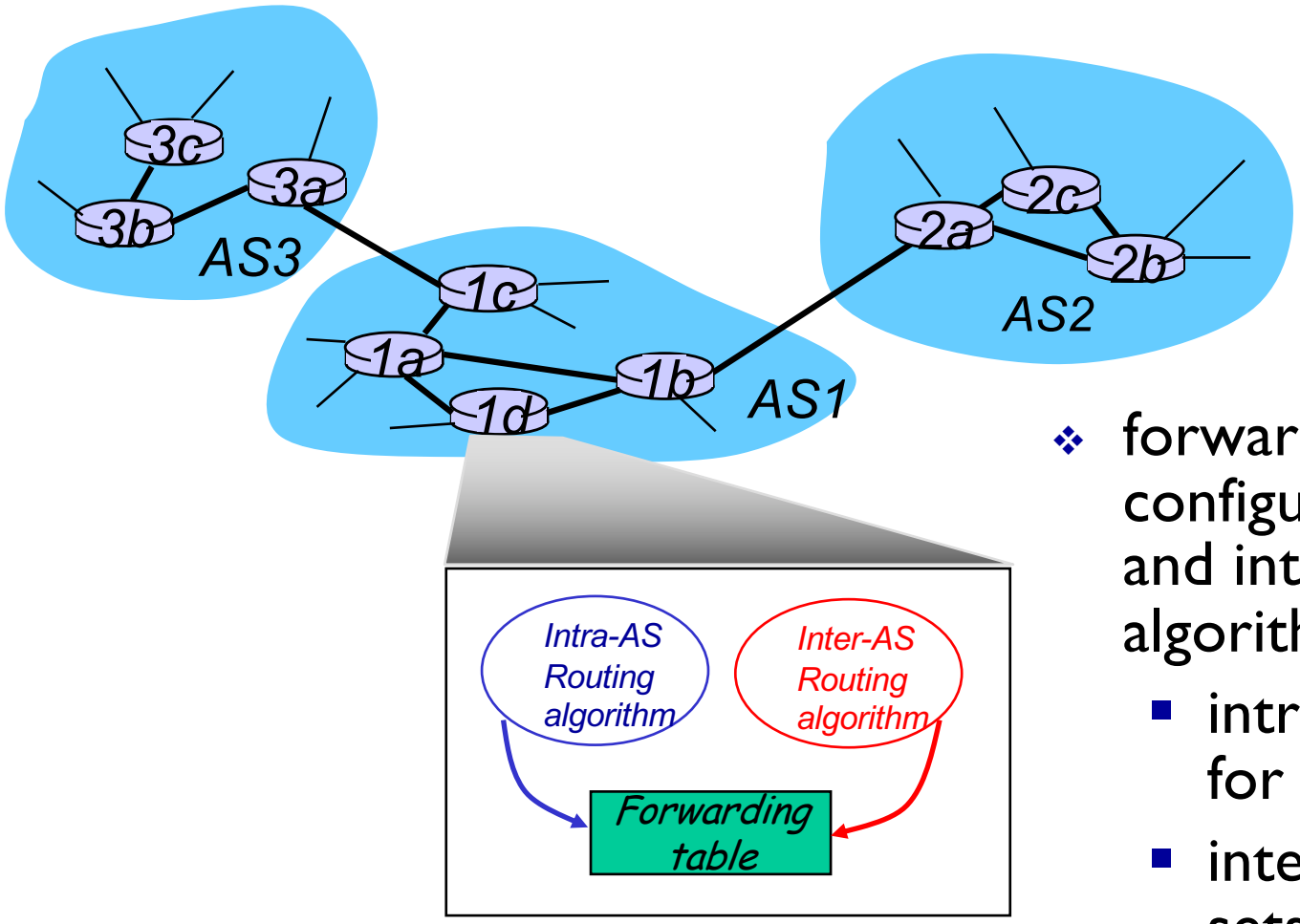
CSMA/CD (collision detection)



Ethernet CSMA/CD algorithm

1. NIC receives datagram from network layer, creates frame
2. If NIC senses channel idle, starts frame transmission. If NIC senses channel busy, waits until channel idle, then transmits.
3. If NIC transmits entire frame without detecting another transmission, NIC is done with frame !
4. If NIC detects another transmission while transmitting, aborts and sends jam signal
5. After aborting, NIC enters *binary (exponential) backoff:*
   - after *m*th collision, NIC chooses *K* at random from $\{0, 1, 2, \ldots, 2^m-1\}$. NIC waits $K \cdot 512$ bit times, returns to Step 2
   - longer backoff interval with more collisions

Interconnected ASes



- forwarding table configured by both intra- and inter-AS routing algorithm
  - intra-AS sets entries for internal dests
  - inter-AS & intra-AS sets entries for external dests

DV: Routing Information Protocol (RIP), BGP
LS: OSPF (Open Shortest Path First routing)

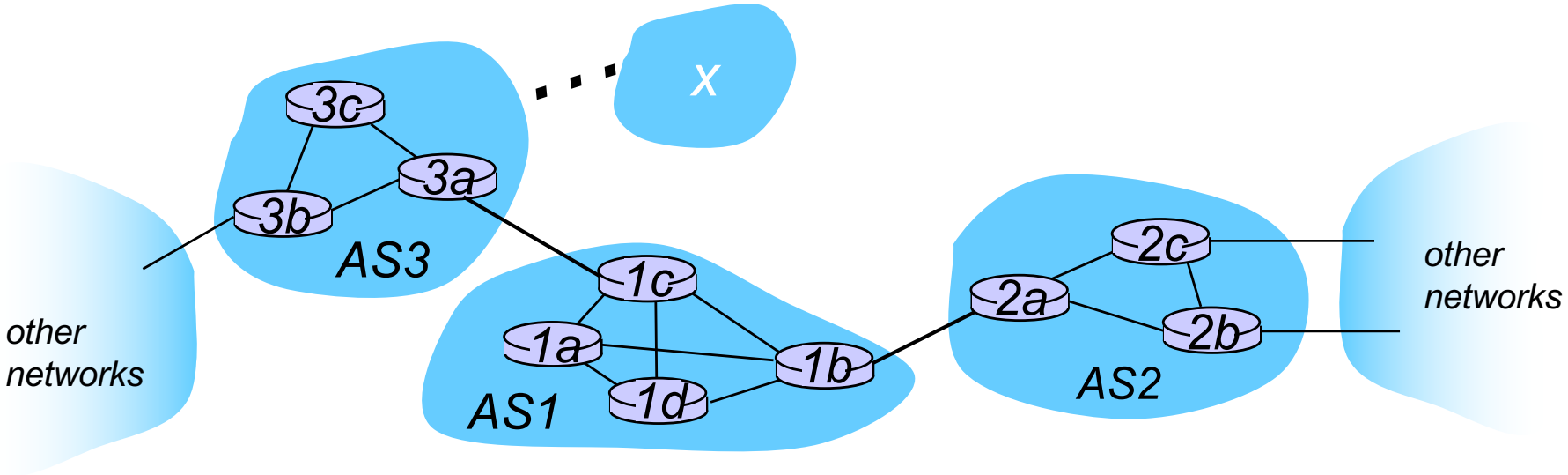
Inter-AS tasks

- suppose router in AS1 receives datagram destined outside of AS1:
  - router should forward packet to gateway router, but which one?

AS1 must:

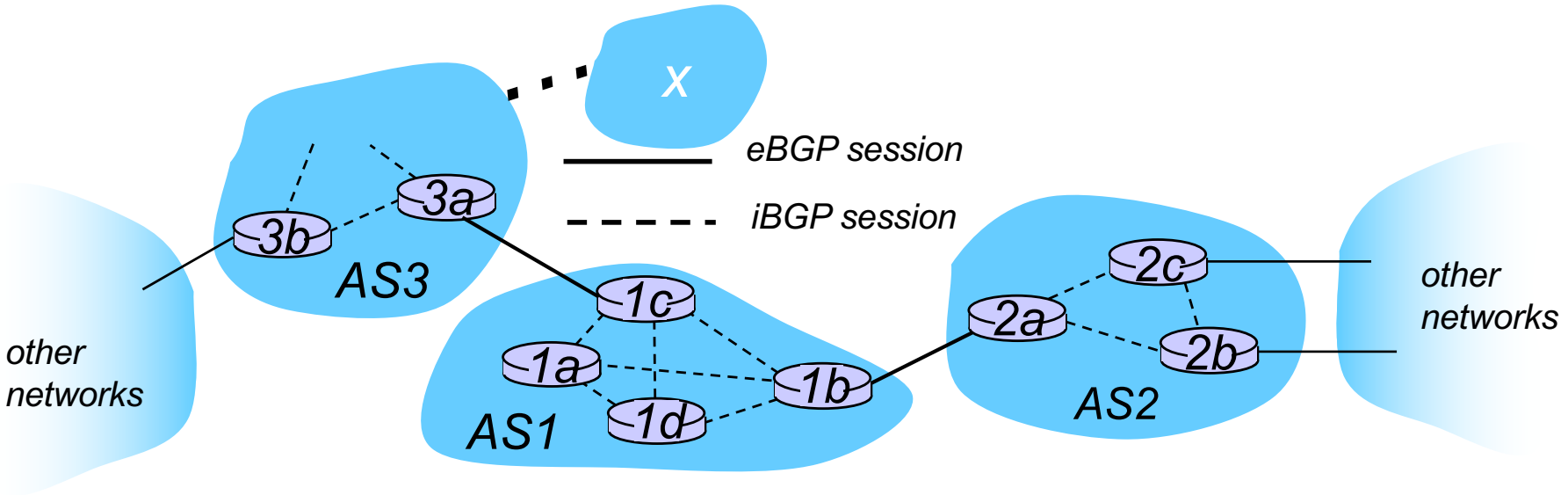
1. learn which dests are reachable through AS2, which through AS3
2. propagate this reachability info to all routers in AS1

job of inter-AS routing!



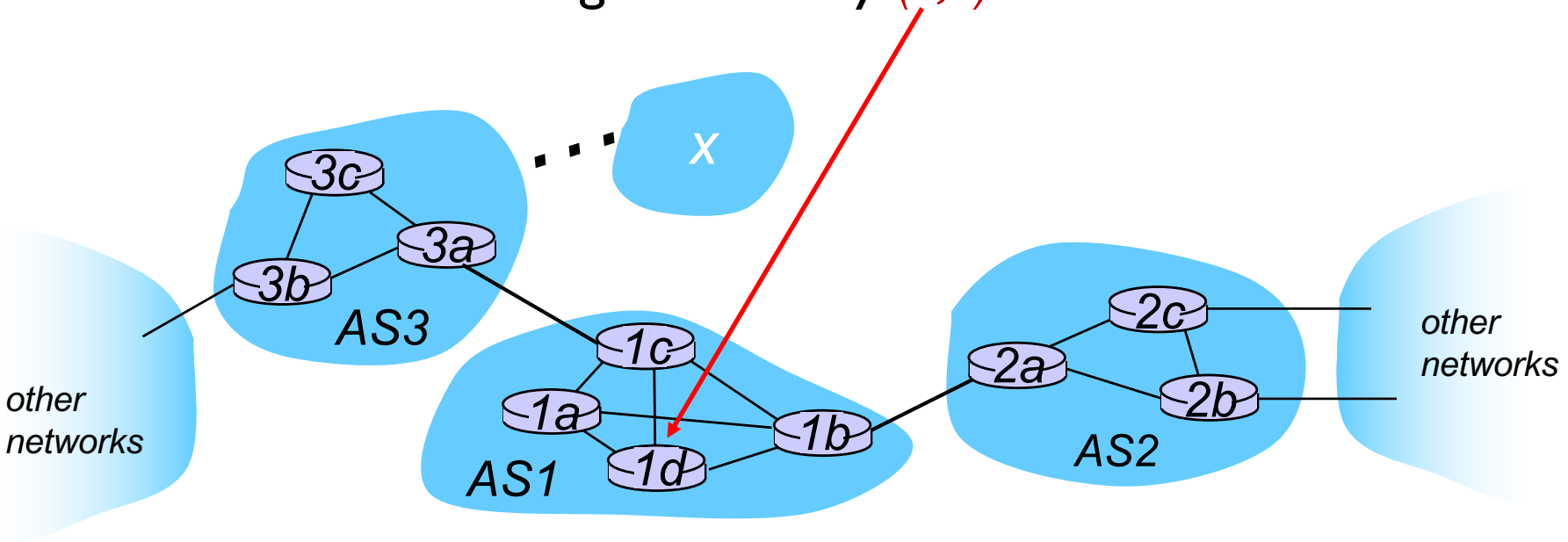
BGP basics: distributing path information

- using eBGP session between 3a and 1c, AS3 sends prefix reachability info to AS1.
  - 1c can then use iBGP do distribute new prefix info to all routers in AS1
  - 1b can then re-advertise new reachability info to AS2 over 1b-to-2a eBGP session
- when router learns of new prefix, it creates entry for prefix in its forwarding table.



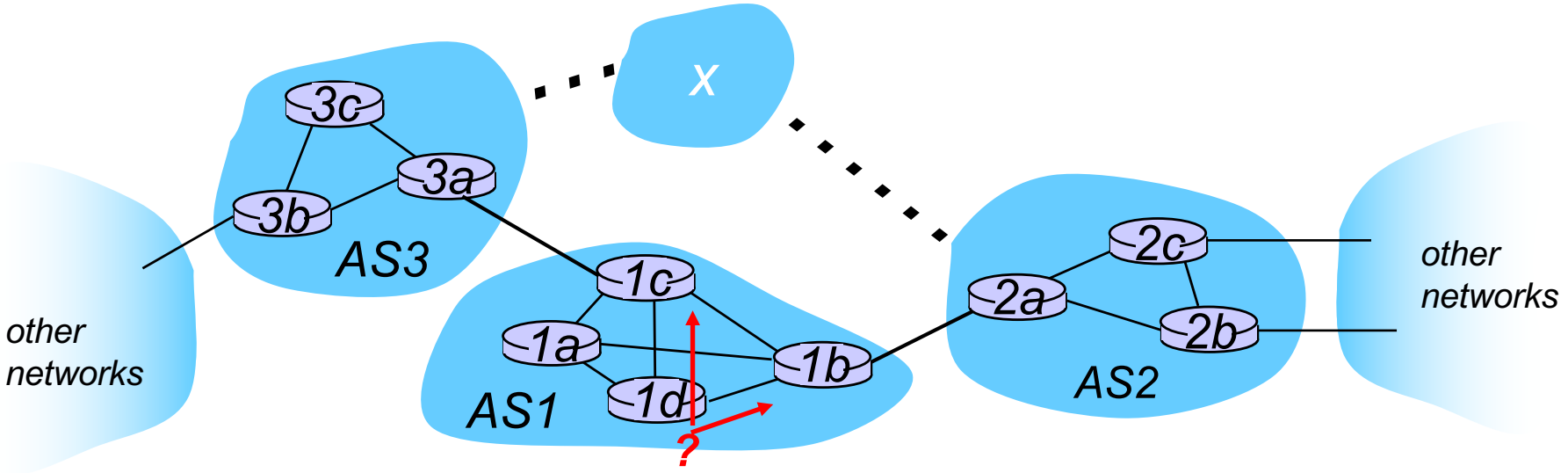
Example: setting forwarding table in router 1d

- suppose AS1 learns (via inter-AS protocol) that subnet *x* reachable via AS3 (gateway 1c), but not via AS2
  - inter-AS protocol propagates reachability info to all internal routers
- router 1d determines from intra-AS routing info that its interface e is on the least cost path to 1c
  - installs forwarding table entry *(x,e)*



Example: choosing among multiple ASes

- now suppose AS1 learns from inter-AS protocol that subnet *x* is reachable from AS3 *and* from AS2.
- to configure forwarding table, router 1d must determine which gateway it should forward packets towards for dest x
  - this is also job of inter-AS routing protocol!
  - *hot potato routing: send* packet towards closest of two routers.



Final Grade: 4 components

Labs: 10%

3 labs,

Lab1-5points; Lab2-25+2pts; Lab3-25 + 1 bonus pt

Quizzes: 30%

9 Quizzes

the one with lowest percentage is not counted

Projects: 30%

3 project, each worth of 15%

Exams: 30%

Mid-term exam: (32 + 2 pts)

Final Exam: (32 + 2 pts)

Questions?