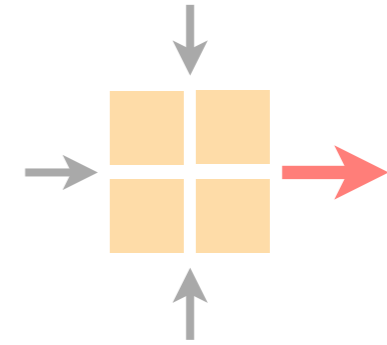


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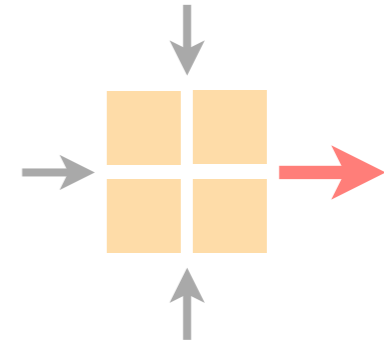
ETH Zürich

12 Mar 2026

Slides adapted from Tobias Bühler

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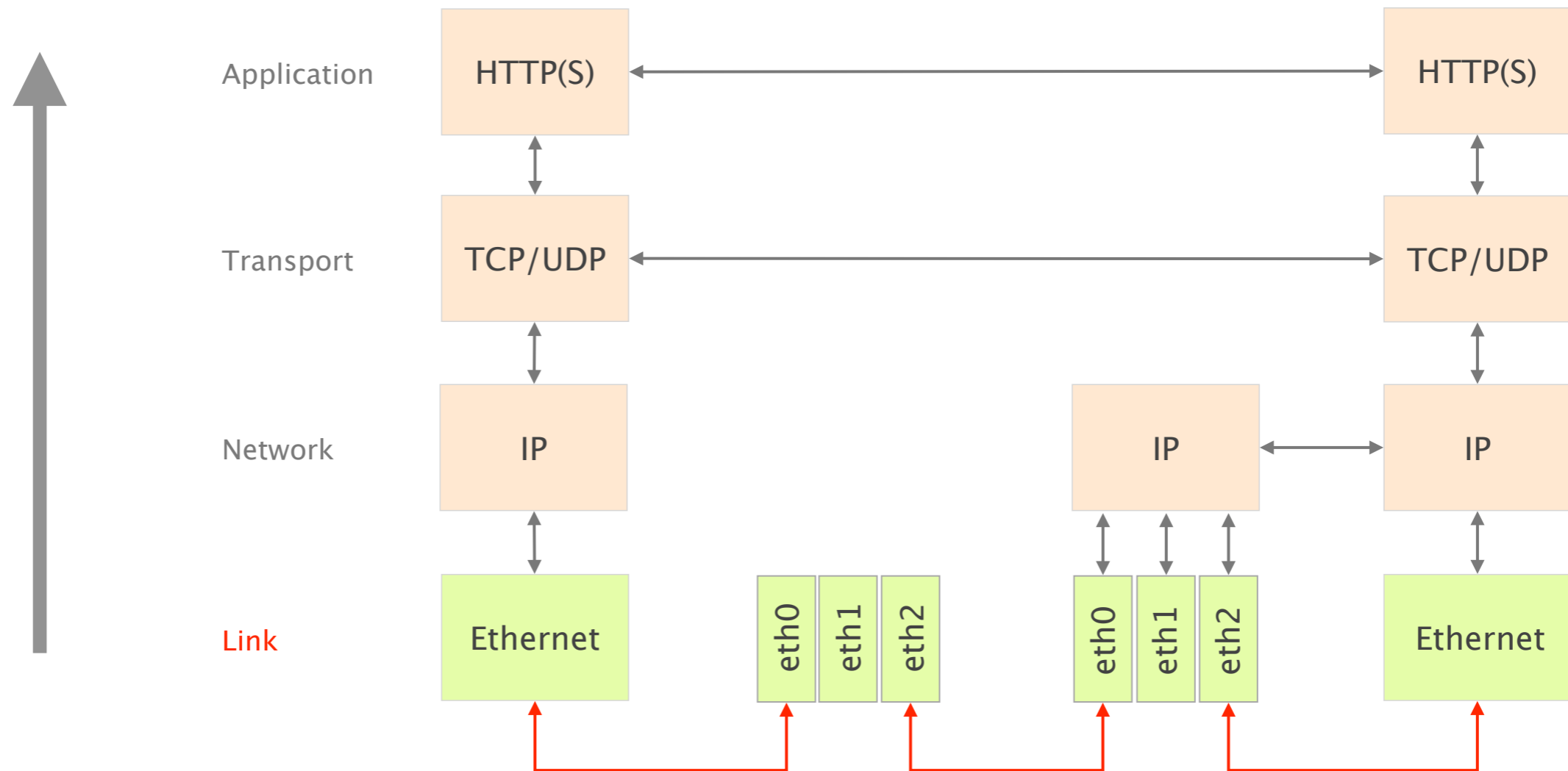


Important lecture topics

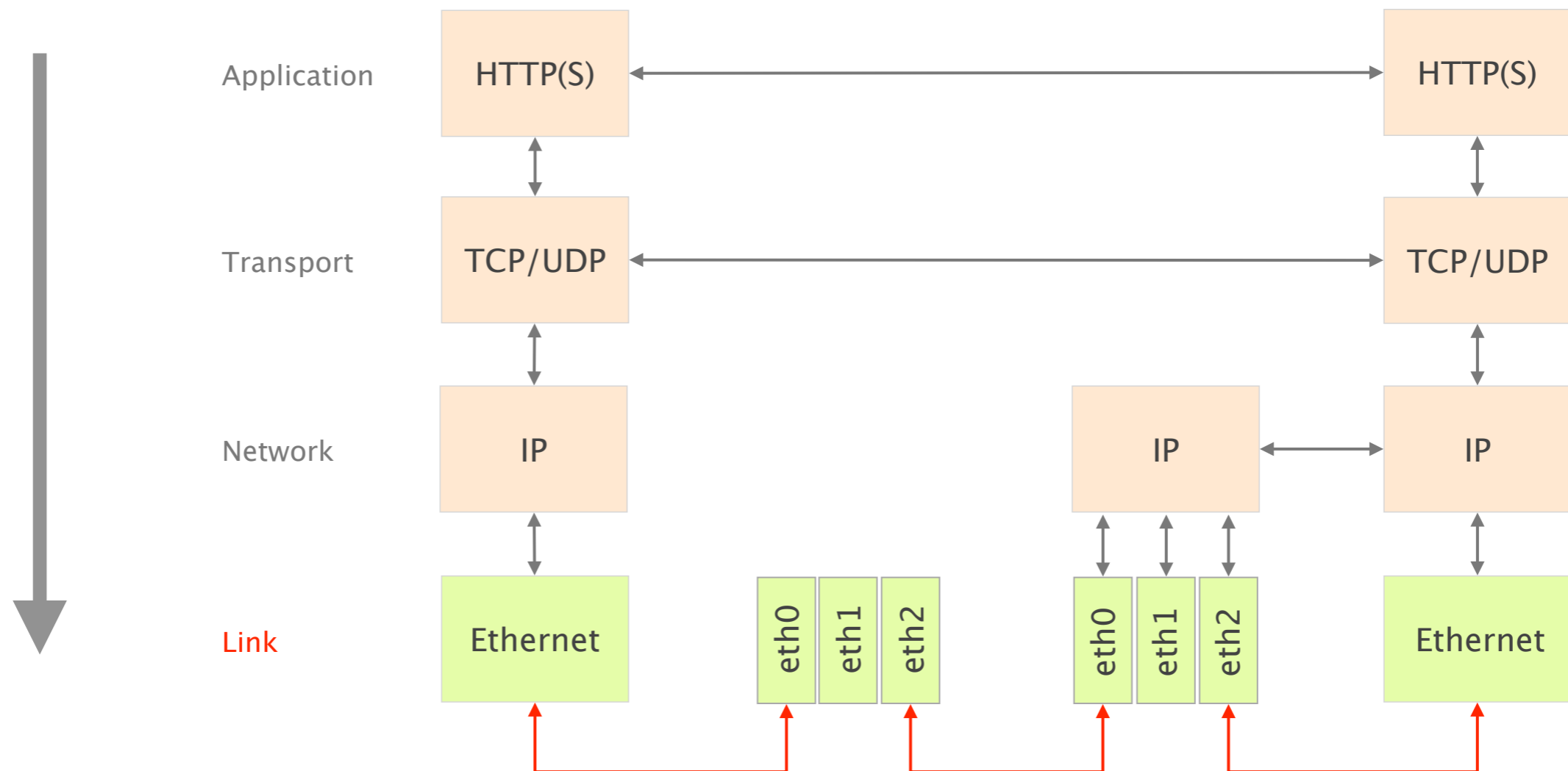
Introduction to this week's exercise

Time to solve the exercise

In the lecture we go through the layers bottom-up



Another possible approach would be top-down



Common Problem: Concepts of other layers are usually needed to understand the current one

We saw that when speaking about MAC addresses (L2), suddenly we also care about IP addresses (L3)

MAC addresses identify **sender and receiver** adapters

used on a “single” link

How does a MAC address look like?

48 bits address, e.g., **00:1A:2B:3C:4D:5E**

vendor prefix
assigned by IEEE

assigned by vendor

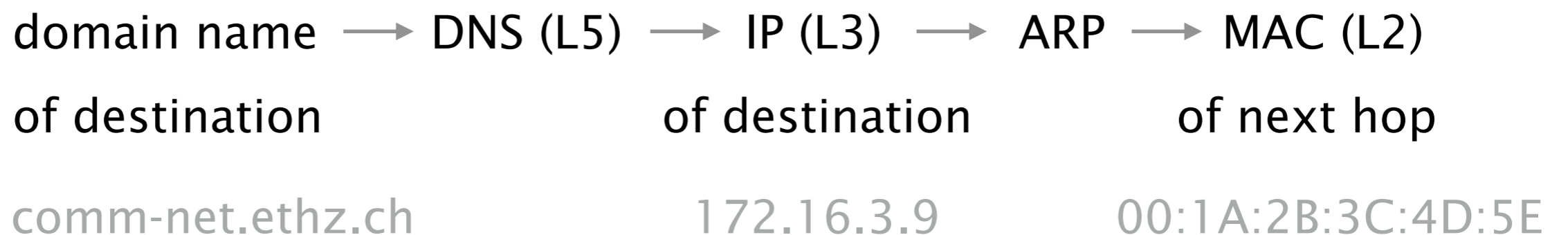
Switches use MAC addresses to forward frames within the same network.

IP addresses identify devices across networks

Why can't we use MAC addresses for that?

There are billions of devices on the Internet. MAC addresses are flat (non-hierarchical), so we cannot aggregate routes and would need an entry for every device. To scale routing, we need hierarchical and logical addresses such as IP addresses.

Actually, domain names are easier to remember than IP addresses:



Given an IP address reachable on a link,
How do I find out what MAC to use?

Who are you?

IP-to-MAC binding

Address Resolution Protocol



That can only work if hosts can get an IP address

Who am I?

MAC-to-IP binding

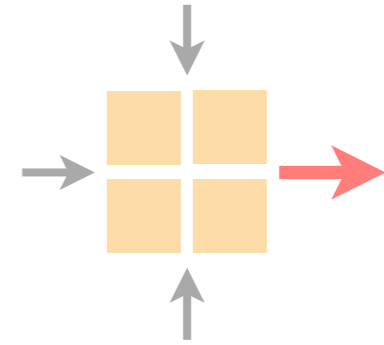
How do I acquire an IP address?

Dynamic Host Configuration Protocol

We will explore both concepts
(ARP and DHCP) in today's exercise

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Spring 2026



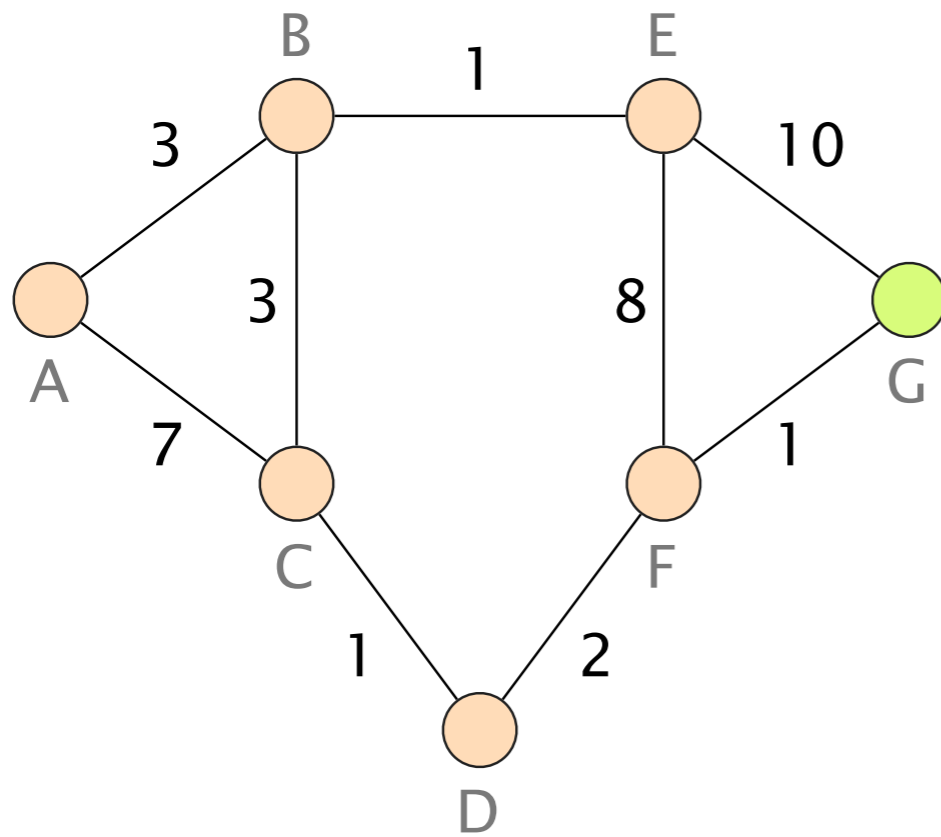
Important lecture topics

Introduction to this week's exercise

Time to solve the exercise

Two more questions related to routing concepts

Task 3.1 Distance Vector



Compute shortest paths using a distance vector algorithm

Compared to link-state algorithms, paths are now computed in a distributed fashion

Task 3.2 Reverse Dijkstra (exam question 2020)

#	U	A	B	C	D	E	F	G	H	I
1	0	2	3	1	-	-	-	10	-	11
2	0	2	2	1	8	-	-	10	-	11
3	0	2	2	1	8	-	-	10	-	11
4	0	2	2	1	8	100	-	10	-	11
5	0	2	2	1	8	9	15	10	-	11
6	0	2	2	1	8	9	15	10	-	11
7	0	2	2	1	8	9	13	10	14	11
8	0	2	2	1	8	9	12	10	14	11
9	0	2	2	1	8	9	12	10	13	11
10	0	2	2	1	8	9	12	10	13	11

Reminder on Dijkstra's Loop:

- 1) pick node with min distance not in S
- 2) add this node to S
- 3) update min distances
(to this node's neighbors)

Back to Dijkstra (link-state)

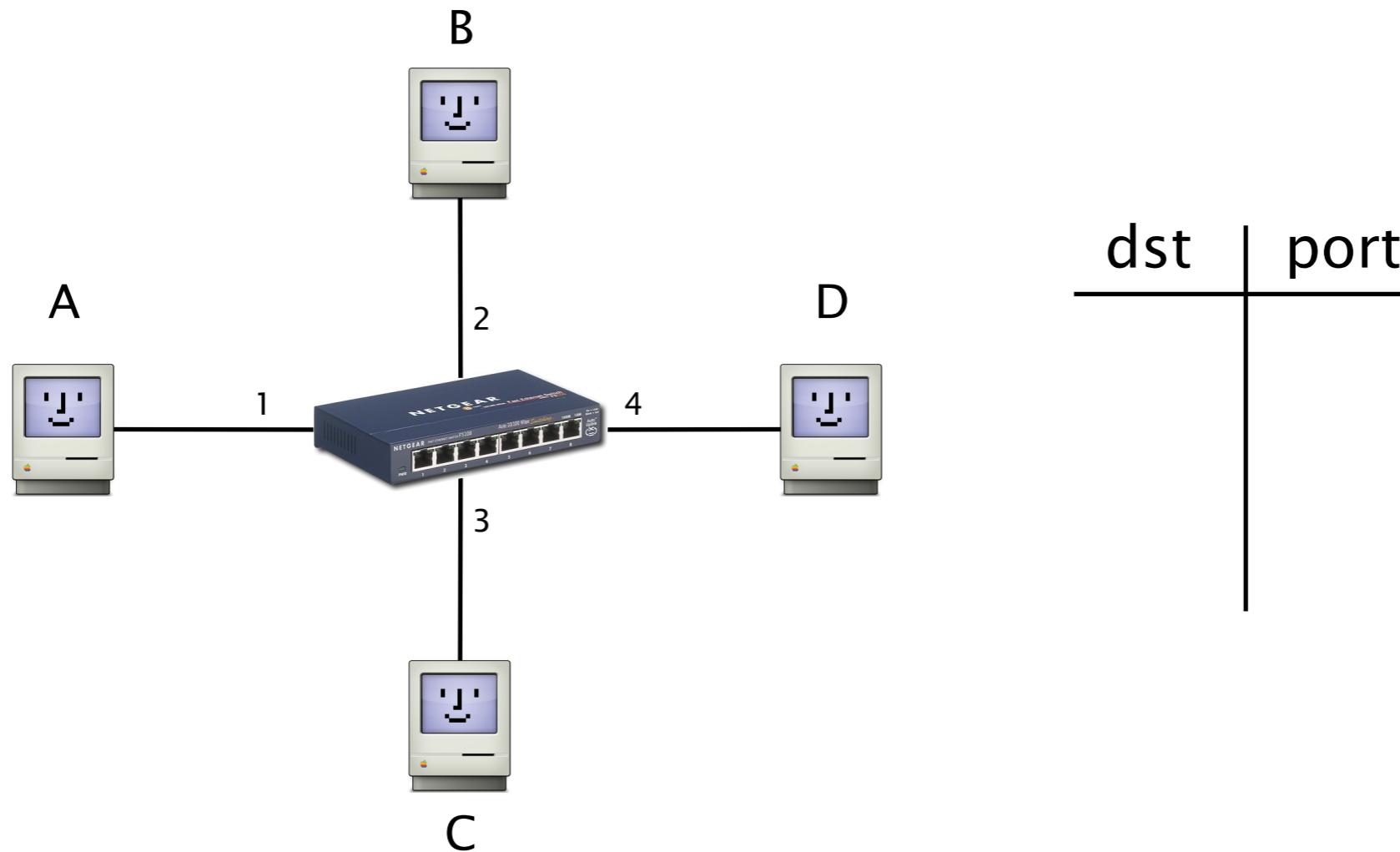
We do not know the network topology, except for nodes

Additionally we know Dijkstra's output

Figure out the links and their weights?

And three questions related to Ethernet & Switching

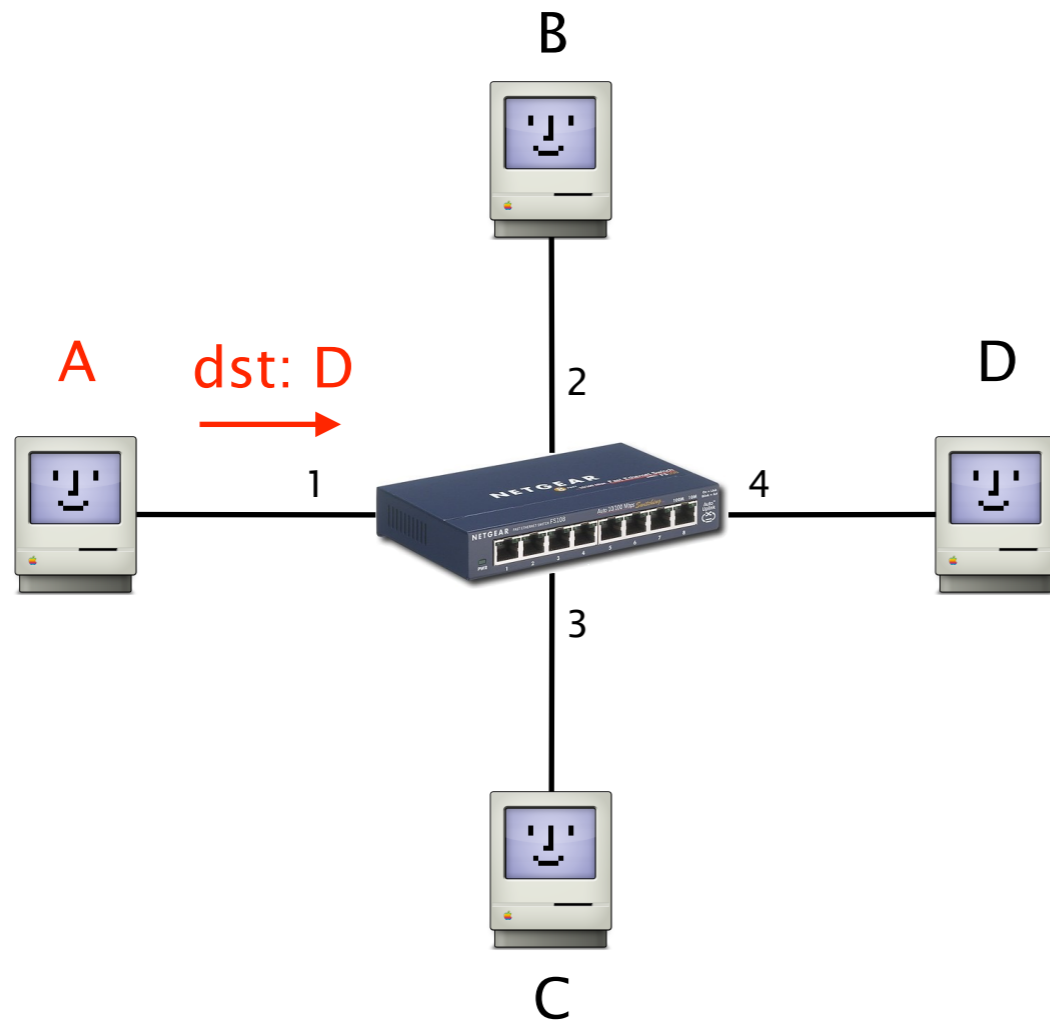
Task 3.3: Apple vs. Microsoft



As a reminder, let's look at this simple example

A switch learns how to map **MACs** to **ports**

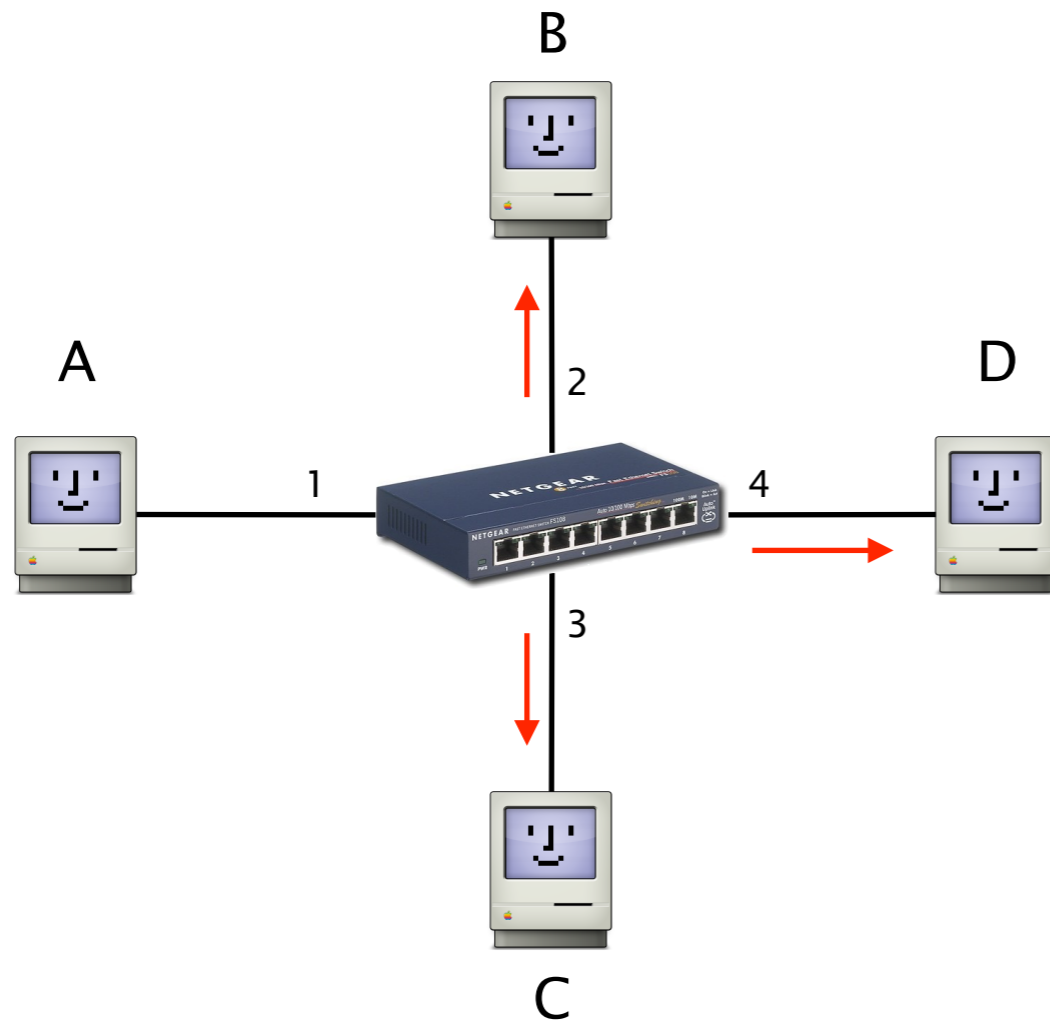
Task 3.3: Apple vs. Microsoft



dst	port
A	1

Switch learns how to map **A** to **port 1**

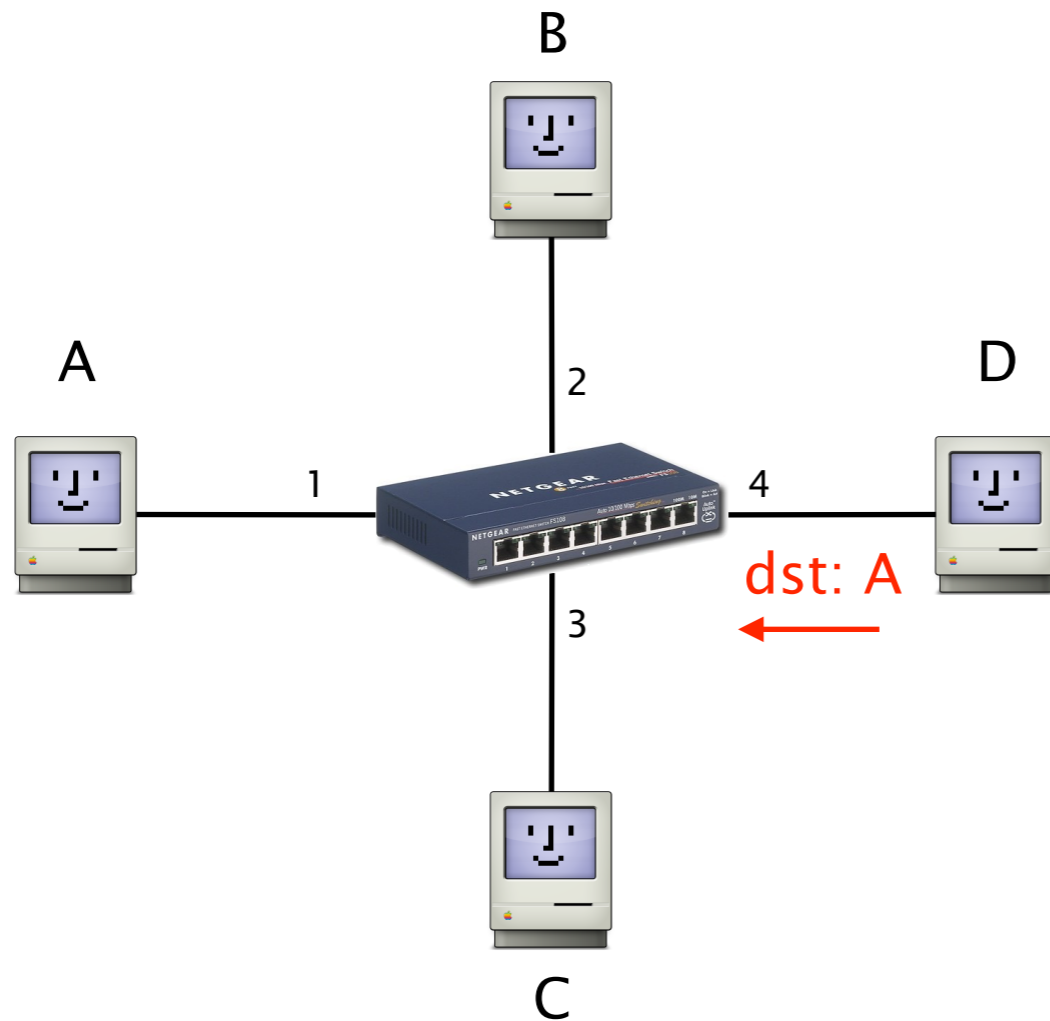
Task 3.3: Apple vs. Microsoft



dst	port
A	1

Dst **D** unknown: **broadcast**

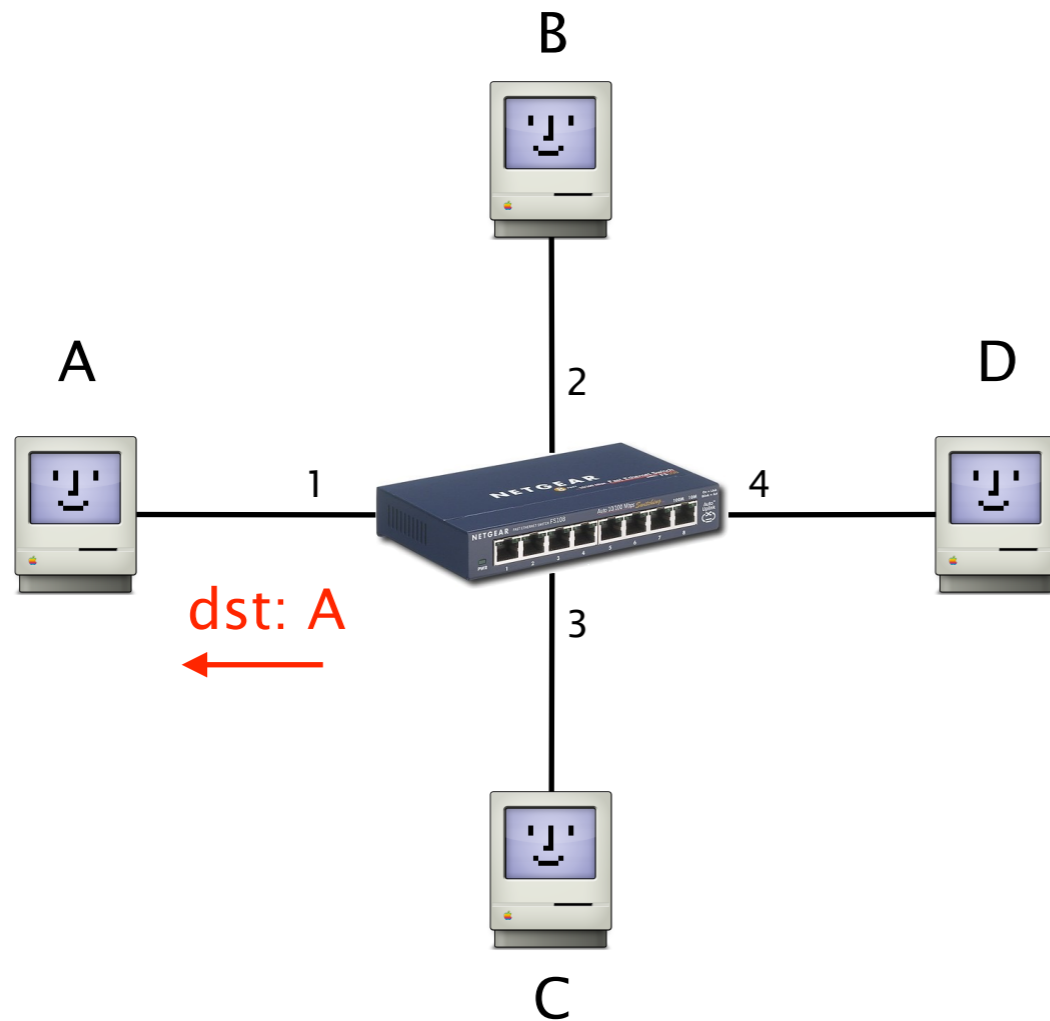
Task 3.3: Apple vs. Microsoft



dst	port
A	1
D	4

Switch learns how to map **D** to **port 4**

Task 3.3: Apple vs. Microsoft



dst	port
A	1
D	4

Dst A known, **no broadcast** required

Task 3.4: Impostor

Put your knowledge about DHCP and ARP together

Who am I?

MAC-to-IP binding

How do I acquire an IP address?

Dynamic Host Configuration Protocol (DHCP)

Who are you?

IP-to-MAC binding

Given an IP address reachable on a link,
how do I find out what MAC to use?

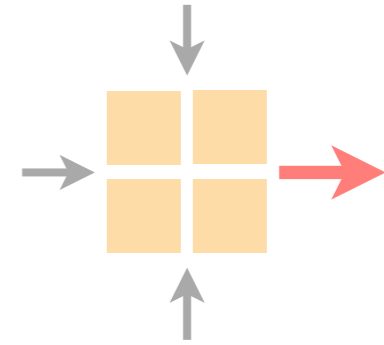
Address Resolution Protocol (ARP)

Task 3.5: MAC-Learning (exam question 2021)

Use your knowledge from task 3.3 to solve this one

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Spring 2026



Important lecture topics

Introduction to this week's exercise

Time to solve the exercise