

# Computer Networks

## COL 334/672

Data Plane

*Slides adapted from KR*

Sem 1, 2025-26

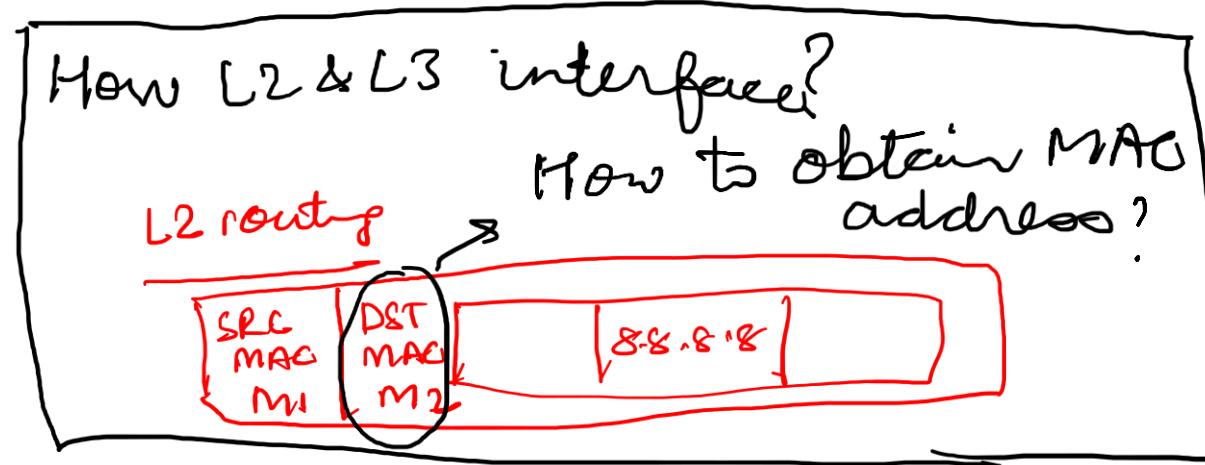
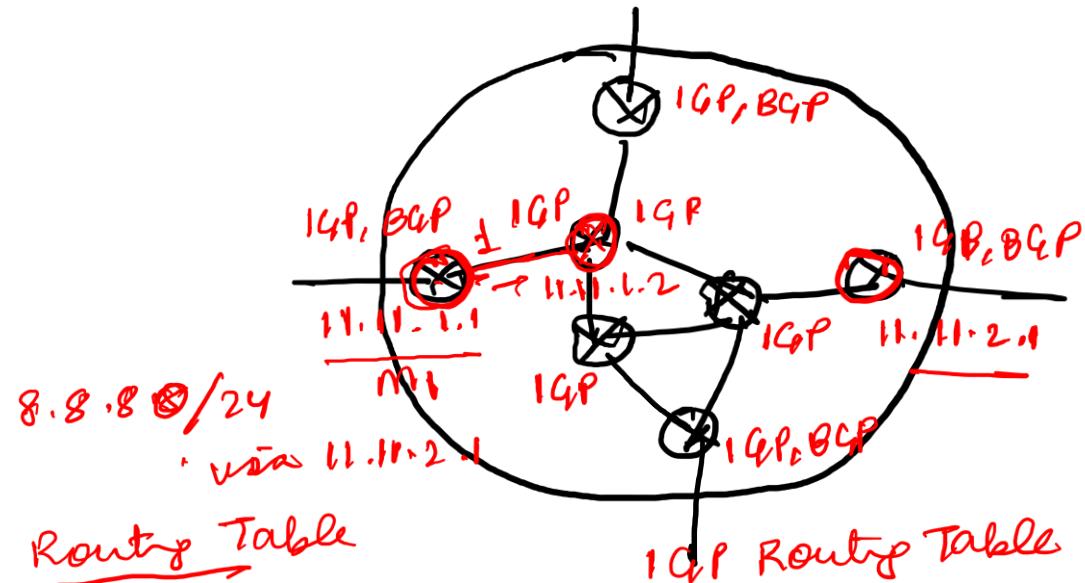
# Quiz on Moodle (NOT Moodlenew)

Password : bgp

# Story so far ..

- Routing algorithms in the network layer
  - Intra-domain routing through an interior gateway protocol such as OSPF, RIP
  - Inter-domain routing through BGP

*Now, completing the picture*



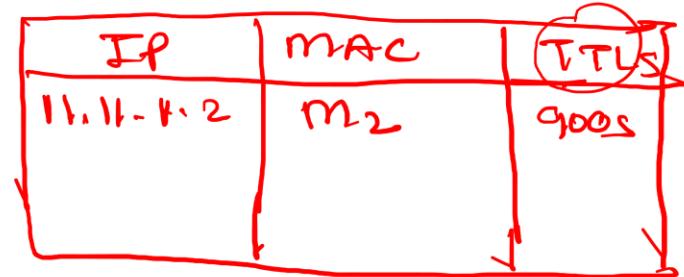
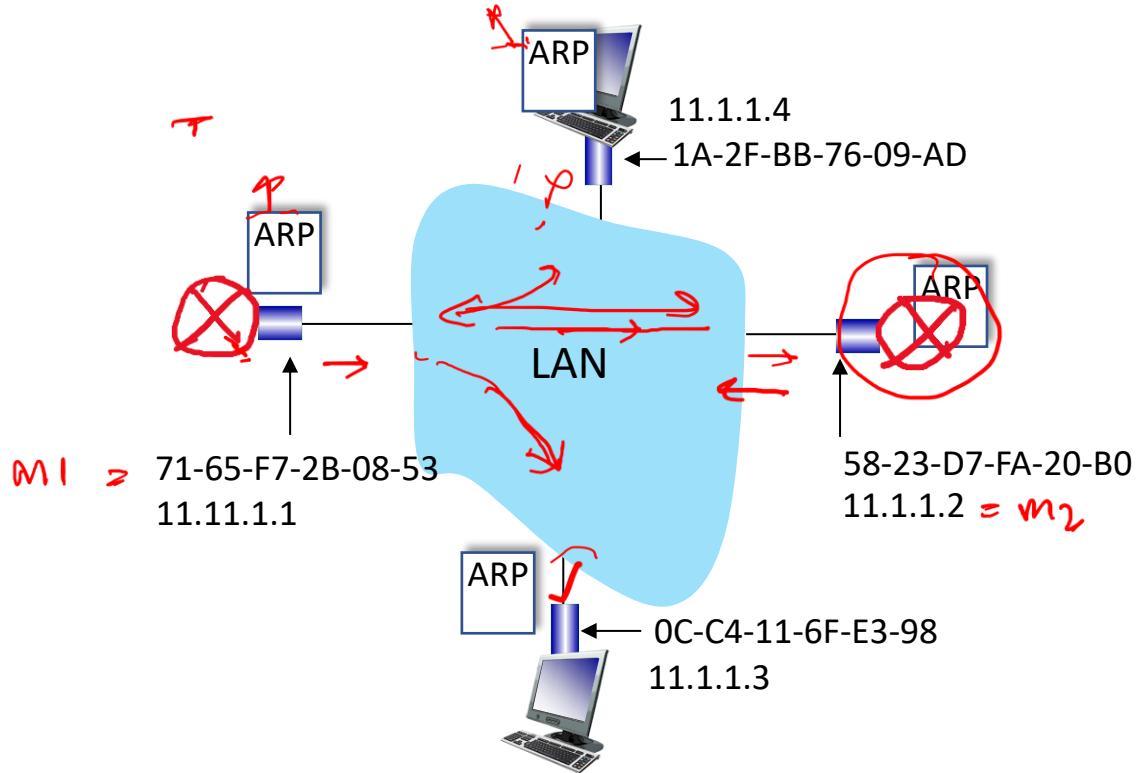
Forwarding Table

=

PREFIX	PORT	NXT HOP	MAC Address
8.8.8.0/24	1	11.11.1.2	

# ARP: address resolution protocol

ARP: determines interface's MAC address, knowing its IP address



ARP REQ

ETHERNET PACKET

SRC MAC	DST MAC	target IP
= m <sub>1</sub>	= FFFFFF	= 11.1.1.2

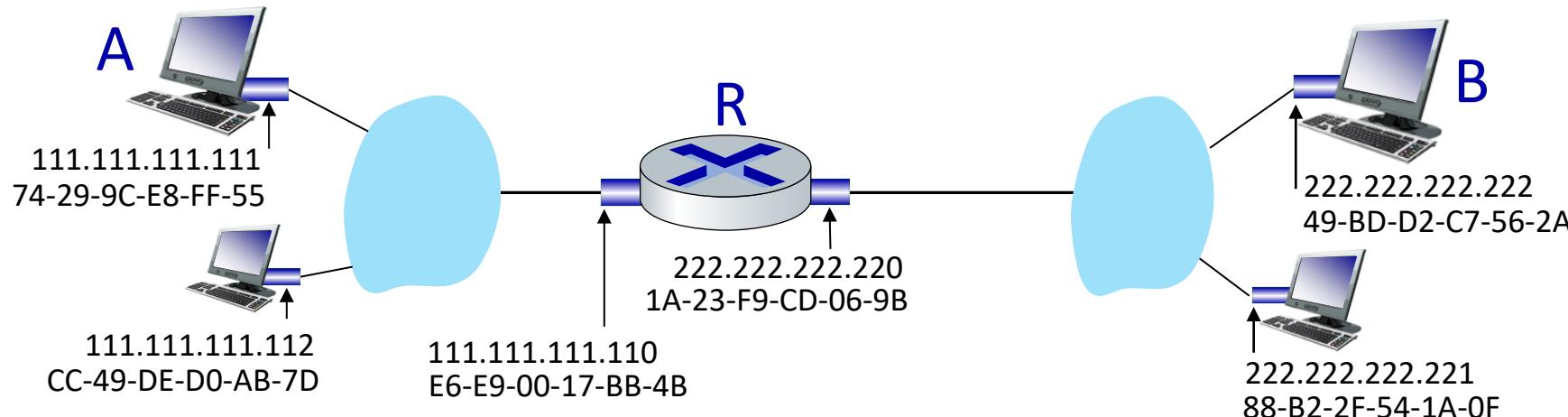
ARP REP

SRC MAC	DST MAC	TARGET IP = ...
= m <sub>2</sub>	= m <sub>1</sub>	TTL = ...

# Putting it all together: Routing to another subnet

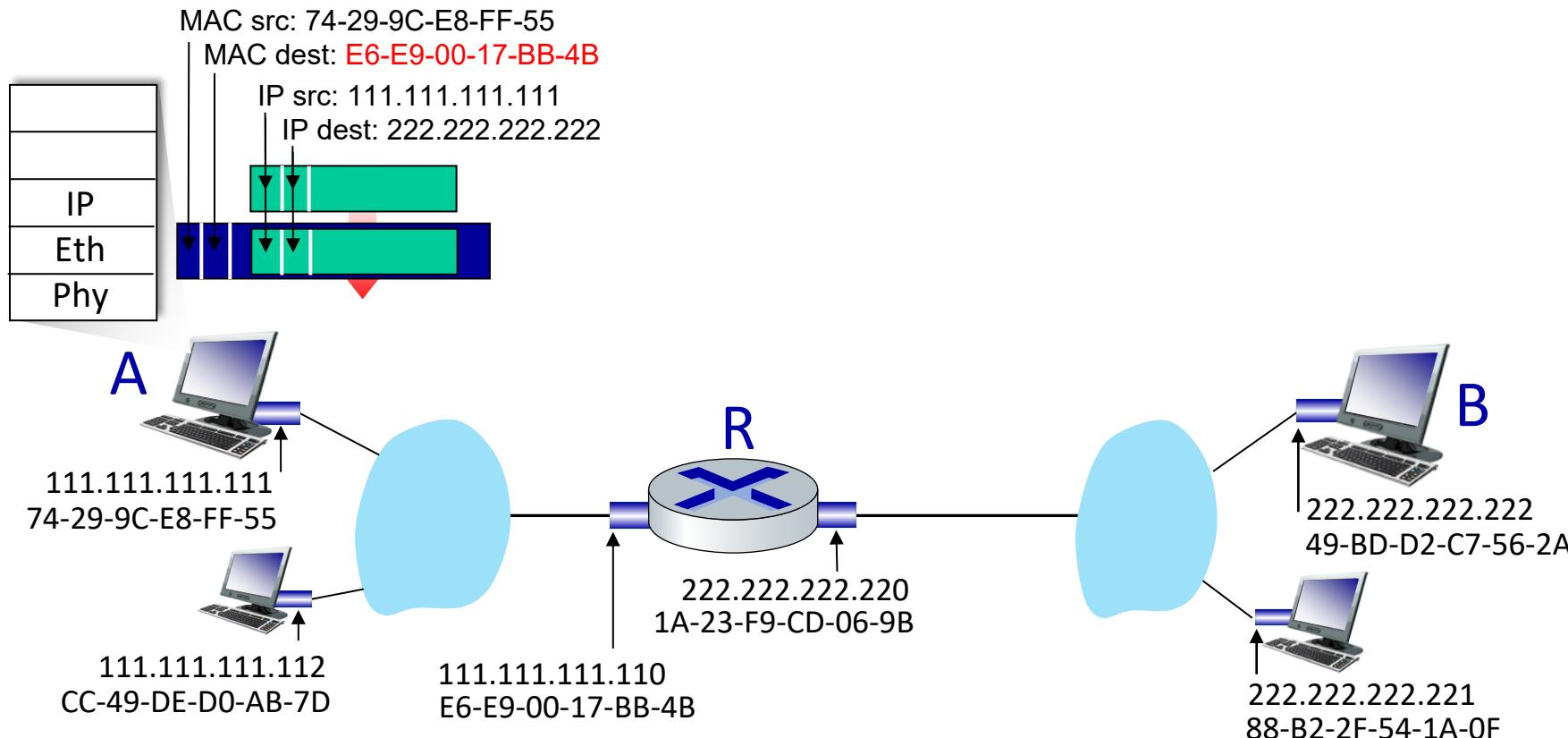
walkthrough: sending a datagram from *A* to *B* via *R*

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



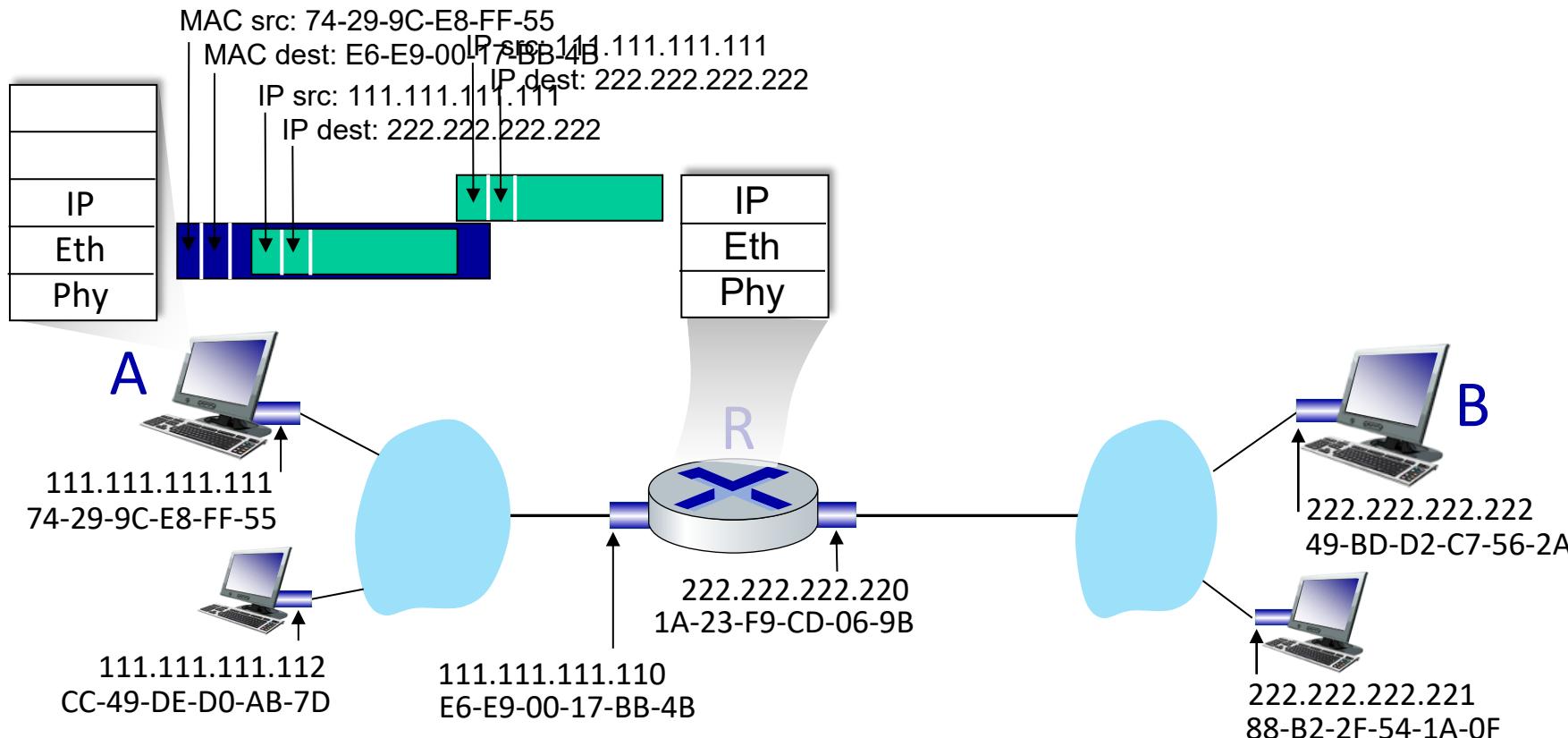
# Routing to another subnet: addressing

- A creates IP datagram with IP source A, destination B
- A creates link-layer frame containing A-to-B IP datagram
  - R's MAC address is frame's destination



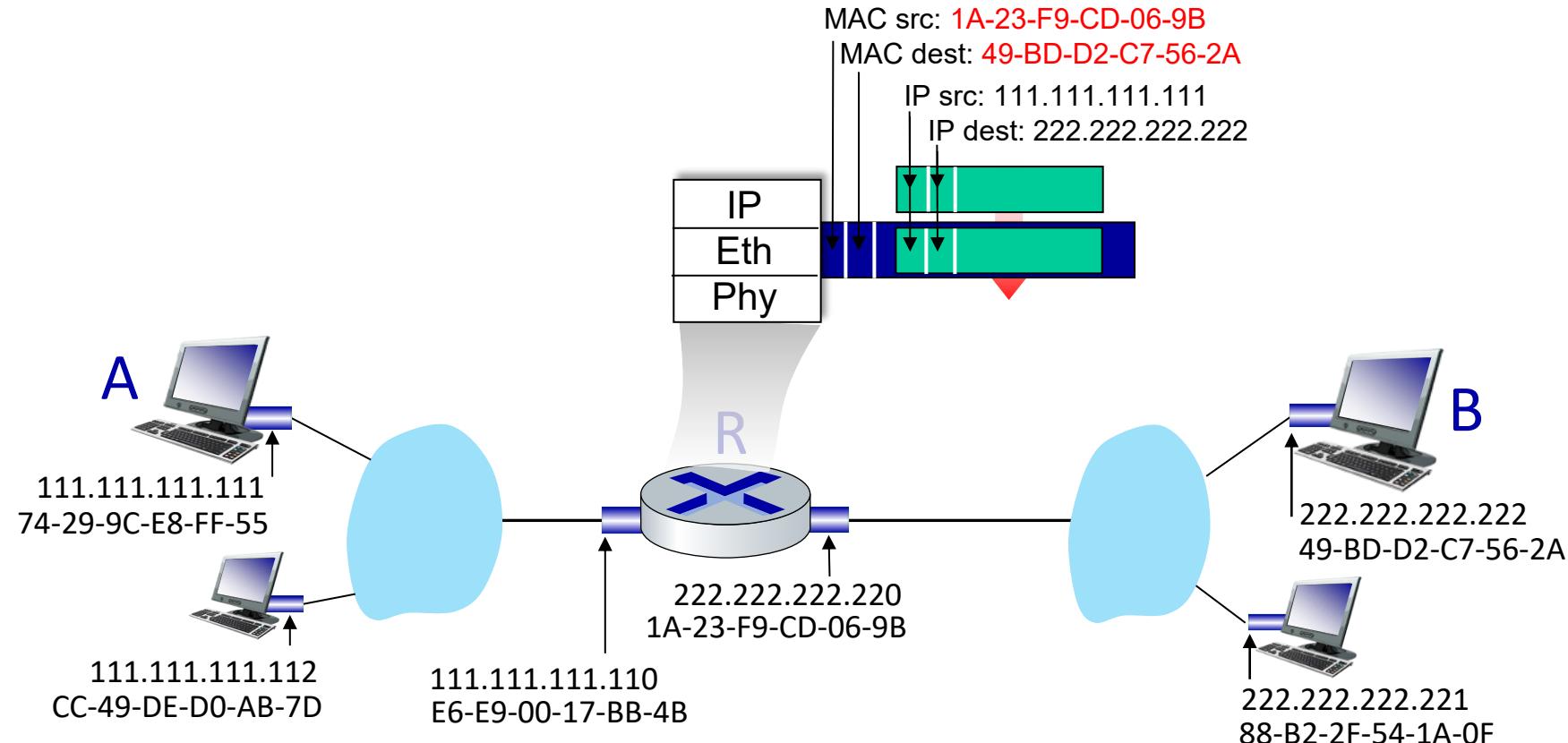
# Routing to another subnet: addressing

- frame sent from A to R
- frame received at R, datagram removed, passed up to IP



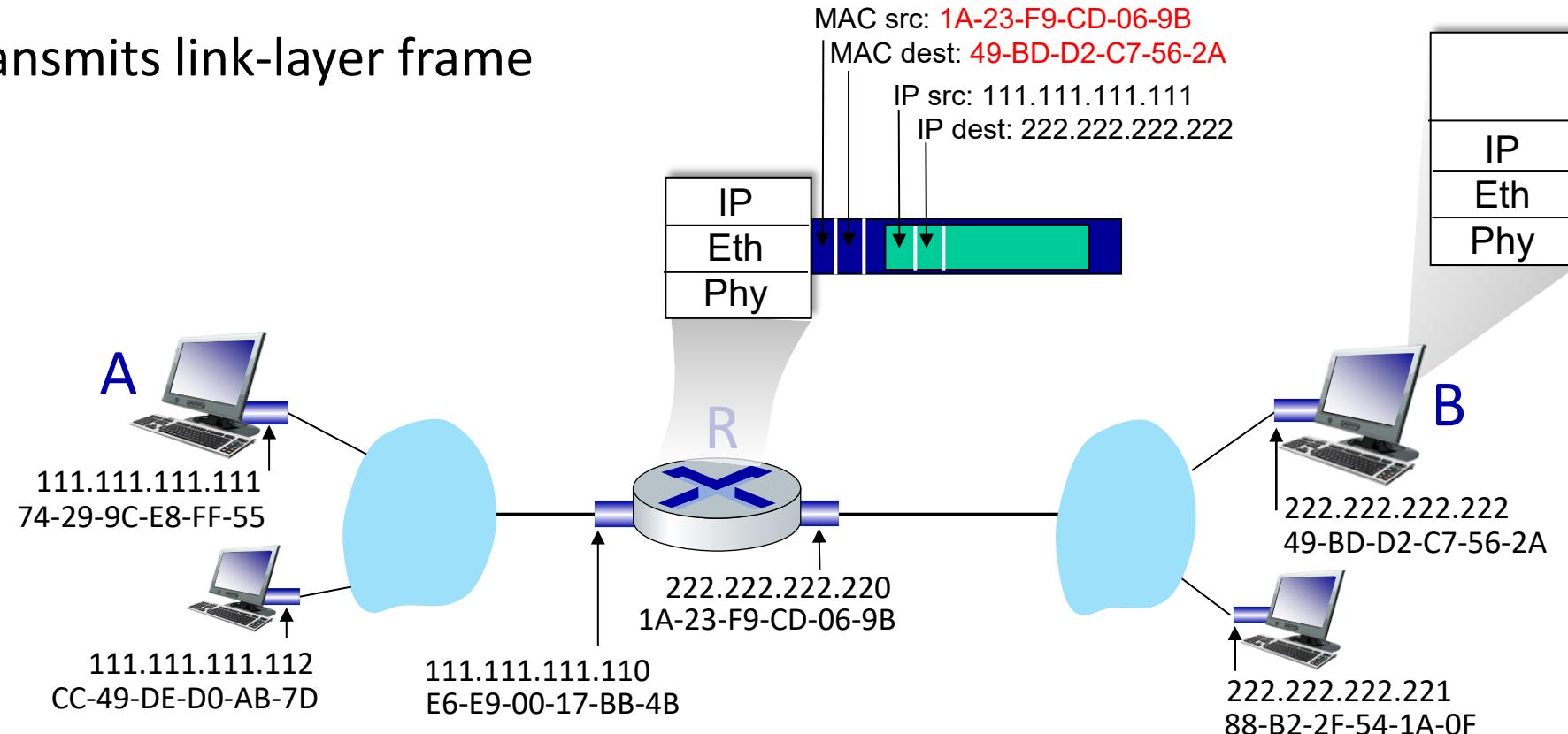
# Routing to another subnet: addressing

- R determines outgoing interface, passes datagram with IP source A, destination B to link layer
- R creates link-layer frame containing A-to-B IP datagram. Frame destination address: B's MAC address



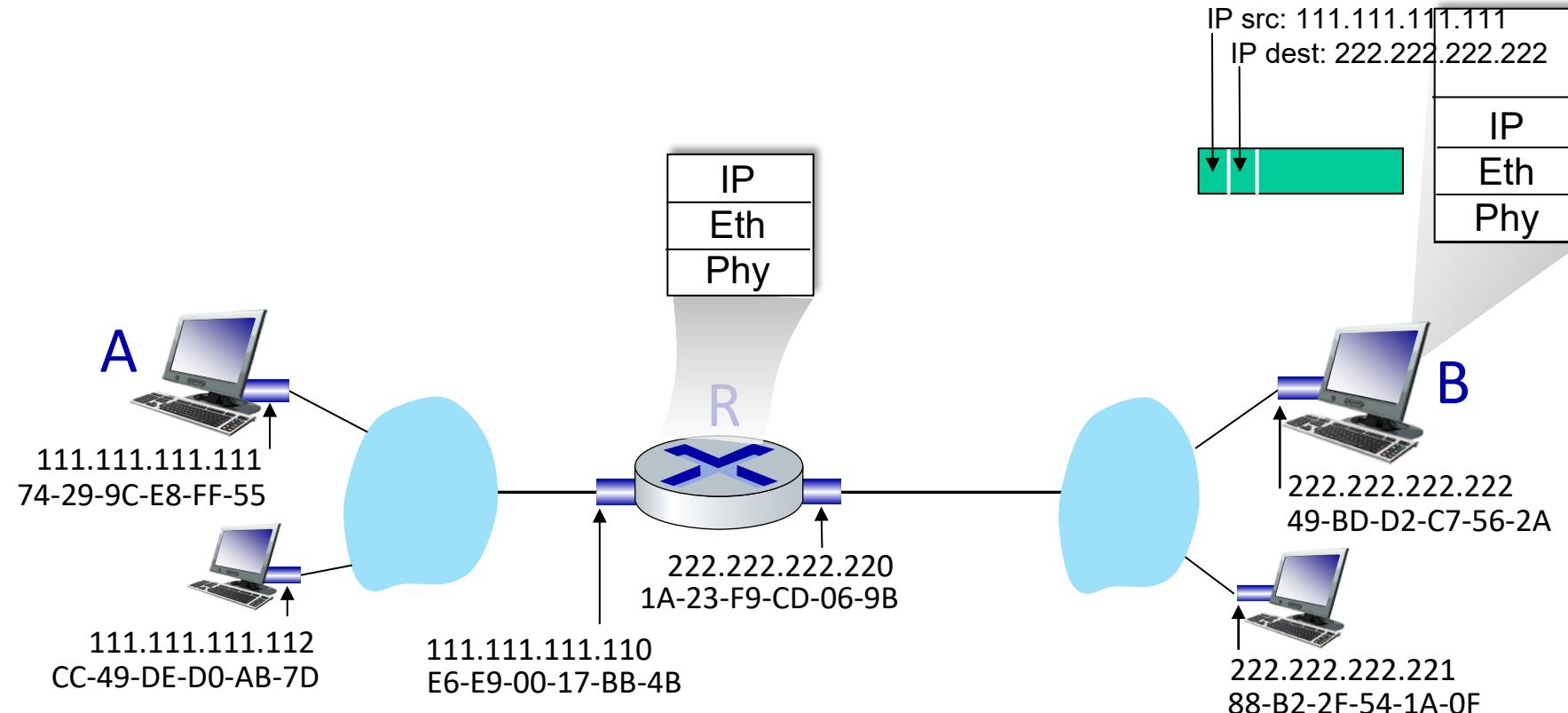
# Routing to another subnet: addressing

- R determines outgoing interface, passes datagram with IP source A, destination B to link layer
- R creates link-layer frame containing A-to-B IP datagram. Frame destination address: B's MAC address
- transmits link-layer frame



# Routing to another subnet: addressing

- B receives frame, extracts IP datagram destination B
- B passes datagram up protocol stack to IP

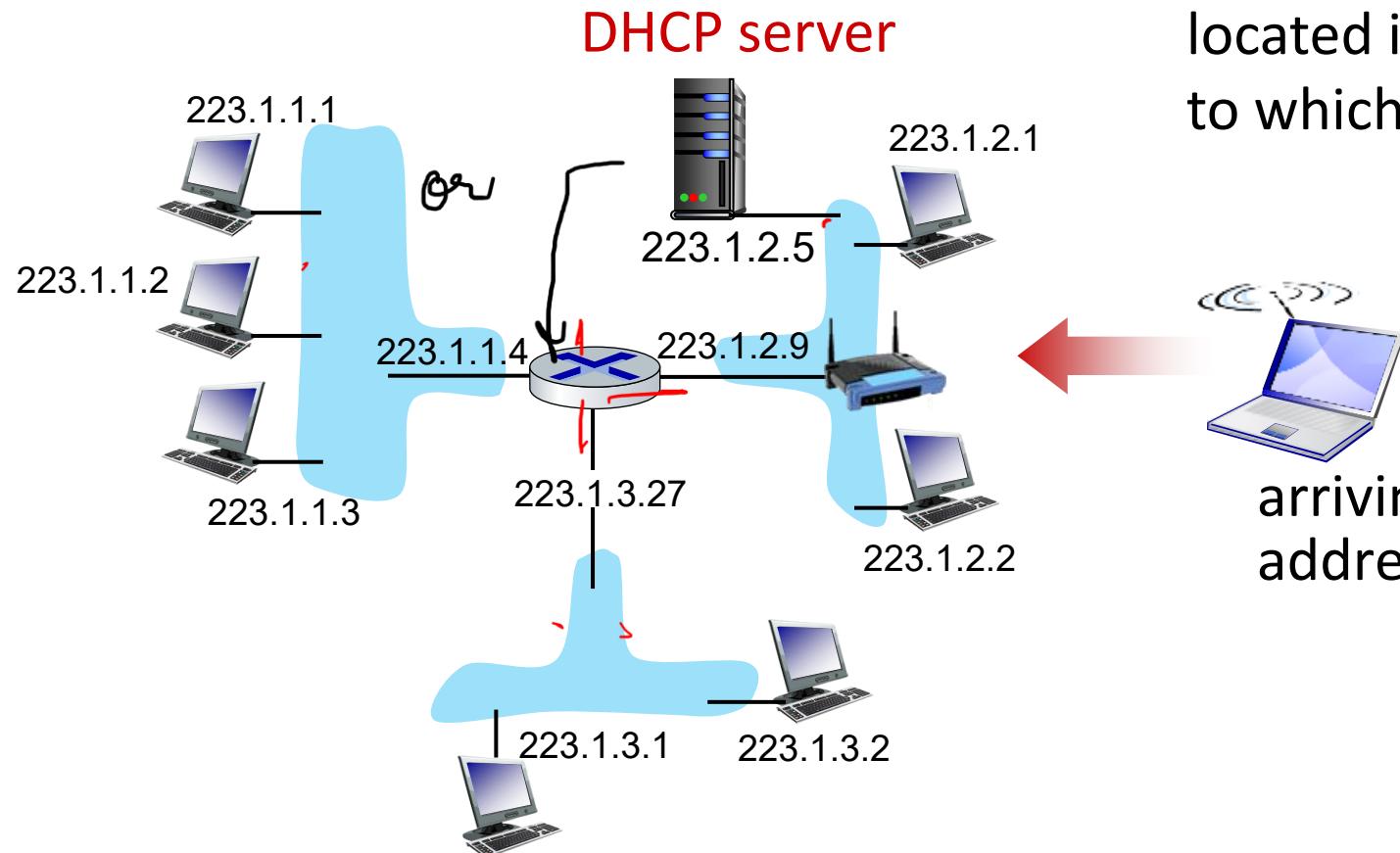


# IP addresses: how to get one?

How does *host* get IP address?

- hard-coded by sysadmin in config file (e.g., `/etc/rc.config` in UNIX)
- **DHCP: Dynamic Host Configuration Protocol:** dynamically get address from a server
  - “plug-and-play”
  - consists of a server running over UDP, responsible for assigning client IP address

# DHCP client-server scenario



Typically, DHCP server will be co-located in router, serving all subnets to which router is attached

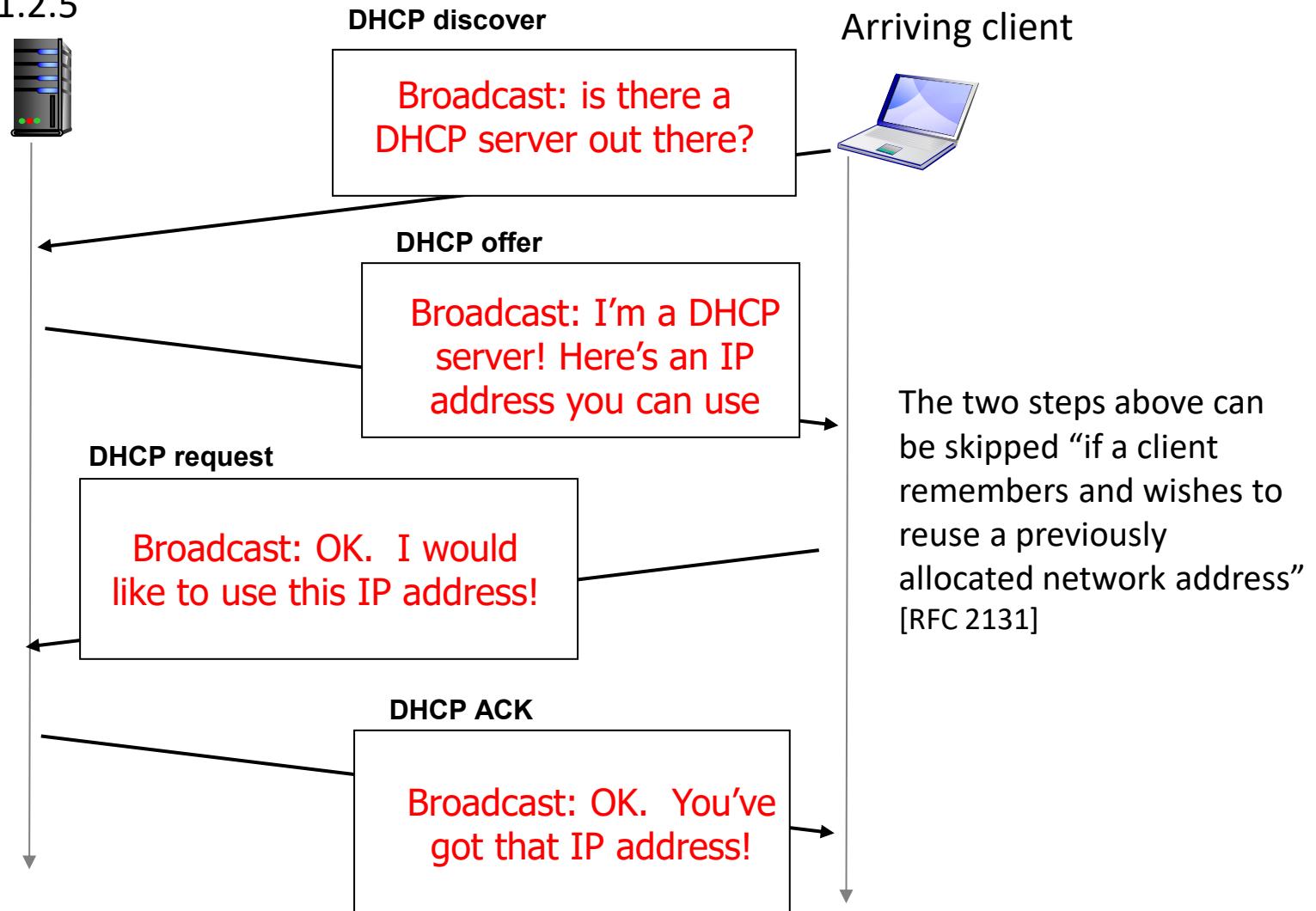
arriving **DHCP client** needs address in this network

# DHCP client-server scenario

DHCP server: 223.1.2.5

Other information:

- address of first-hop router for client
- name and IP address of DNS sever
- network mask (indicating network versus host portion of address)



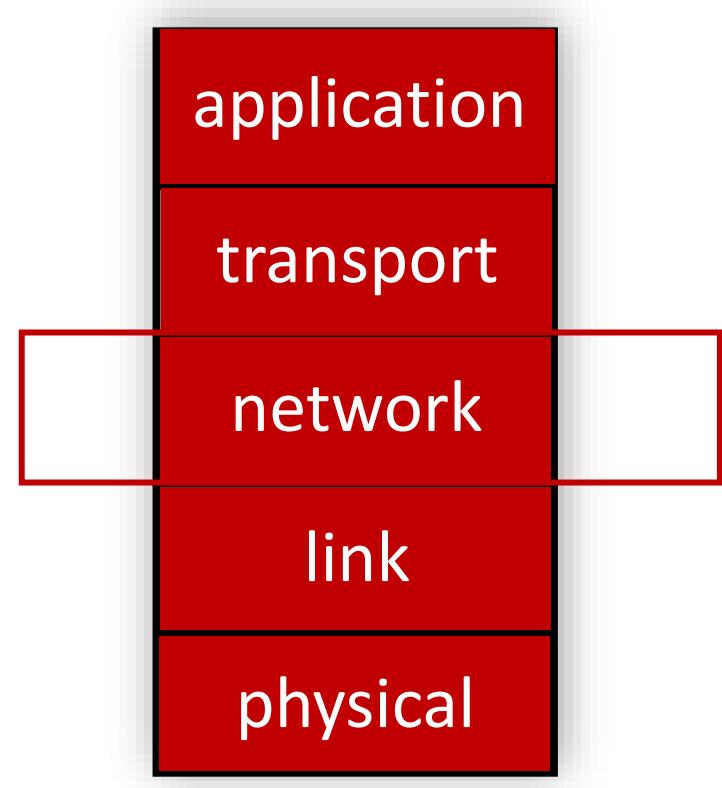
# Recap

## Network-layer functions:

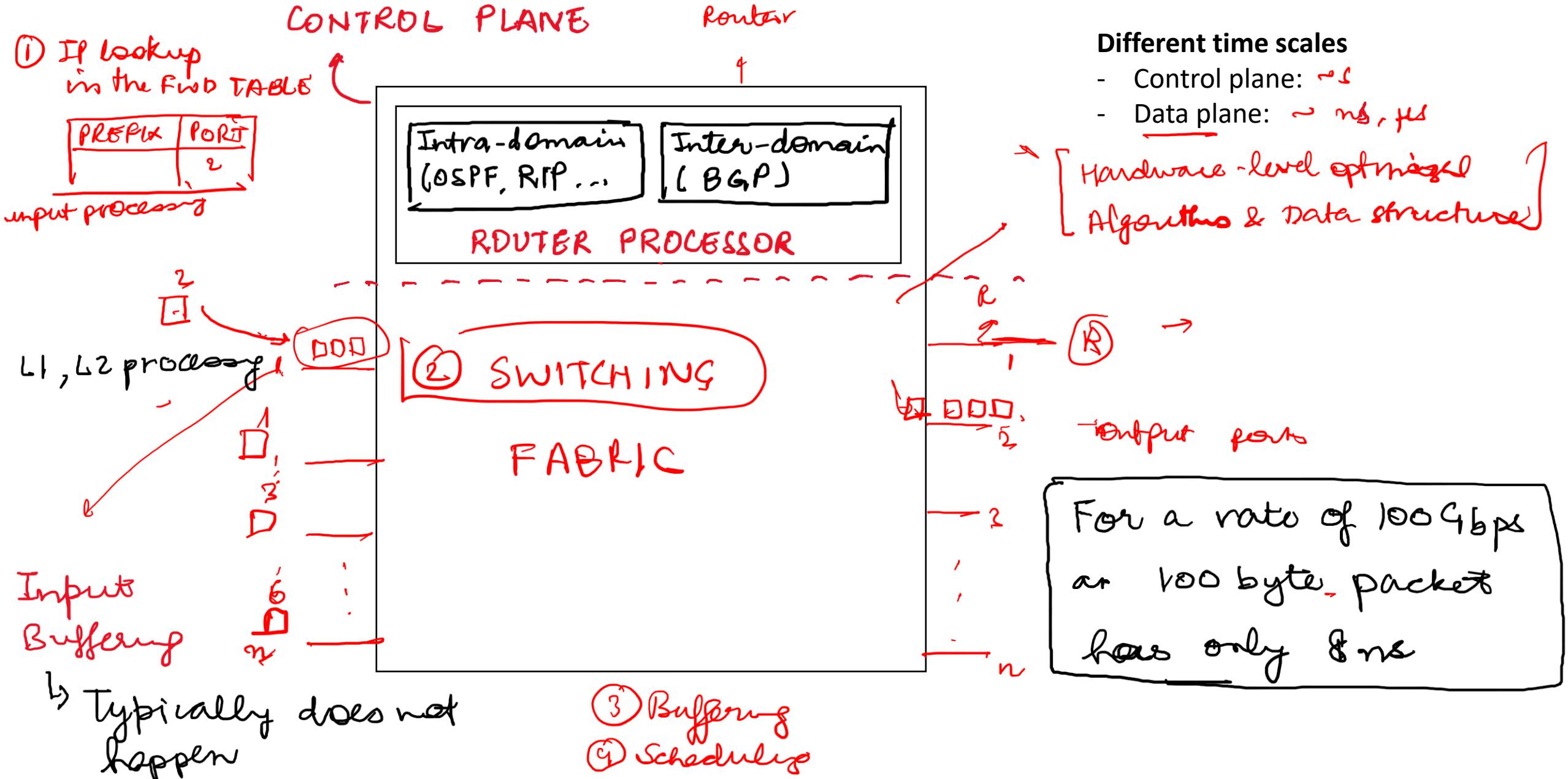
- *routing*: determine route taken by packets from source to destination
  - *routing algorithms*

Chapt<sup>n</sup> 4

- *forwarding*: move packets from a router's input link to appropriate router output link



# Router Architecture



# Next Class: Data Plane Functions

- IP lookup
- Switching
- Queuing
- Scheduling