COMPUTER NETWORKS

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COMPUTER NETWORKS

Unit – 5 Link Layer and LAN Roadmap

- Introduction
- Error detection, correction
- Multiple access protocols
- LANs
  - Addressing, ARP
  - Ethernet
  - switches
- Physical layer
- Wireless LANs: IEEE 802.11
- A day in the life of a web request

COMPUTER NETWORKS

Class 49 : Switched LAN : Learning Objectives

- Link layer Addressing
- Address Resolution Protocol

MAC Addresses

- 32-bit IP address:
  - *network-layer* address for interface
  - used for layer 3 (network layer) forwarding
  - e.g.: 128.119.40.136

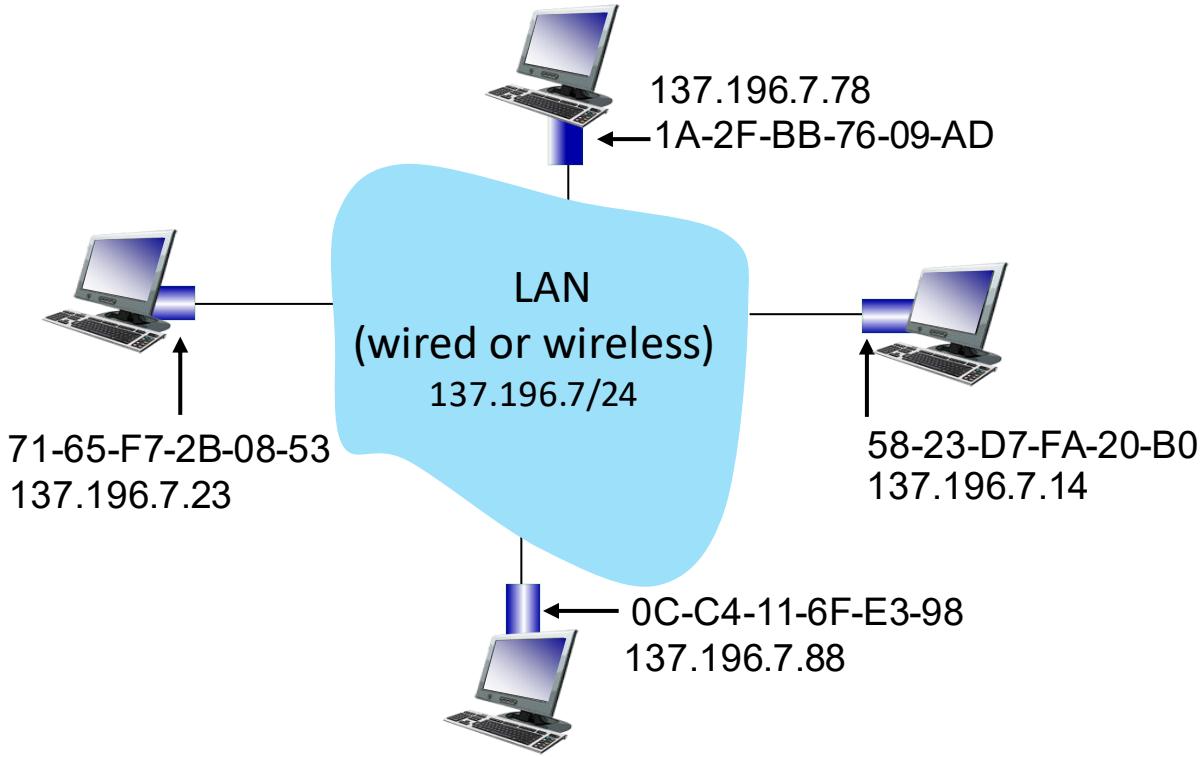
- MAC (or LAN or physical or Ethernet) address:
  - function: used "locally" to get frame from one interface to another physically-connected interface (same subnet, in IP-addressing sense)
  - 48-bit MAC address (for most LANs) burned in NIC ROM, also sometimes software settable
  - e.g.: 1A-2F-BB-76-09-AD

hexadecimal (base 16) notation (each "numeral" represents 4 bits)

MAC Addresses

Each interface on LAN

- has unique 48-bit MAC address
- has a locally unique 32-bit IP address (as we've seen)

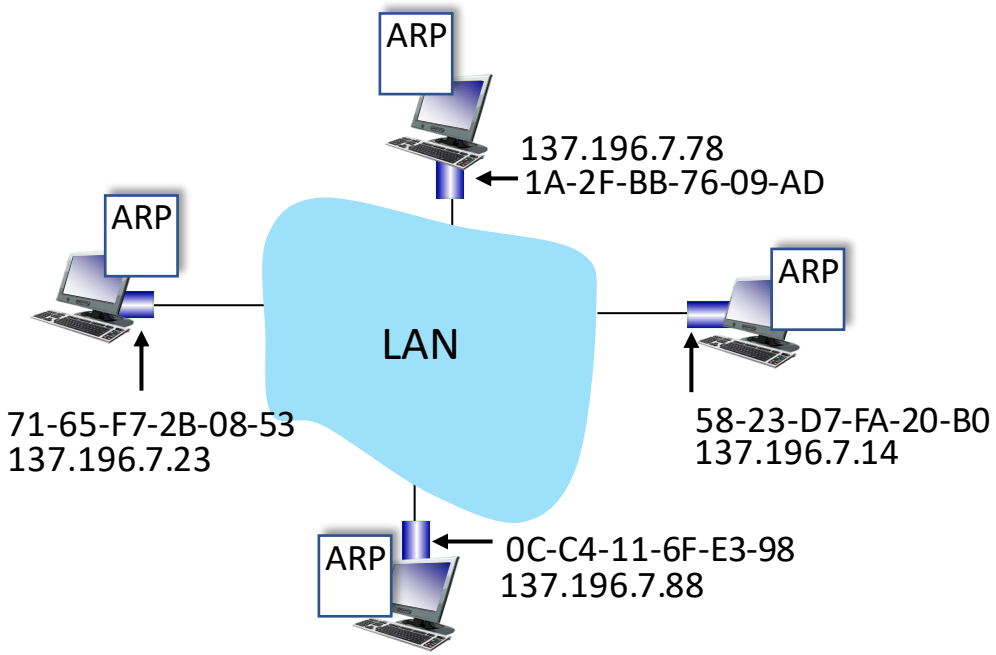


MAC Addresses

- MAC address allocation administered by IEEE
- manufacturer buys portion of MAC address space (to assure uniqueness)
- analogy:
  - MAC address: like Social Security Number
  - IP address: like postal address
- MAC flat address: portability
  - can move interface from one LAN to another
  - recall IP address *not* portable: depends on IP subnet to which node is attached

ARP : Address Resolution Protocol

Question: how to determine interface's MAC address, knowing its IP address?



ARP table: each IP node (host, router) on LAN has table

- IP/MAC address mappings for some LAN nodes:

  < IP address; MAC address; TTL>

- TTL (Time To Live): time after which address mapping will be forgotten (typically 20 min)

ARP Protocol in action

Example: A wants to send datagram to B

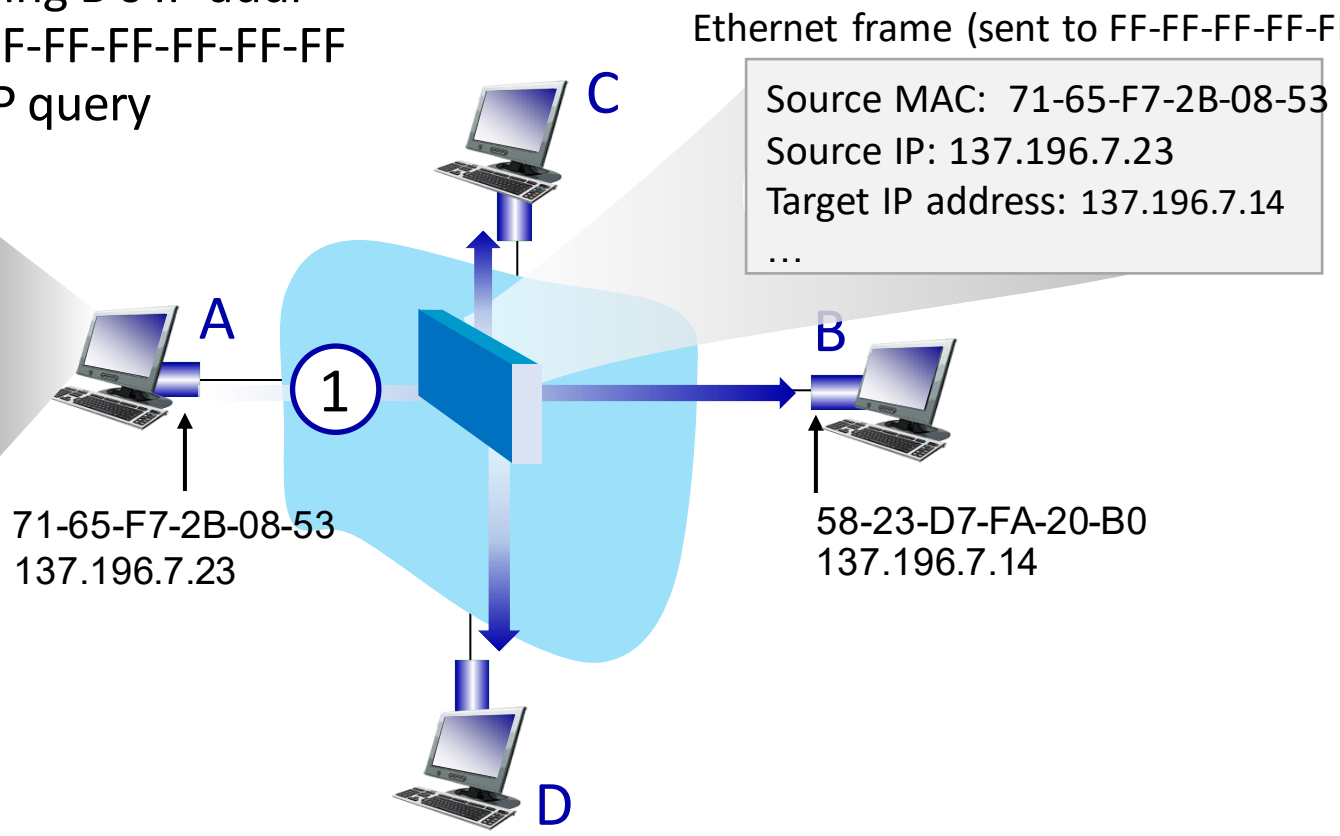
- B's MAC address not in A's ARP table, so A uses ARP to find B's MAC address

A broadcasts ARP query, containing B's IP addr

1. destination MAC address = FF-FF-FF-FF-FF-FF
2. all nodes on LAN receive ARP query

ARP table in A

IP addr	MAC addr	TTL



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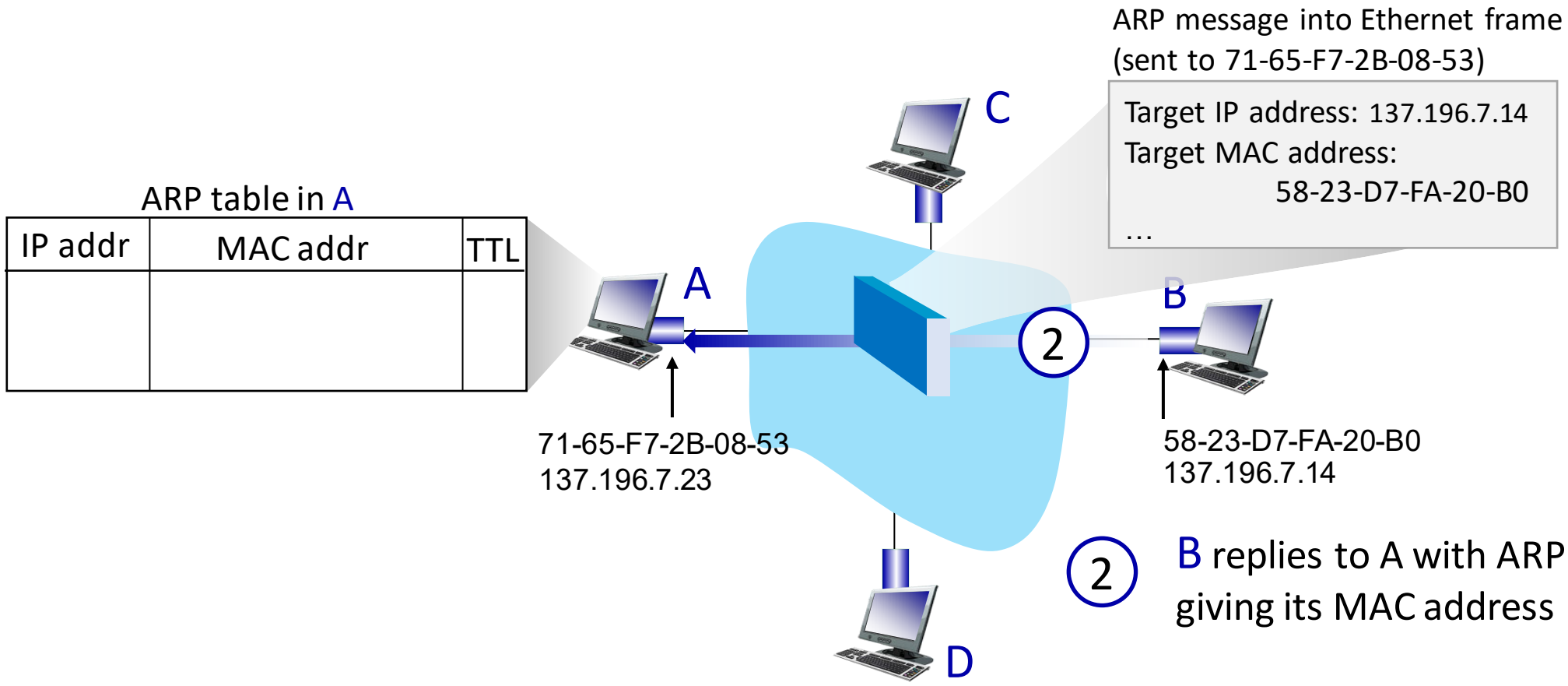

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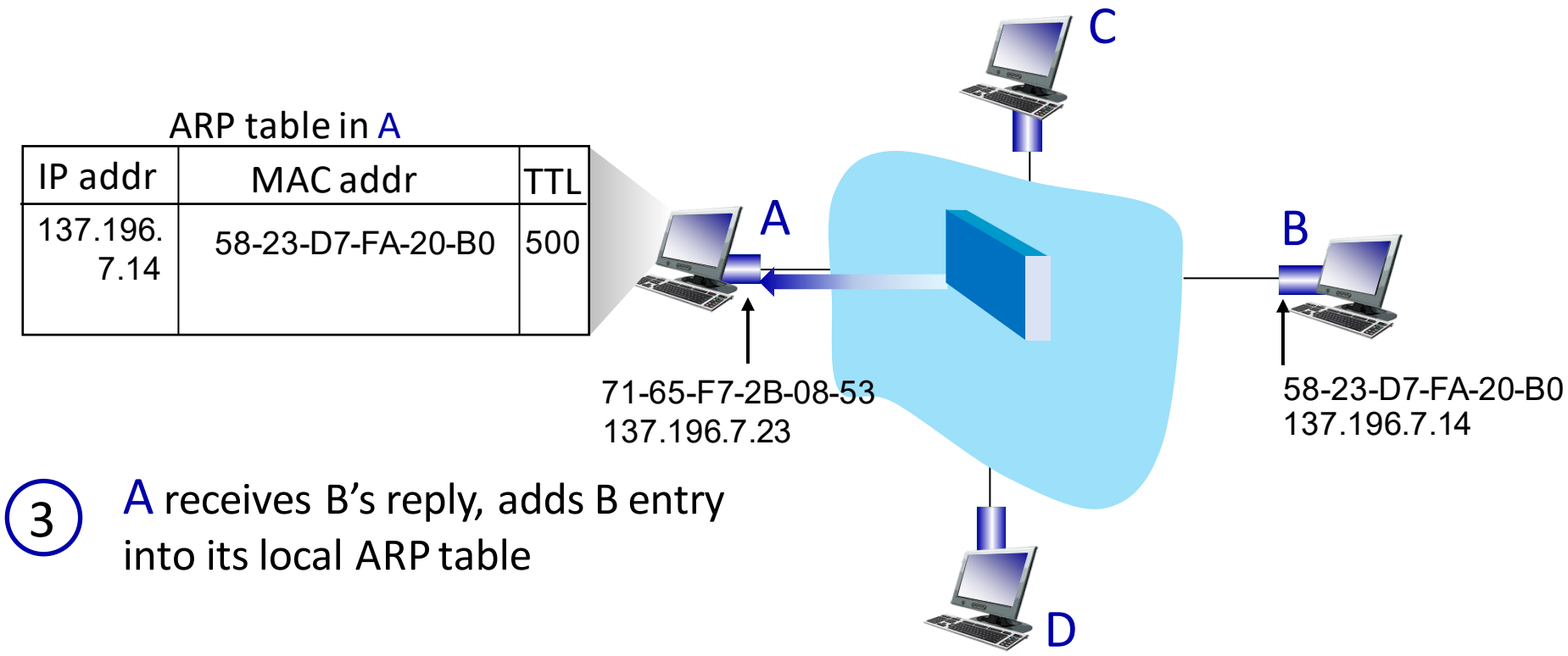
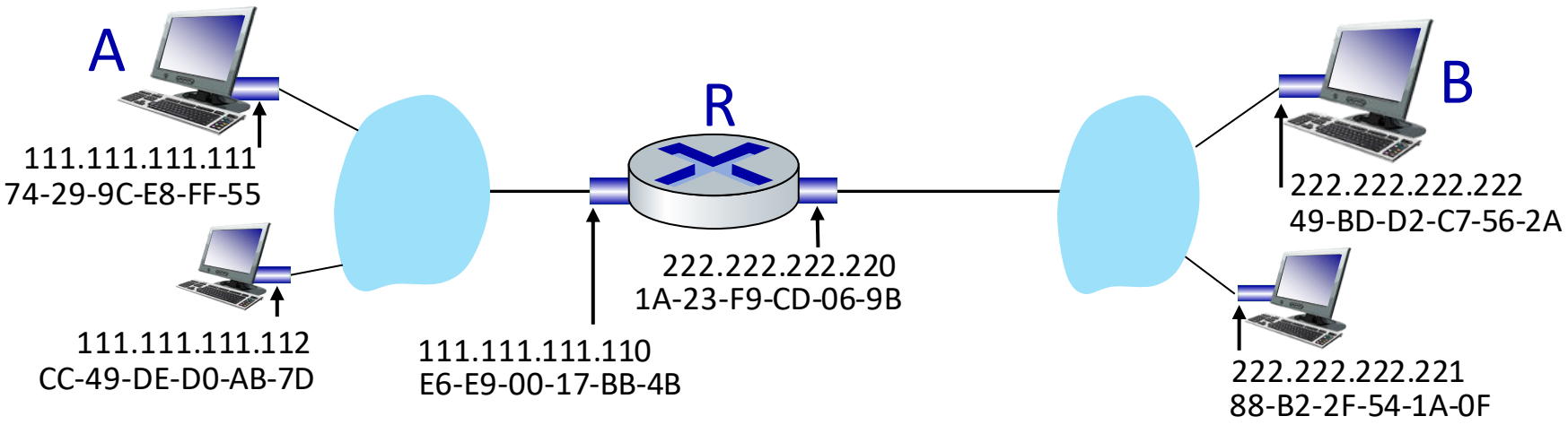


3 A receives B's reply, adds B entry into its local ARP table

Routing to another Subnet : Addressing

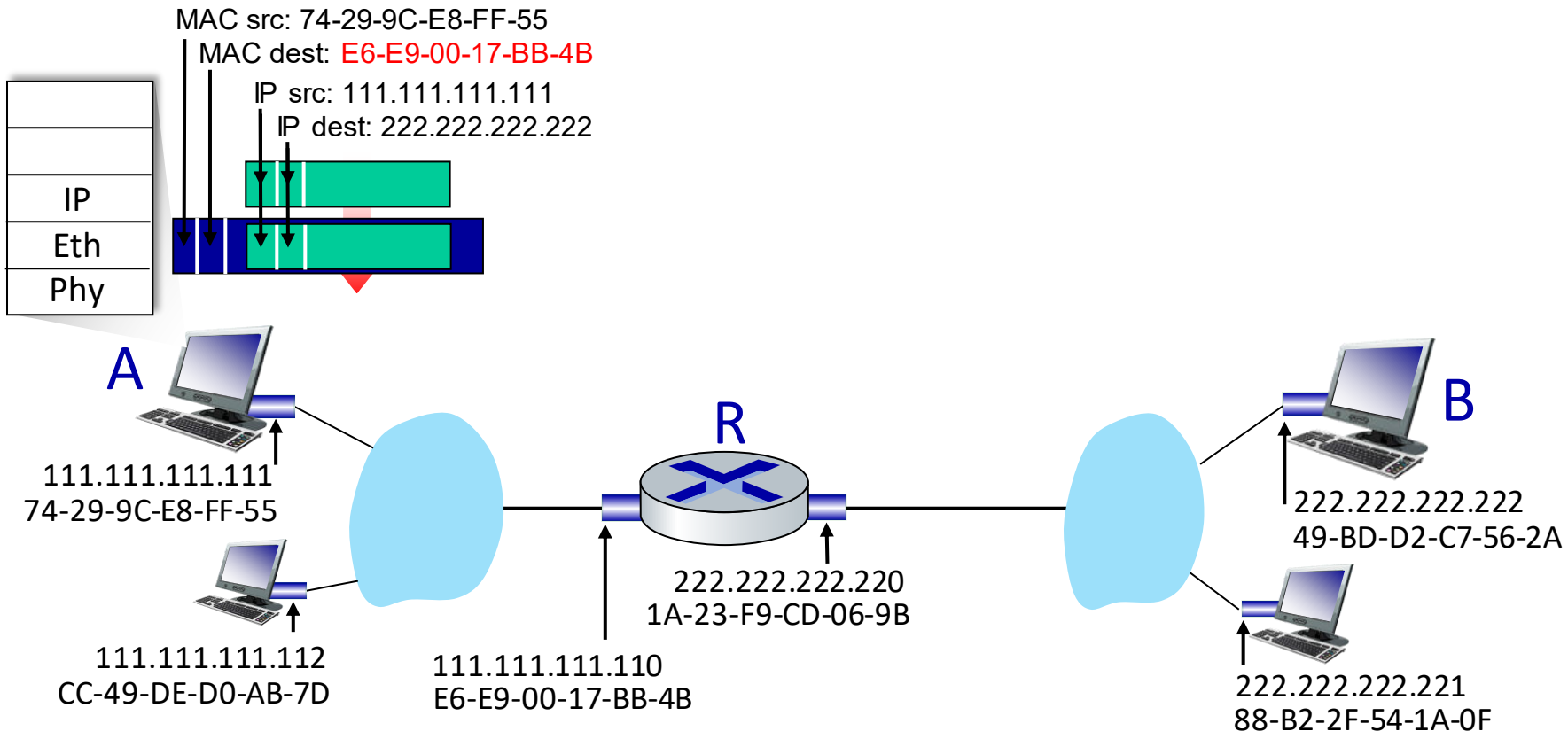
Walkthrough: sending a datagram from *A* to *B* via *R*

- 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?)



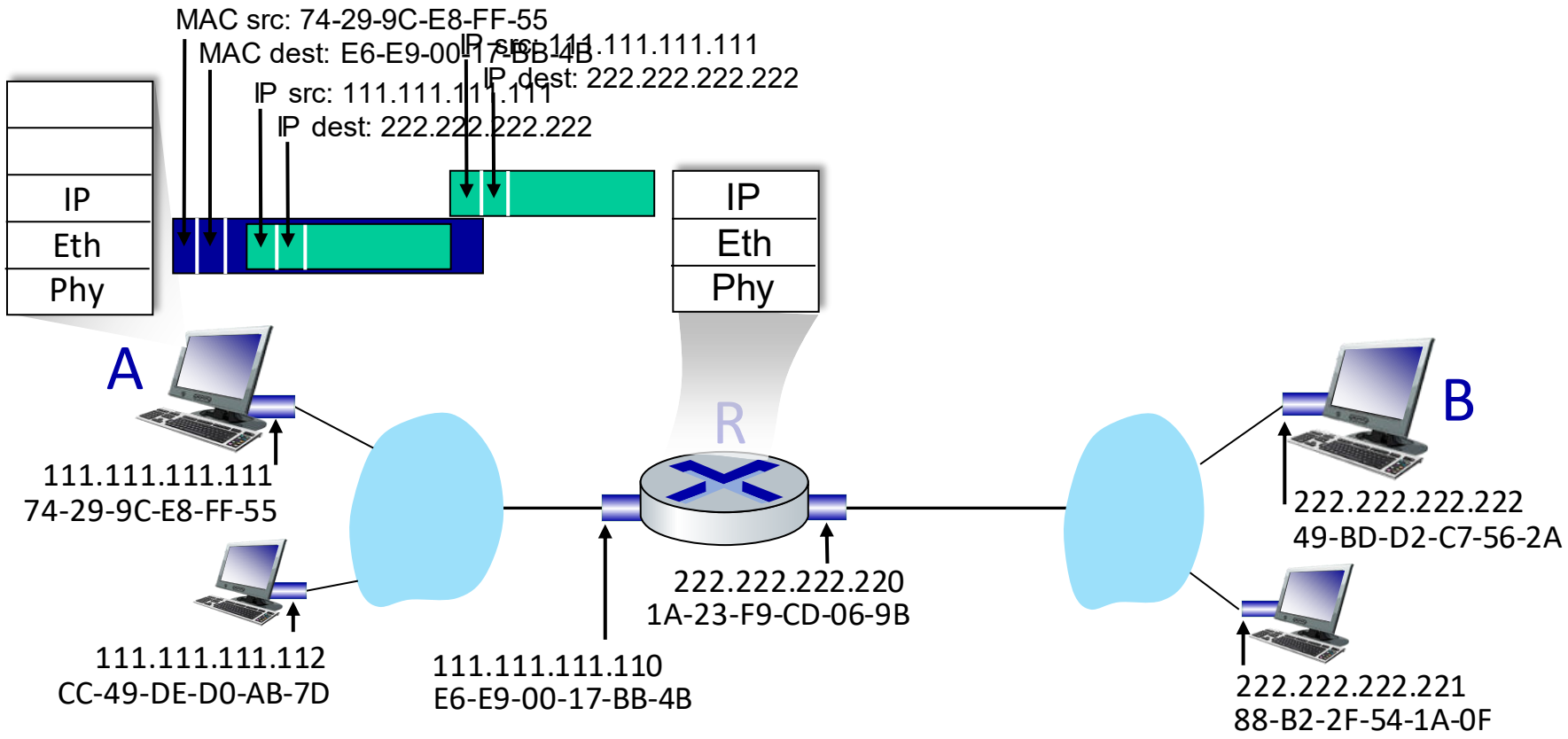
Routing to another Subnet : Addressing

- 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



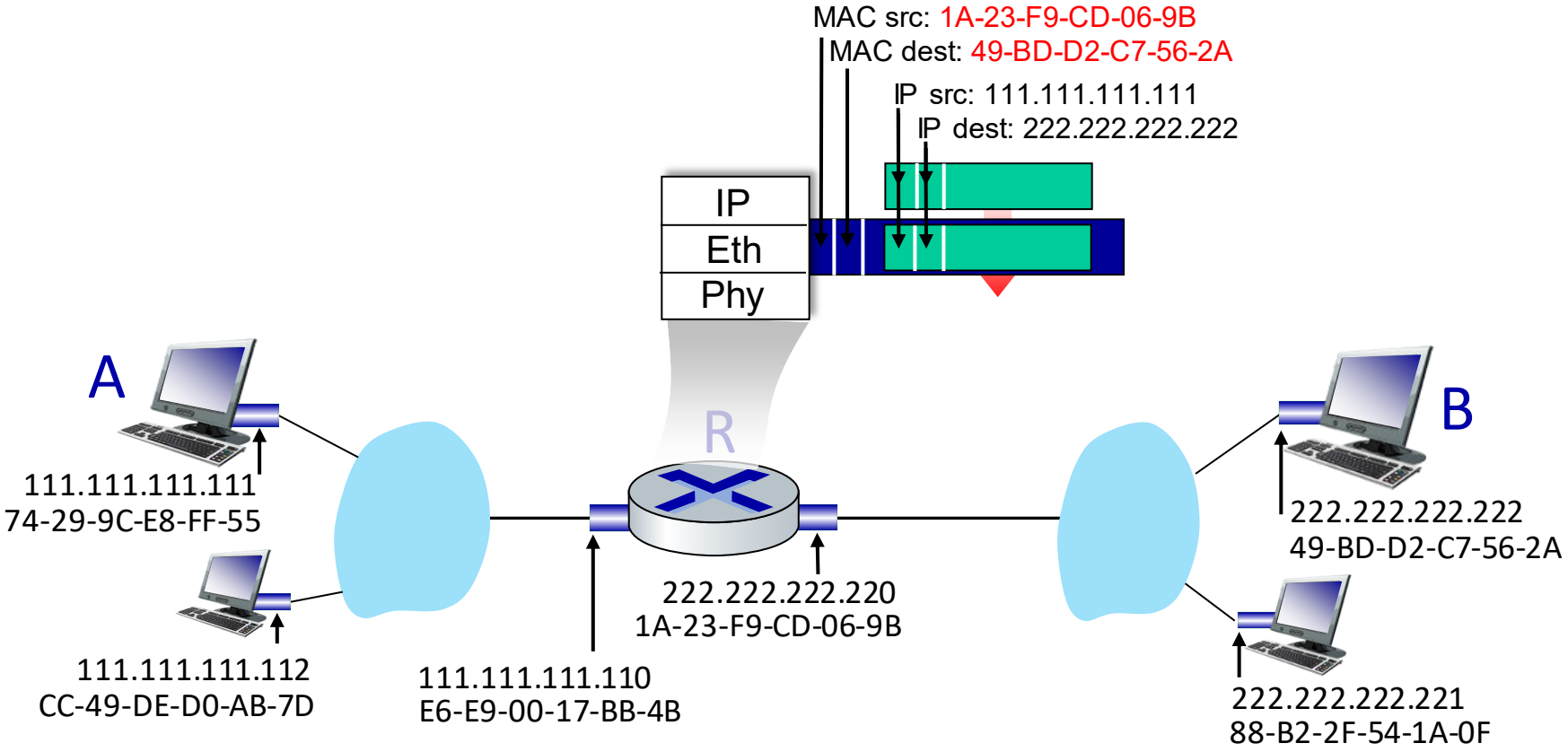
Routing to another Subnet : Addressing

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



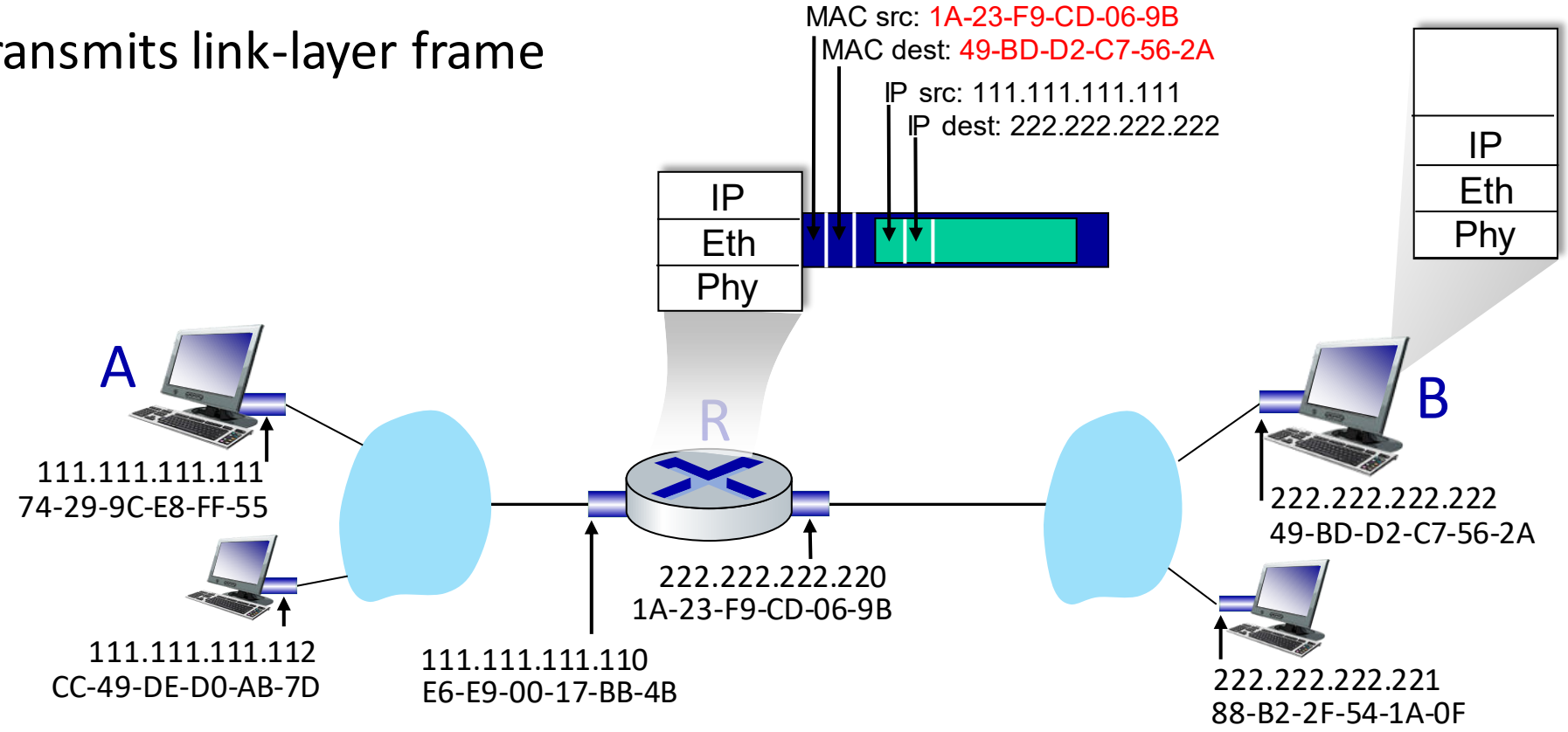
Routing to another Subnet : Addressing

- 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



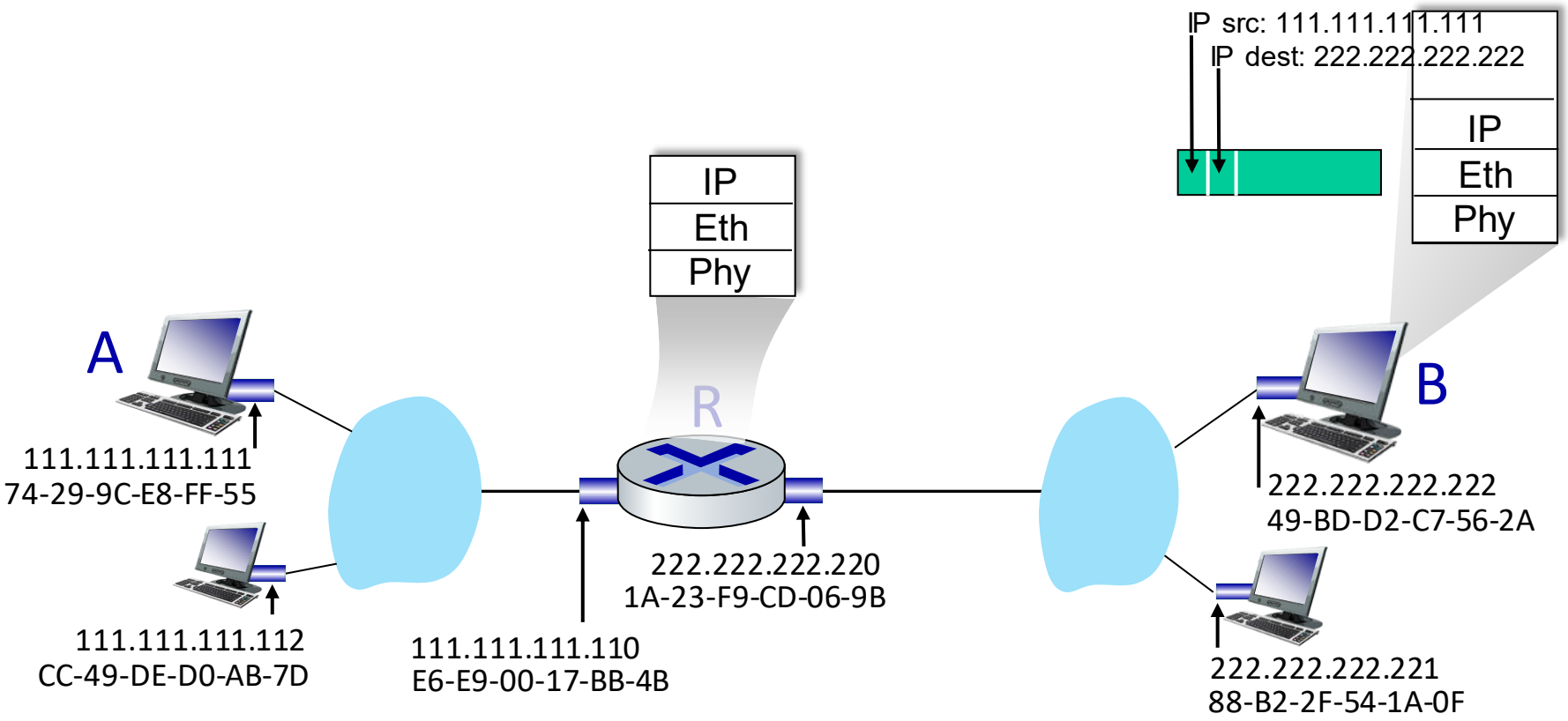
Routing to another Subnet : Addressing

- 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



THANK YOU

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