

Computer Networks

COL 334/672

Data Plane

Slides adapted from KR

Sem 1, 2025-26

Quiz on Moodle (NOT Moodlenew)

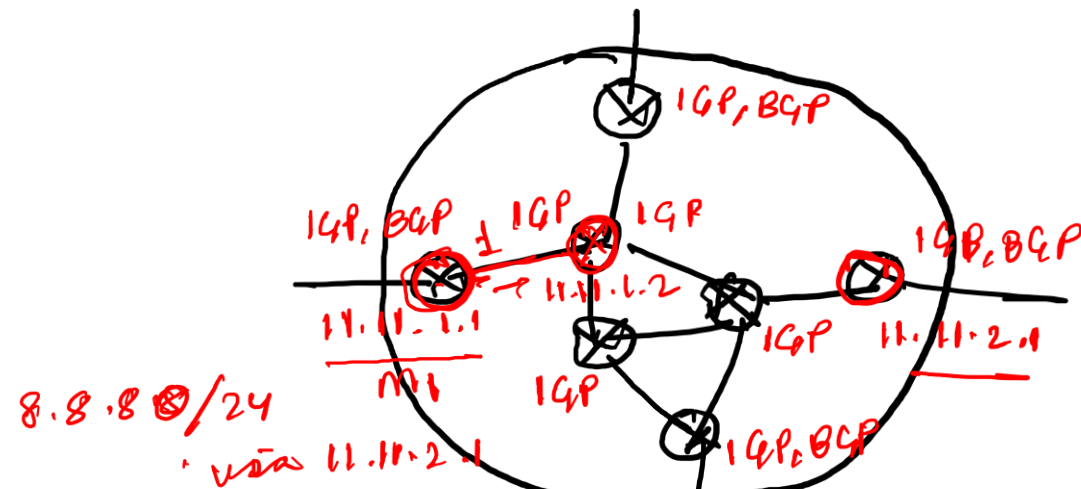
Password : bgp

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

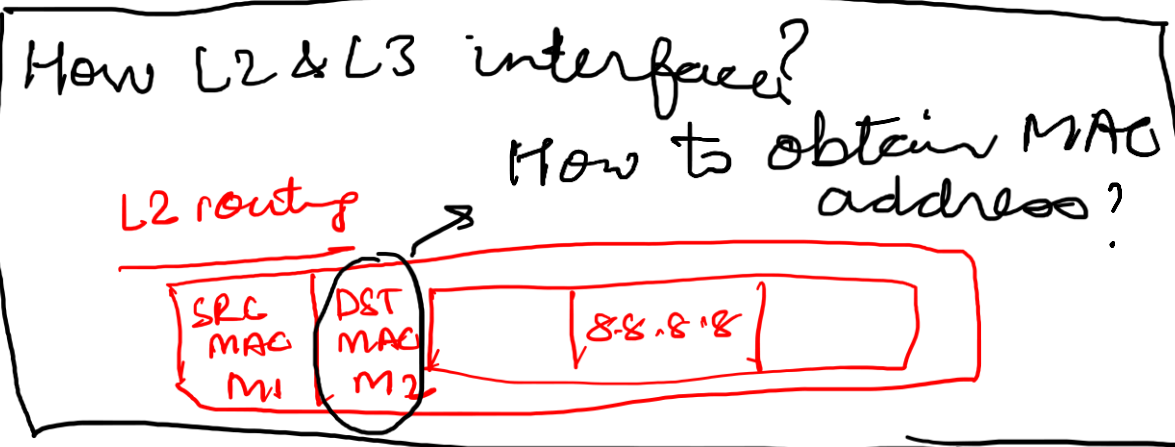


Routing Table

PREFIX	NXT HOP
8.8.8.0/24	11.11.2.1

IGP Routing Table

PREFIX	NXT HOP	PORT
11.11.2.0/24	11.11.1.2	1

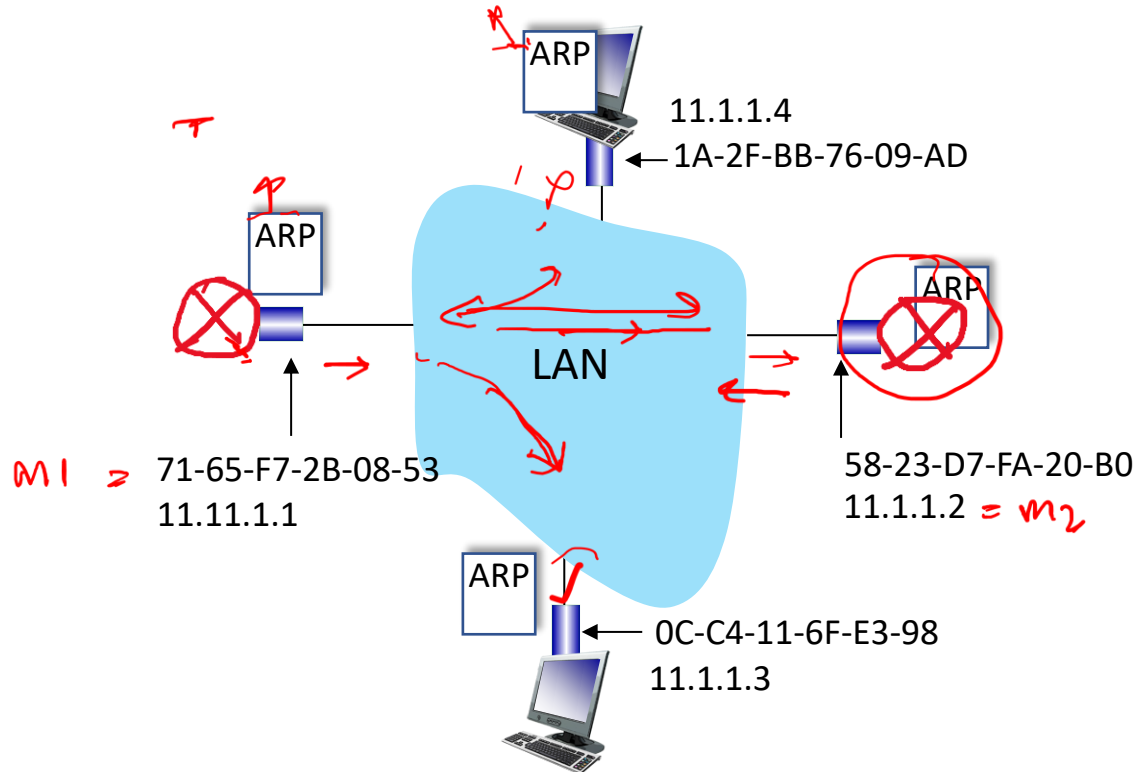


Forwarding Table

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



IP	MAC	TTL
11.1.1.2	m ₂	900s

ARP REQ

ETHERNET PACKET

SRC MAC = m ₁	DST MAC = ffffffff	TARGET IP = 11.1.1.2
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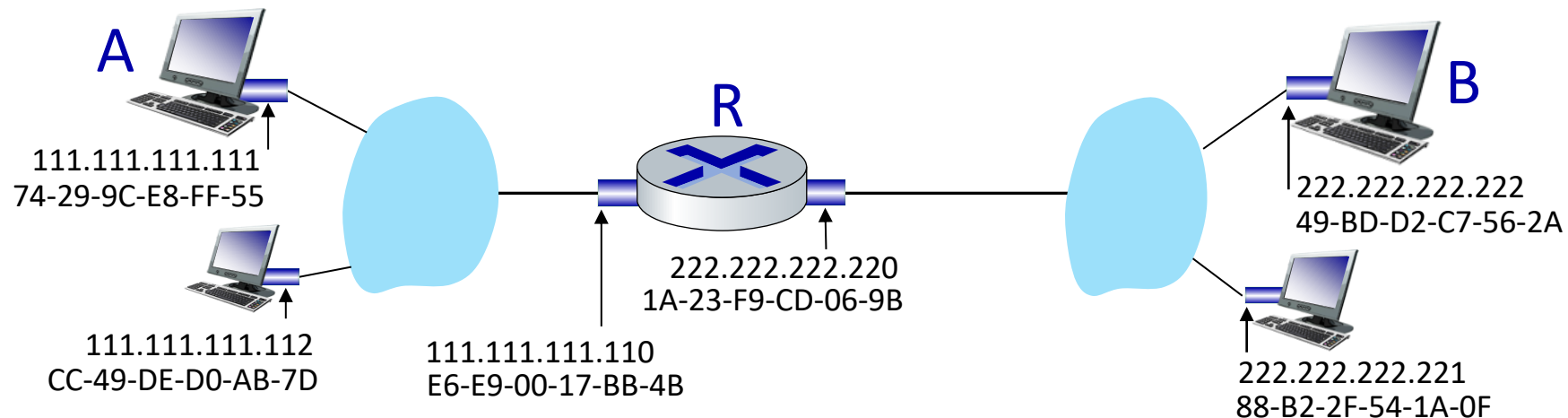
ARP REP

SRC MAC = m ₂	DST MAC = m ₁	TARGET IP: - - - TTL: - - -
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Putting it all together: Routing to another subnet

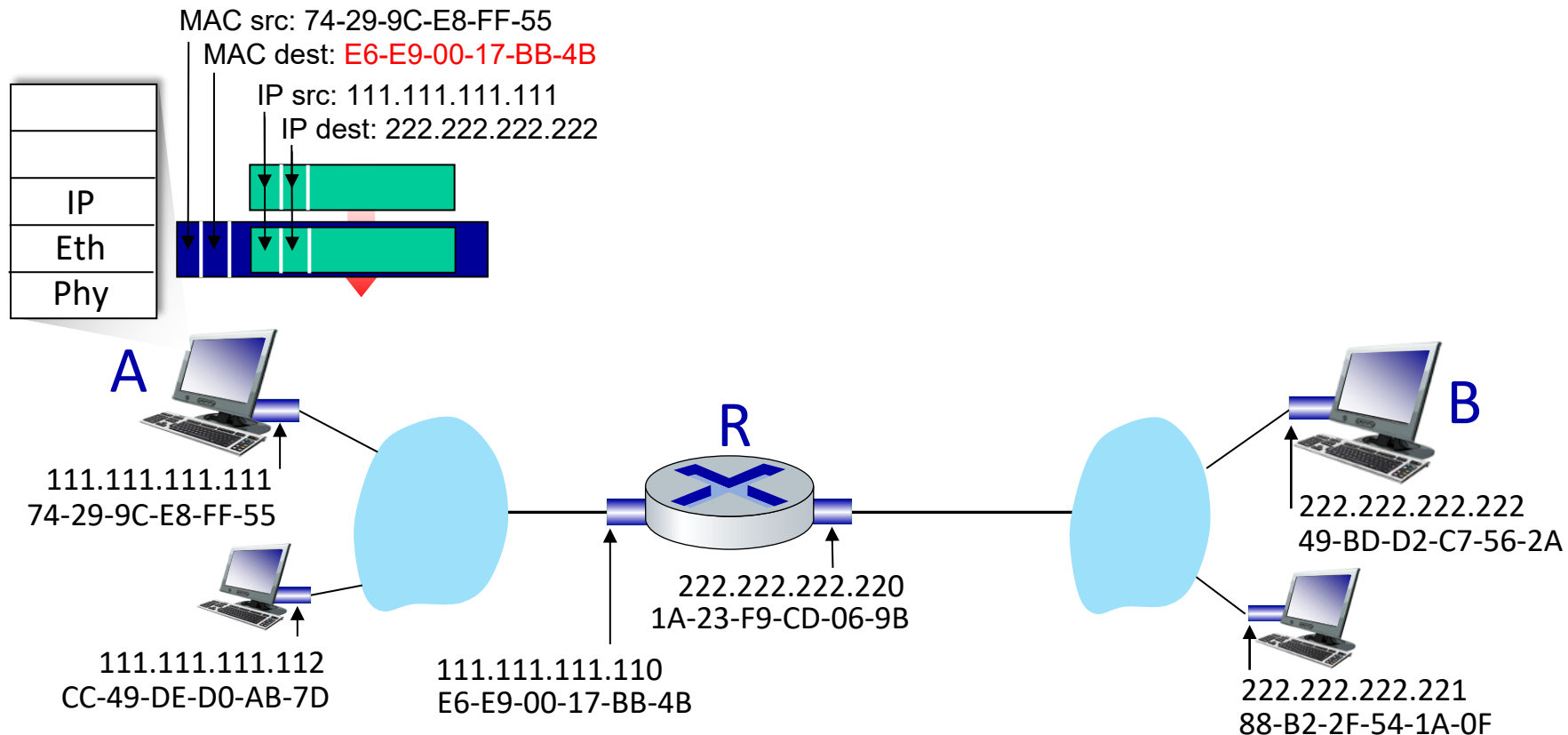
walkthrough: sending a datagram from *A* to *B* via *R*

- 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?)



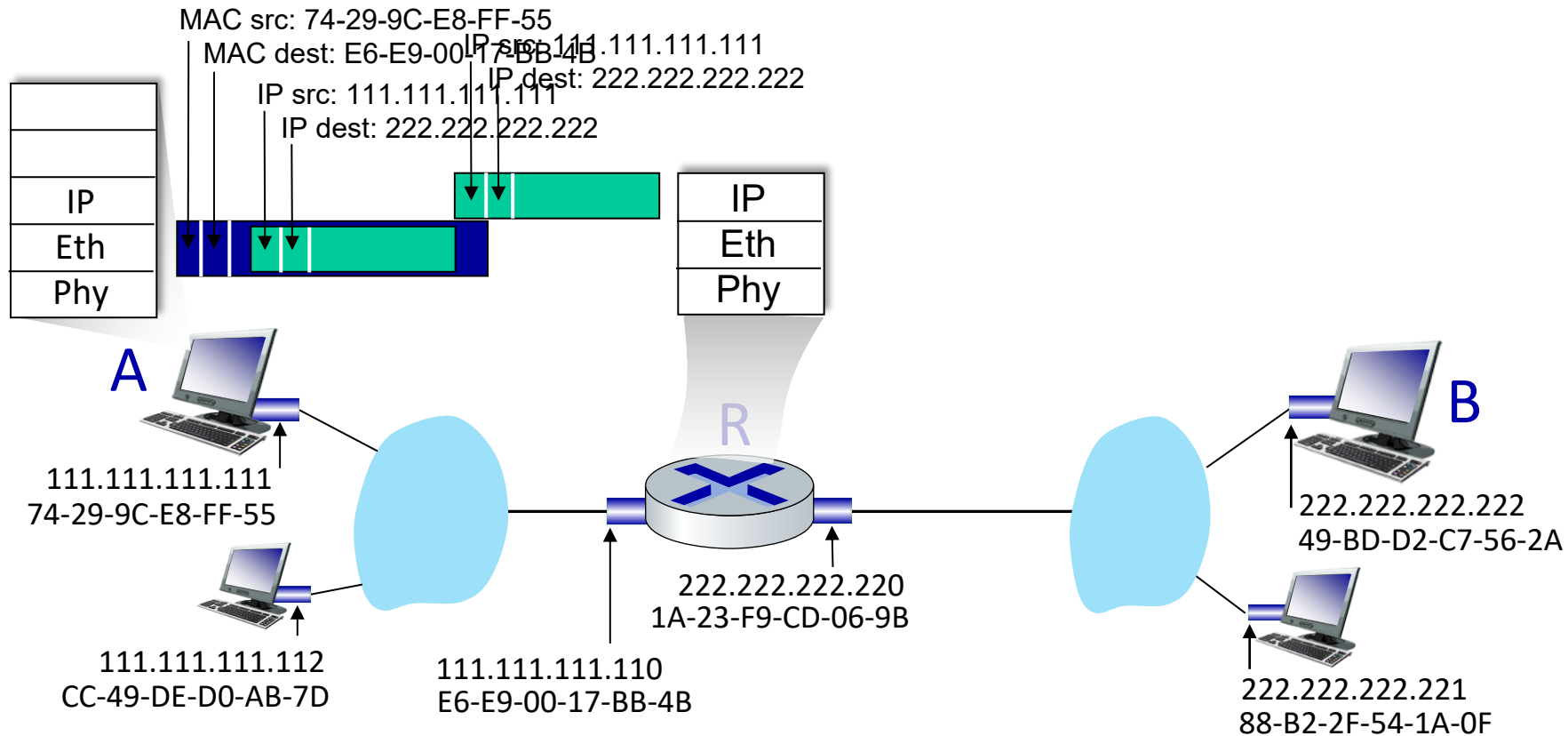
Routing to another subnet: addressing

- 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



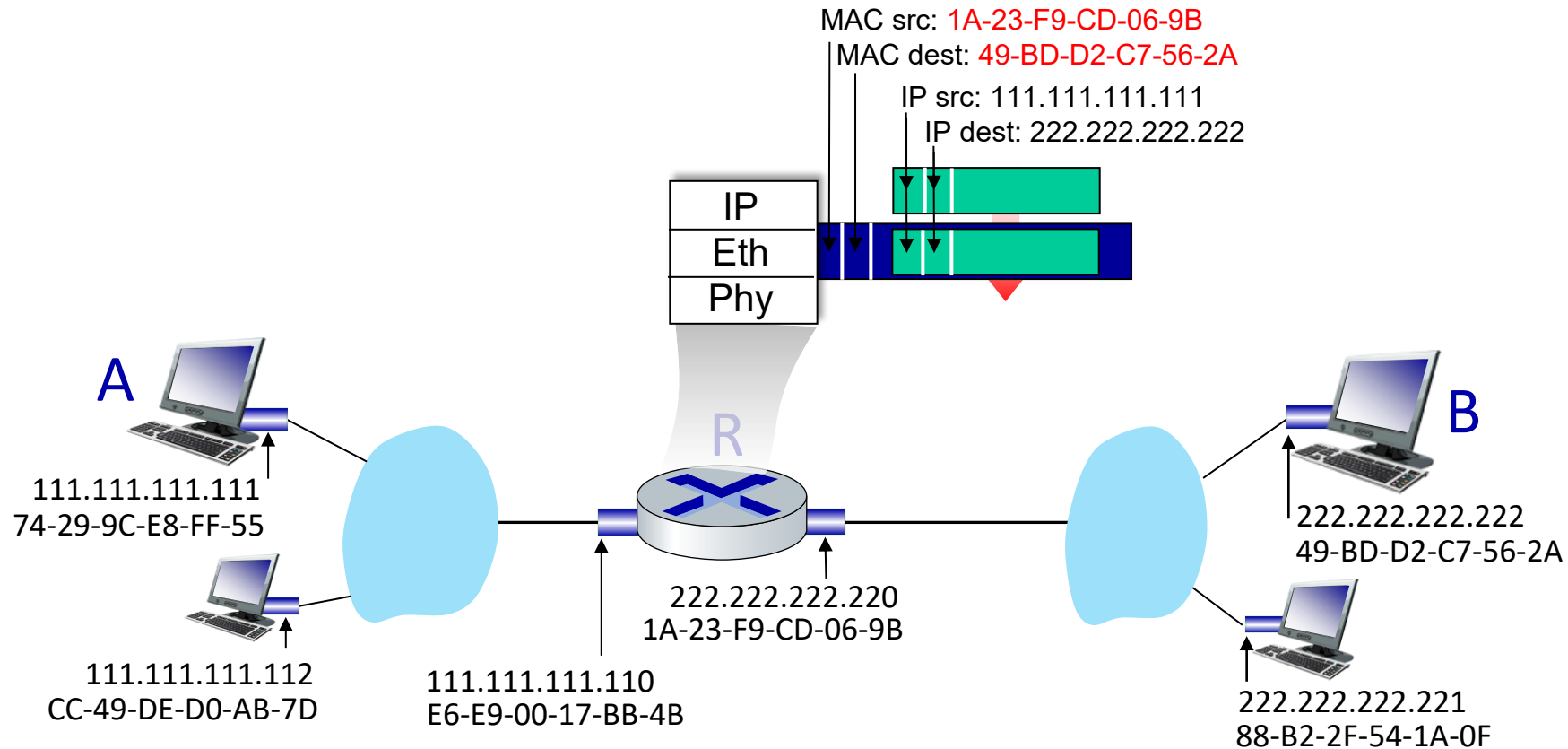
Routing to another subnet: addressing

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



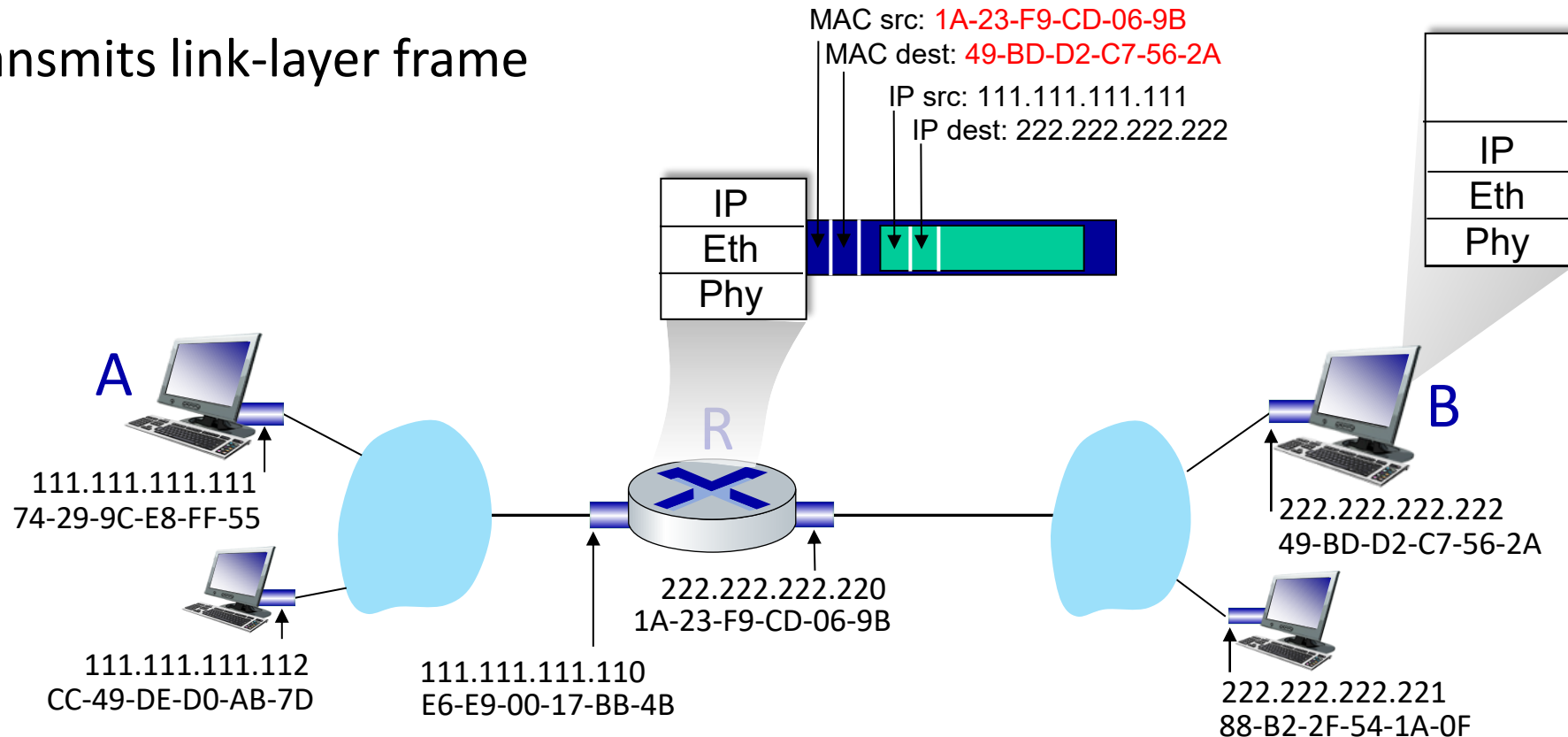
Routing to another subnet: addressing

- 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



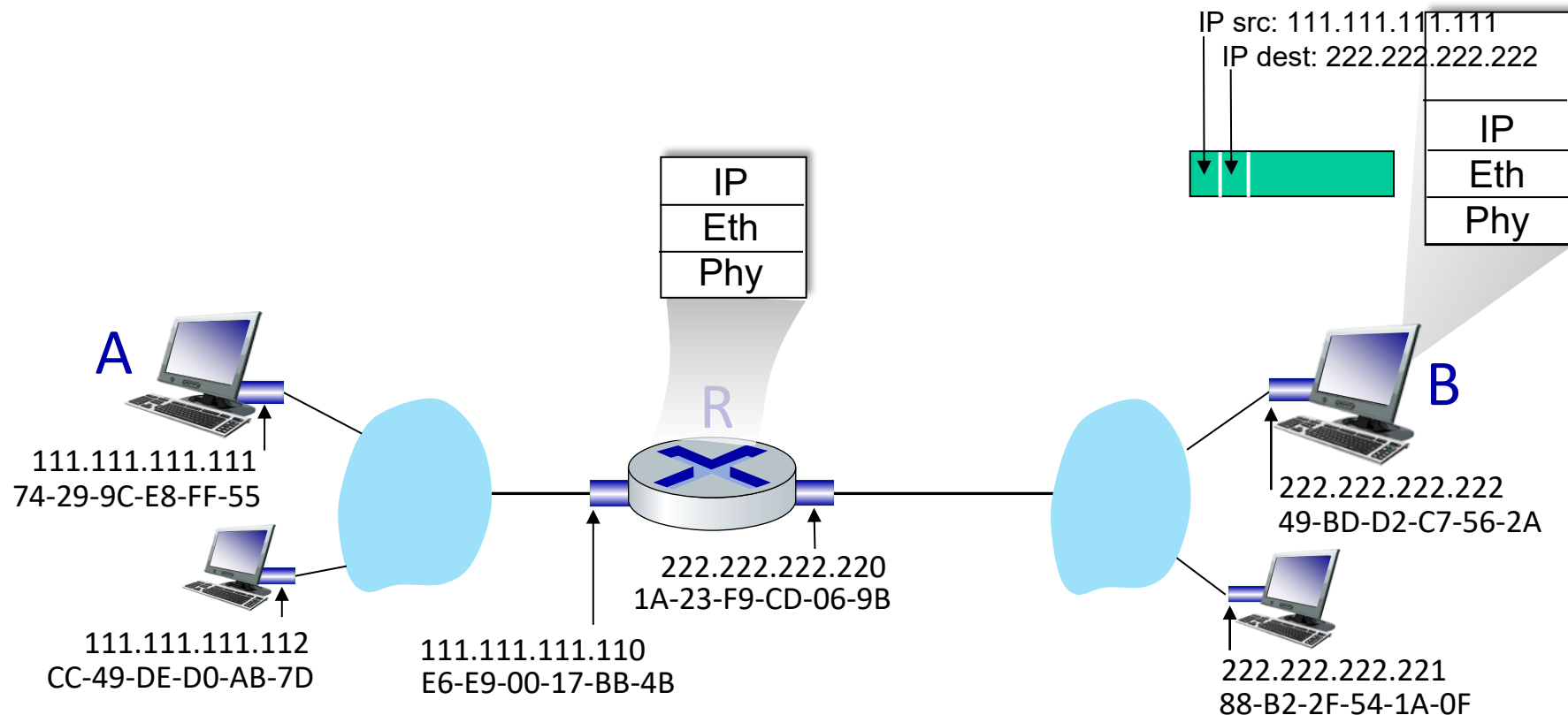
Routing to another subnet: addressing

- 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

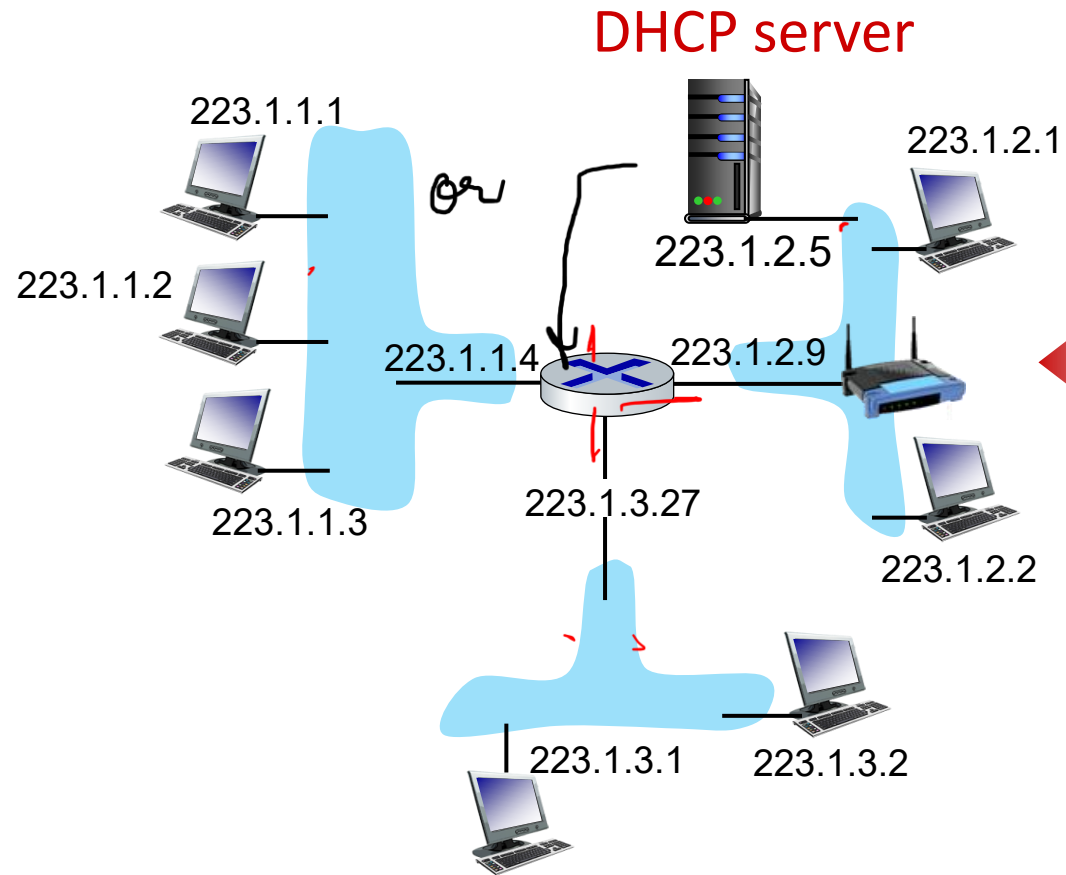


IP addresses: how to get one?

How does *host* get IP address?

- hard-coded by sysadmin in config file (e.g., /etc/rc.config in UNIX)
- **DHCP**: **D**ynamic **H**ost **C**onfiguration **P**rotocol: 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

DHCP discover

Broadcast: is there a
DHCP server out there?

Arriving client



DHCP offer

Broadcast: I'm a DHCP
server! Here's an IP
address you can use

DHCP request

Broadcast: OK. I would
like to use this IP address!

DHCP ACK

Broadcast: OK. You've
got that IP address!

The two steps above can
be skipped "if a client
remembers and wishes to
reuse a previously
allocated network address"
[RFC 2131]

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)

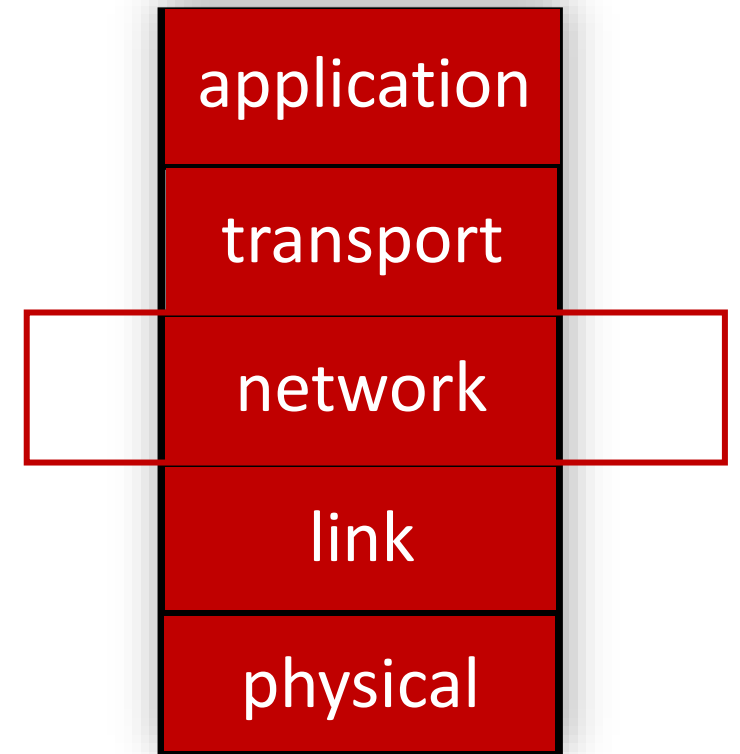
Recap

Network-layer functions:

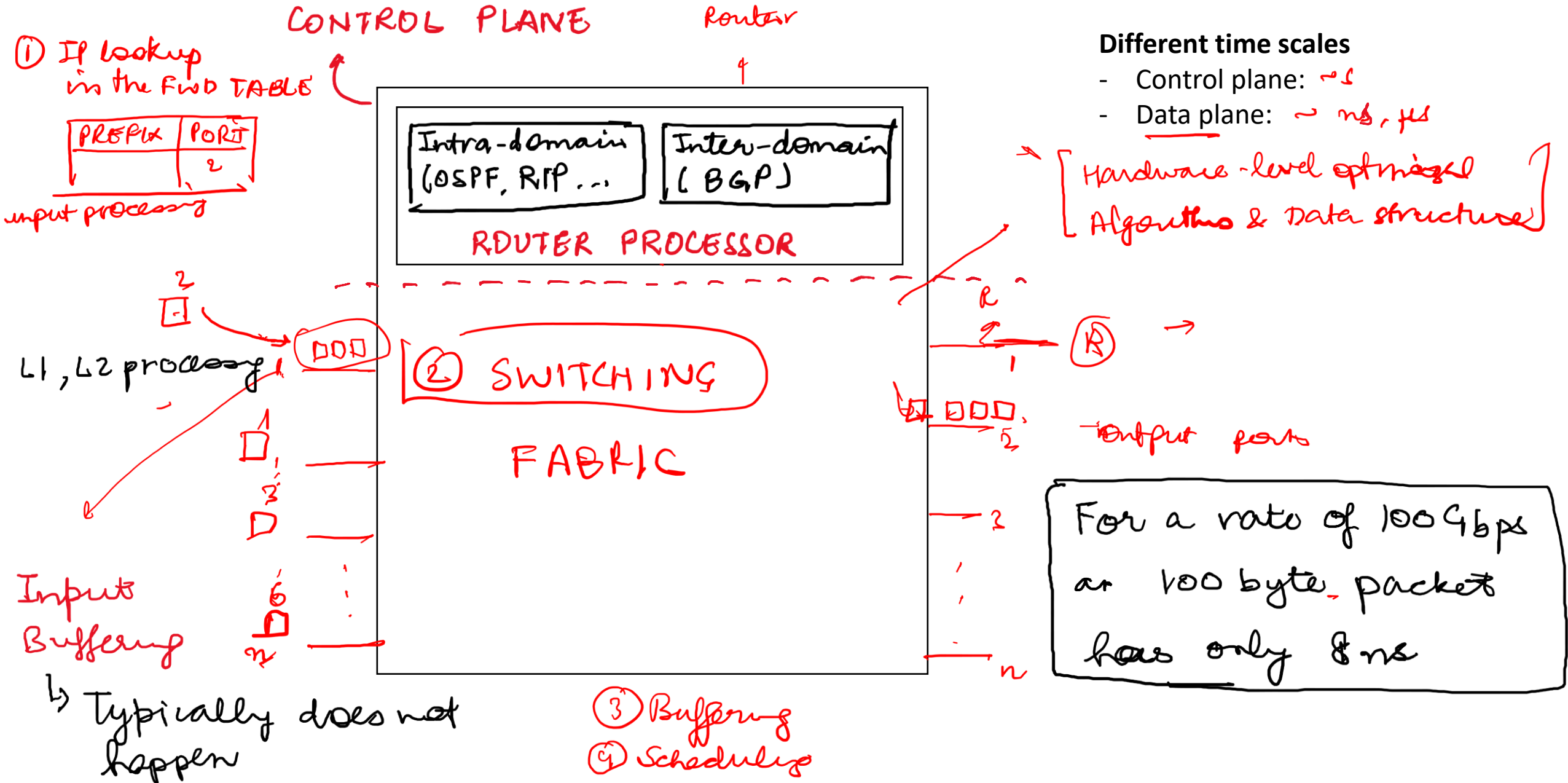
- *routing*: determine route taken by packets from source to destination
 - *routing algorithms*

Chapter 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