



Universiteit Antwerpen
| Faculteit Toegepaste
Ingenieurswetenschappen

Lab of 3-Network Architecture

Ruben Nietvelt, Nabeel Nisar Bhat

2024-2025

Scheduled labs for PR01

Session	Date	Subject	Evaluation	Deadline (23:59)
1	01/10/2024	Introduction to the Linux Operating System	N/A	N/A
2	08/10/2024	Using the shell & exploring the filesystem	Report	14/10/2024
3	15/10/2024	Working with text files, managing running processes and writing shell scripts	Report	22/10/2024
4	23/10/2024	Learning system administration, getting & managing software	Report	28/10/2024
5	29/10/2024	Wireshark introduction	Report	05/11/2024
6	06/11/2024	Protocols in action: TCP and UDP	Report	11/11/2024
7	12/11/2024	Ethernet and ARP	Report	19/11/2024
8	20/11/2024	Setting up a DHCP server	Report	25/11/2024
9	26/11/2024	Setting up a DNS server	Report	03/12/2024
10	04/12/2024	Network Address Translation	Report	09/12/2024
11	10/12/2024	Remote Access & Firewalls (1)		N/A
12	18/12/2024	Remote Access & Firewalls (2)	Blackboard test	

Scheduled labs for PR02

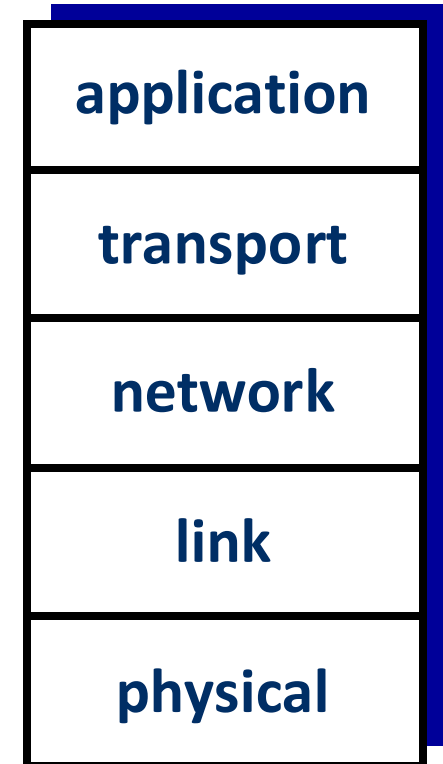
Session	Date	Subject	Evaluation	Deadline (23:59)
1	02/10/2024	Introduction to the Linux Operating System	N/A	N/A
2	09/10/2024	Using the shell & exploring the filesystem	Report	15/10/2024
3	16/10/2024	Working with text files, managing running processes and writing shell scripts	Report	22/10/2024
4	23/10/2024	Learning system administration, getting & managing software	Report	29/10/2024
5	30/10/2024	Wireshark introduction	Report	05/11/2024
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11	11/12/2024	Remote Access & Firewalls (1)		N/A
12	18/12/2024	Remote Access & Firewalls (2)	Blackboard test	

Session 7

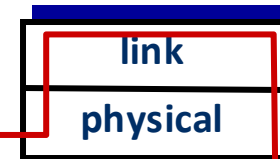
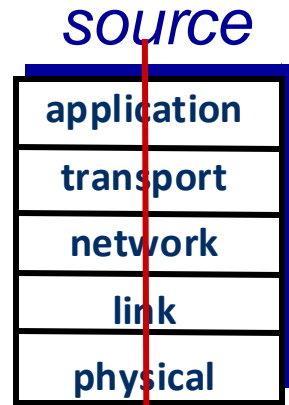
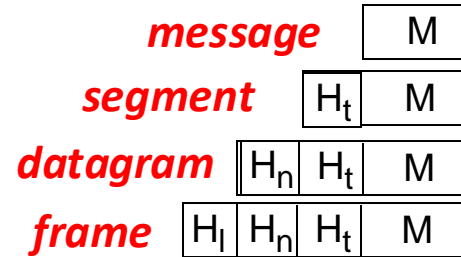
Ethernet and ARP

Internet protocol stack

- **application:** supporting network applications
 - IMAP, SMTP, HTTP
- **transport:** process-process data transfer
 - TCP, UDP
- **network:** routing of datagrams from source to destination
 - IP, routing protocols
- **link:** data transfer between neighboring network elements
 - Ethernet, 802.11 (WiFi), PPP
- **physical:** bits “on the wire”

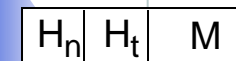
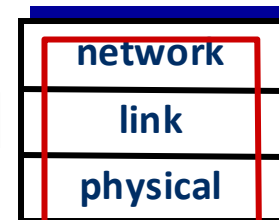
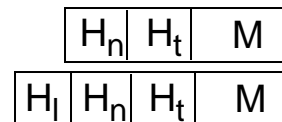
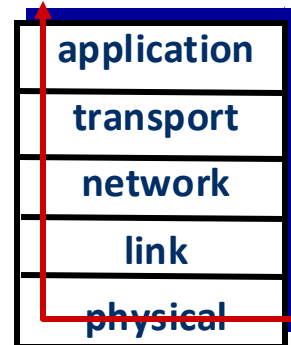
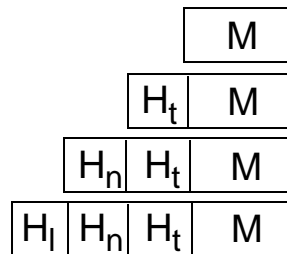


Encapsulation



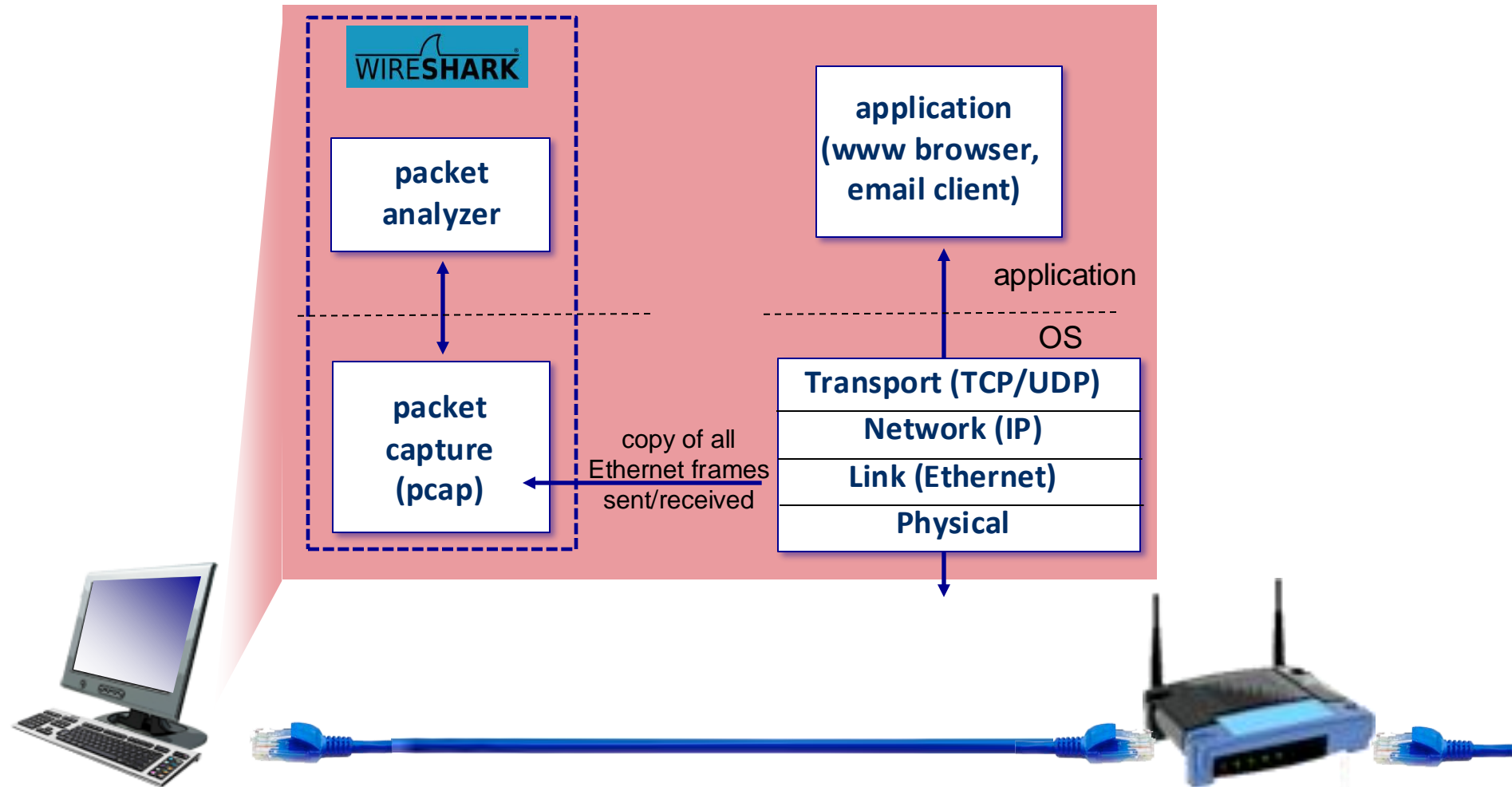
switch

destination



router

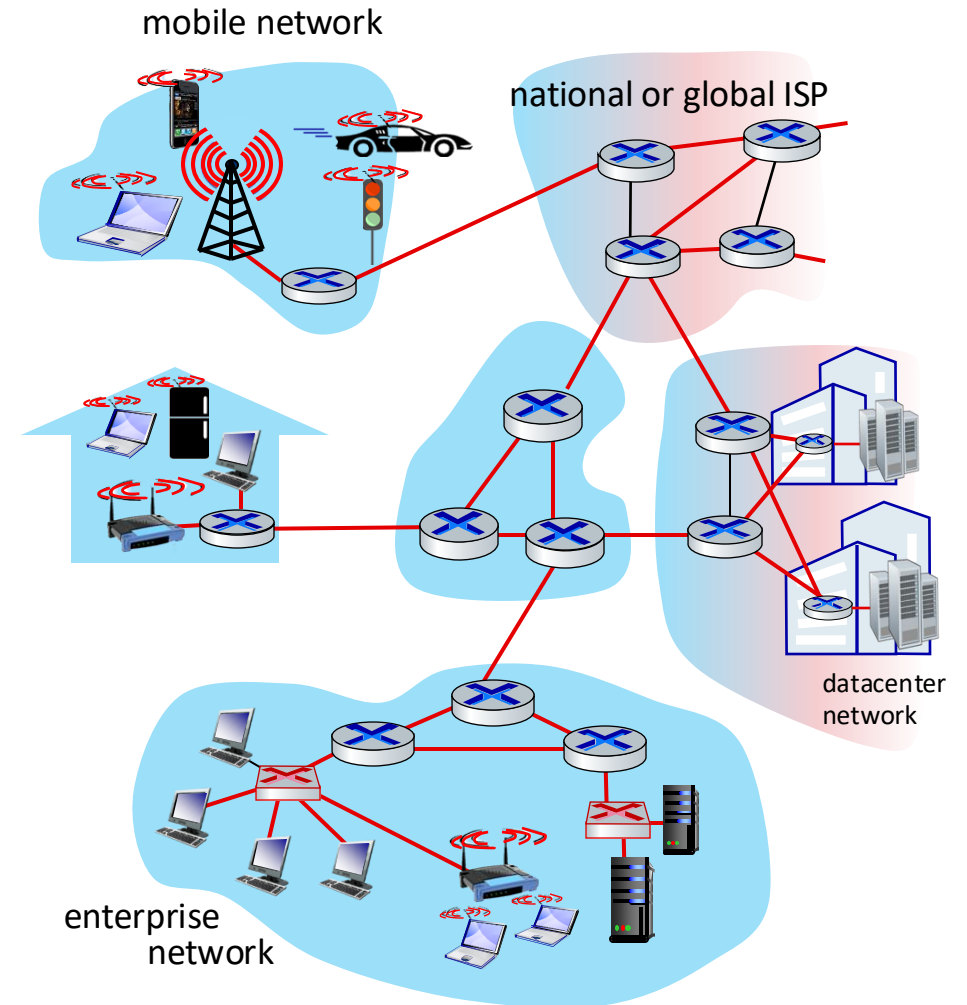
Wireshark



Link layer: introduction

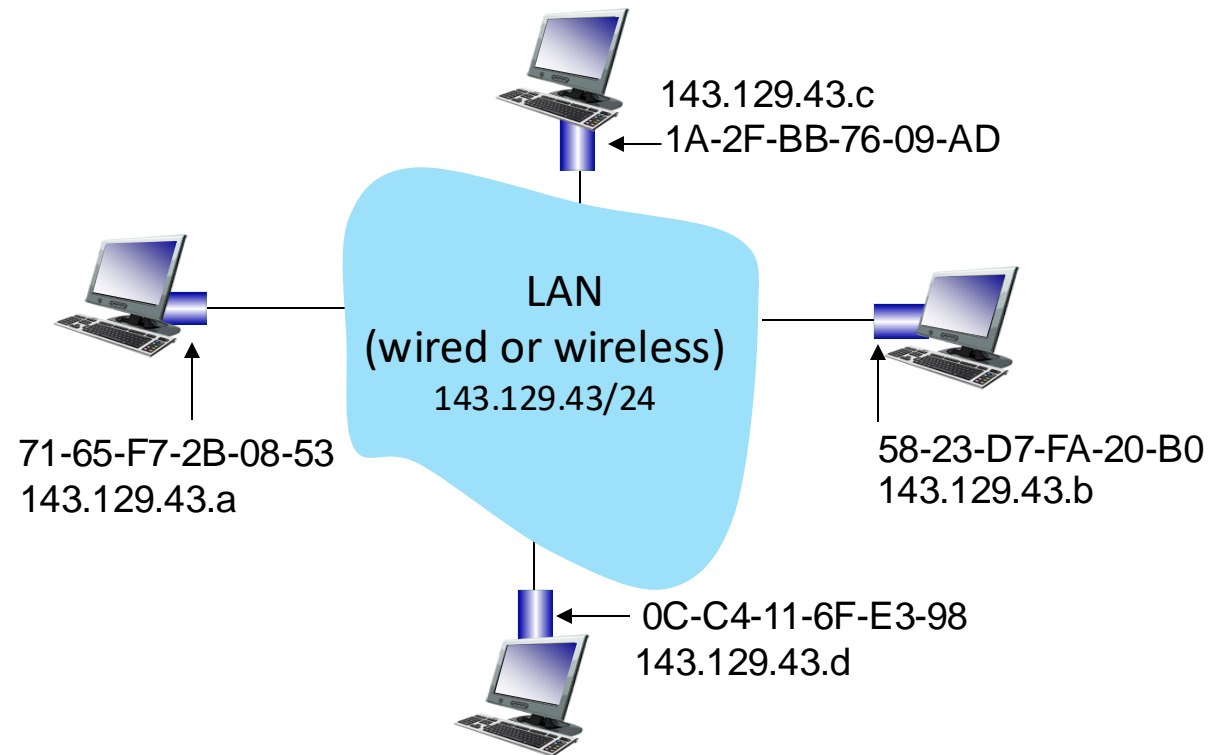
- Terminology:
 - Host, routers: nodes
 - Communication channels that connect adjacent nodes along communication path: link
 - Wired/wireless
 - LAN
 - Layer-2 packet: frame, encapsulates datagram

*link layer has responsibility of transferring datagram from one node to **physically adjacent** node over a link*



MAC addresses

- Each interface on LAN
 - Unique 48-bit MAC address
 - Locally unique 32-bit IP address

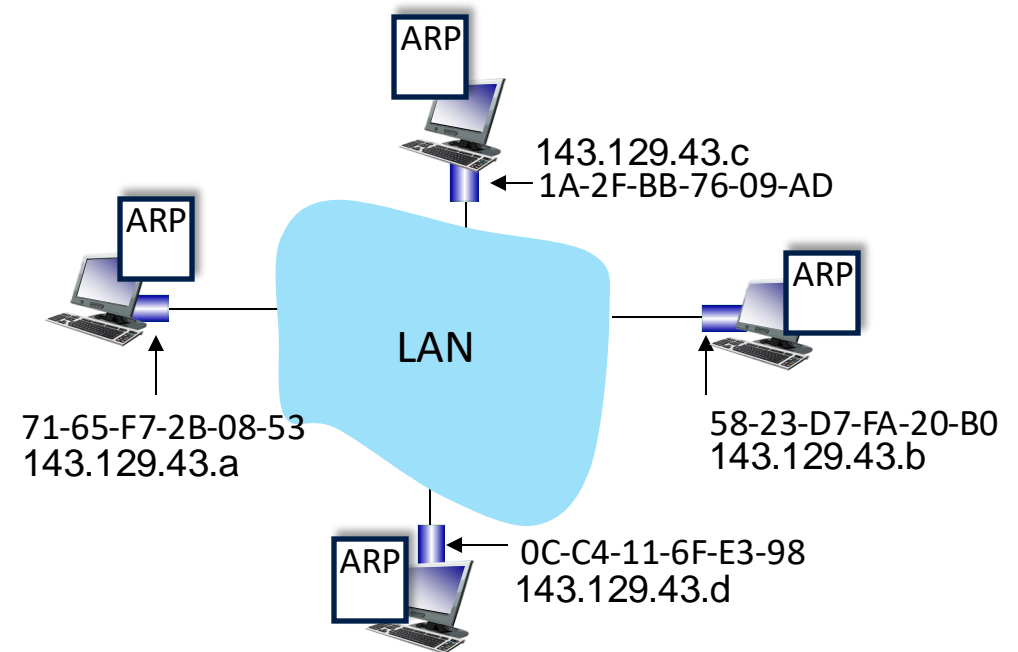


Address Resolution Protocol (ARP)

- Discovering link layer address
- Host A sends IPv4 packet to host B
 - Within same network
 - Does not know hosts B MAC address
 - Host A sends an ARP Broadcast containing hosts B IP address
 - Host B will reply with its MAC address
- IPv6 uses Neighbor Discovery Protocol (NDP)

Address Resolution Protocol (ARP)

- ARP table: each IP node on LAN has a table
 - IP/MAC address mappings for some LAN nodes
 - <IP address; MAC address; TTL>
 - TTL (Time To Live)

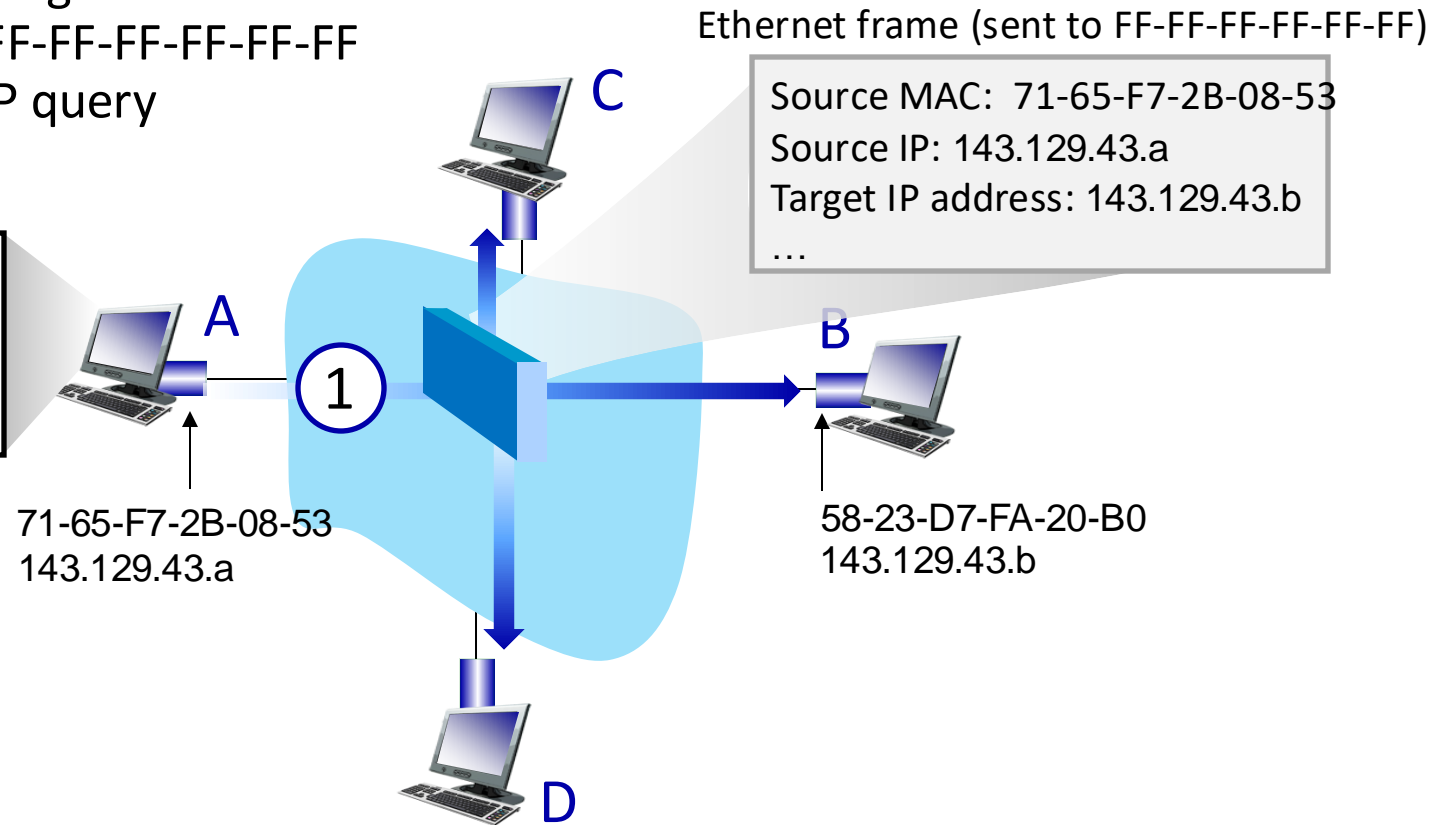


ARP in action

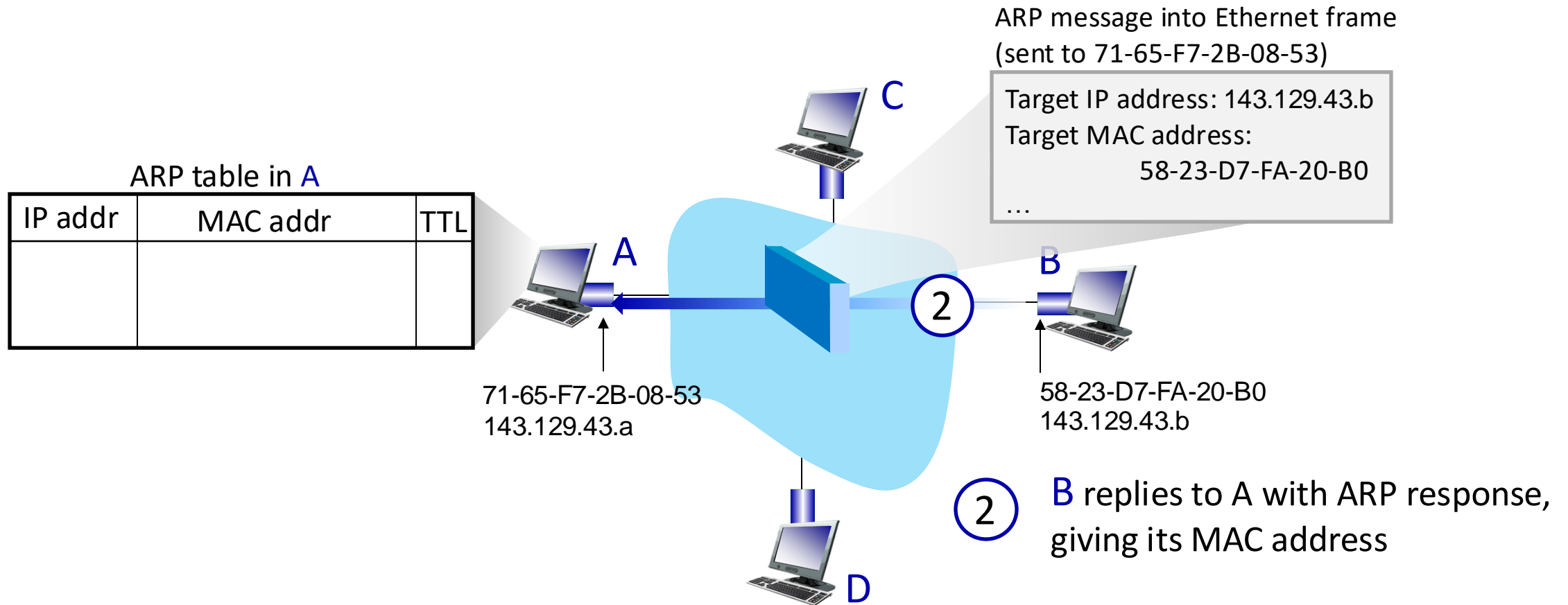
- ① A broadcasts ARP query, containing B's IP addr
- destination MAC address = FF-FF-FF-FF-FF-FF
 - all nodes on LAN receive ARP query

ARP table in A

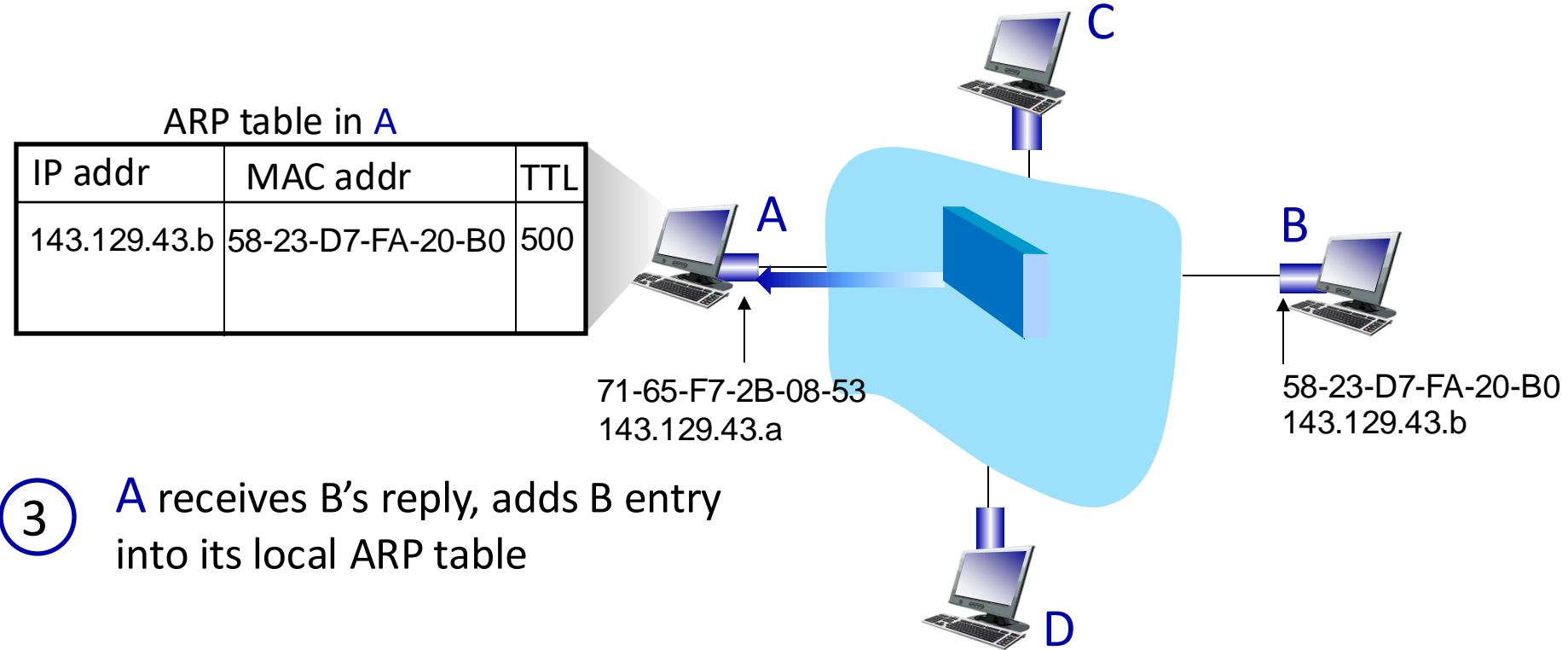
IP addr	MAC addr	TTL



ARP in action



ARP in action



Ethernet frame structure



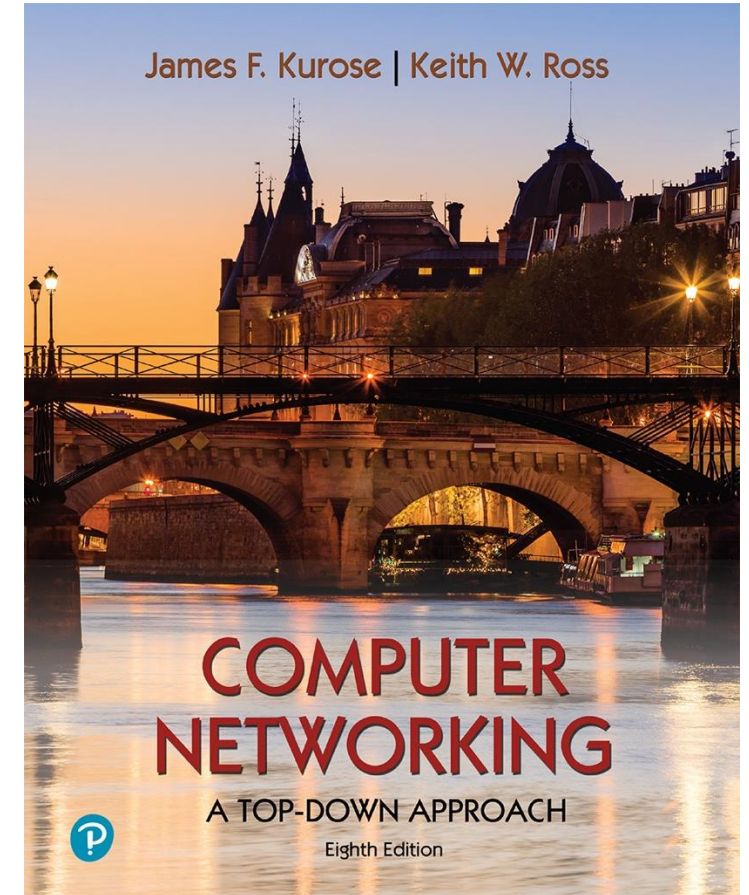
- **Preamble:** synchronize receiver, sender clock rates
- **Addresses:** MAC addresses. Frame accepted if destination address matches
- **Type:** indicates higher layer protocol
- **CRC (cyclic redundancy check)** at receiver: error detected => frame dropped

Ethernet

- **Connectionless: no handshaking**
- **Unreliable: no ACKs or NACKs**
 - **Data in dropped frames recovered by higher layer, otherwise lost**
- **Many different Ethernet standards**
 - **Common MAC protocol and frame format**
 - **Different speeds**

Resources

- **Computer Networking: A Top-Down Approach**
8th edition
Jim Kurose, Keith Ross
Pearson, 2020



Exercises

Ethernet and ARP

Pre-requirements exercises

- Open Wireshark.
- **Start capture before accessing any page!**
- <http://course-3networkarchitecture.ei.fti.uantwerpen.be>
- Choose session 7 after passing your student number.

All of the answers should be supported by screenshots from your Wireshark trace.

Exercise 1: Ethernet

- Select the HTTP GET message.
- Expand the Ethernet II information in the packet details window.
 - a) What is the 48-bit Ethernet address of your computer?
 - b) What is the 48-bit destination address in the Ethernet frame? What device has this as its Ethernet address?
 - c) Give the hexadecimal value for the two-byte Frame type field. What upper layer protocol does this correspond to?
- Select the HTTP response message.
 - d) What is the value of the Ethernet source address? What device has this as its Ethernet address?
 - e) How many bytes from the very start of the Ethernet frame does the ASCII “O” in “OK” appear in the Ethernet frame?

Exercise 2: ARP

- You can easily request your PCs ARP table using the “arp -a” command in Powershell. Open it using administrator privileges.
- a) What is the meaning of each column value in this table?
- Clear your ARP cache using “arp -d *”.
- b) What does these parameters of this command mean?
- While taking a new Wireshark capture, retrieve the session 7 page again.
- c) What are the hexadecimal values for the source and destination addresses in the Ethernet fram containing the ARP request message, and to who belong these addresses?
- d) Give the hexadecimal value for the two-byte Ethernet Frame type field. What upper layer protocol does this correspond to?
- e) What are the hexadecimal values for the source and destination addresses in the Ethernet frame containg the ARP reply message?

