Communication Networks

Spring 2025

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ETH Zürich

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Slides from Tobias Bühler

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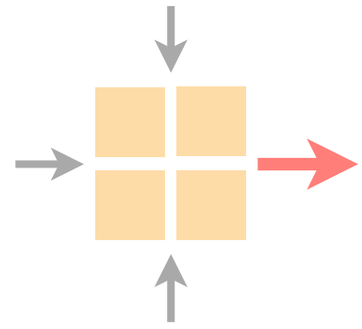
Spring 2025

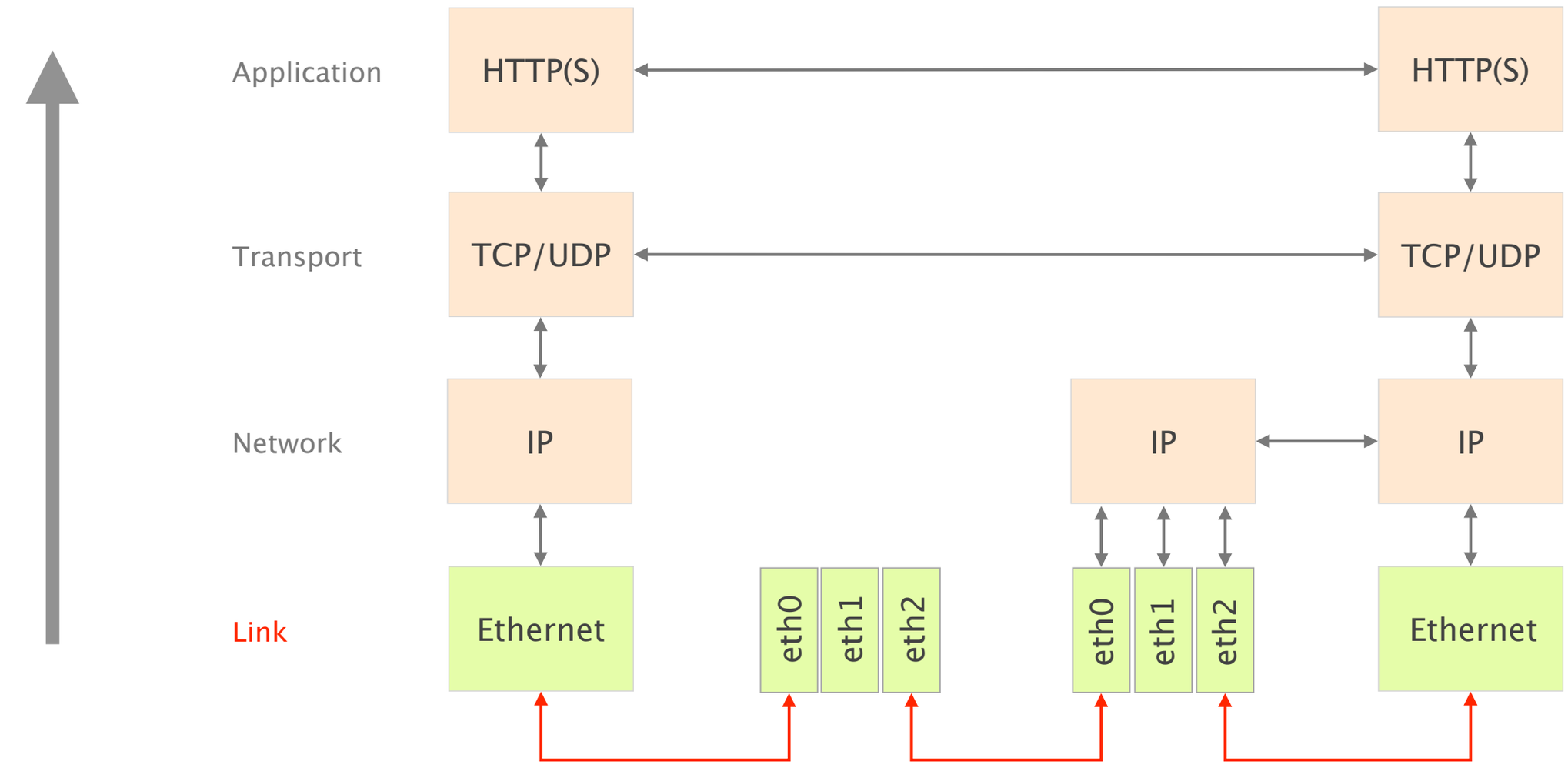


Important lecture topics

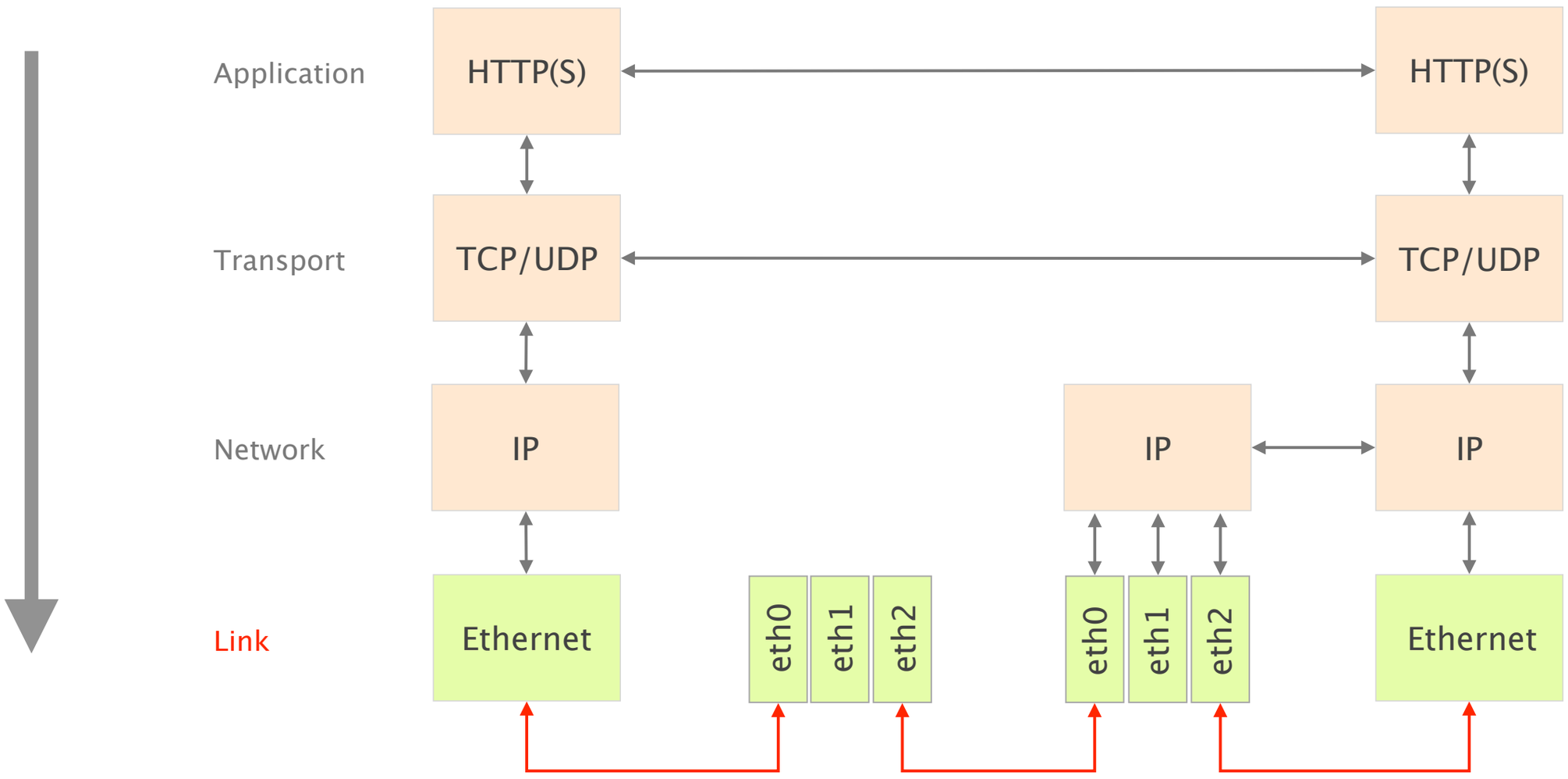
Introduction to this week’s exercise

Time to solve the exercise

In the lecture we go through the layers bottom-up



Another possible approach would be top-down



We face a common problem

No matter the direction, often concepts of other layers are needed to understand the current one

Unfortunately, we cannot prevent that completely

We saw that when speaking about MAC addresses, suddenly we also care about IP addresses

MAC addresses identify sender and receiver adapters

used on a “single” link

MAC addresses identify sender and receiver adapters

used on a “single” link

In general, we therefore use IP addresses (L3)
to address arbitrary hosts

MAC addresses are then used on a hop-by-hop basis
to eventually reach the corresponding host

In fact, for humans domain names are even easier to remember

domain name → DNS (L5) → IP (L3) → ARP → MAC (L2)

of destination — of destination — of next hop

We currently only consider IP addresses
which are reachable over a given link

That simplifies the whole process, we only need to be able to translate from IP to MAC address

IP (L3) → ARP → MAC (L2)

of destination of destination

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

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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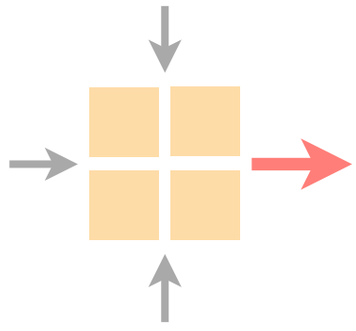

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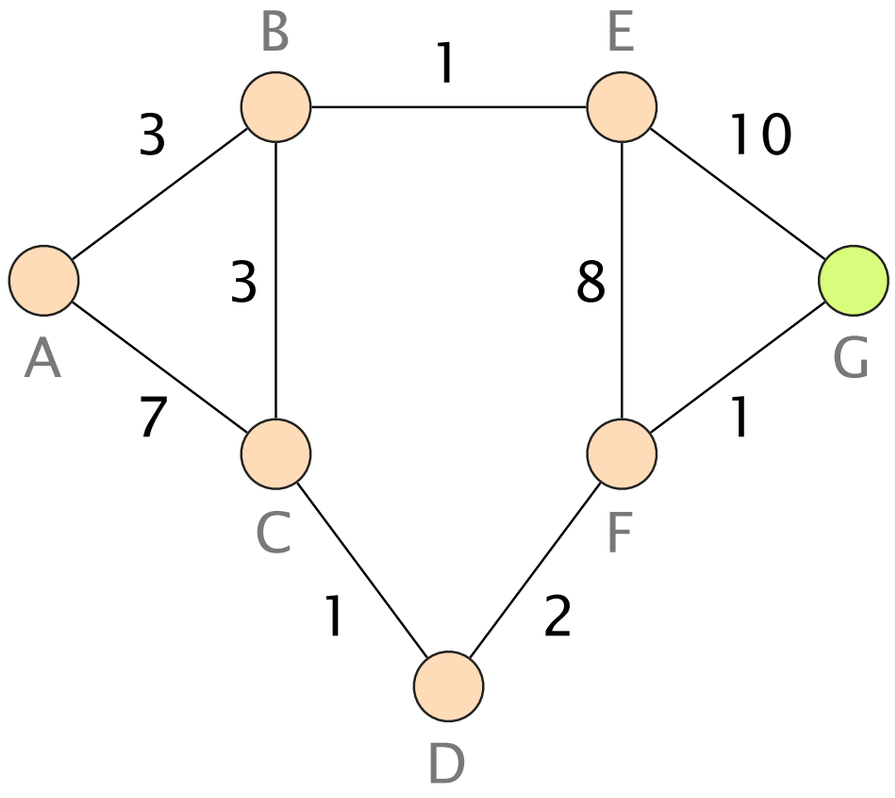
Time to solve the exercise

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

Back to Dijkstra (link-state)

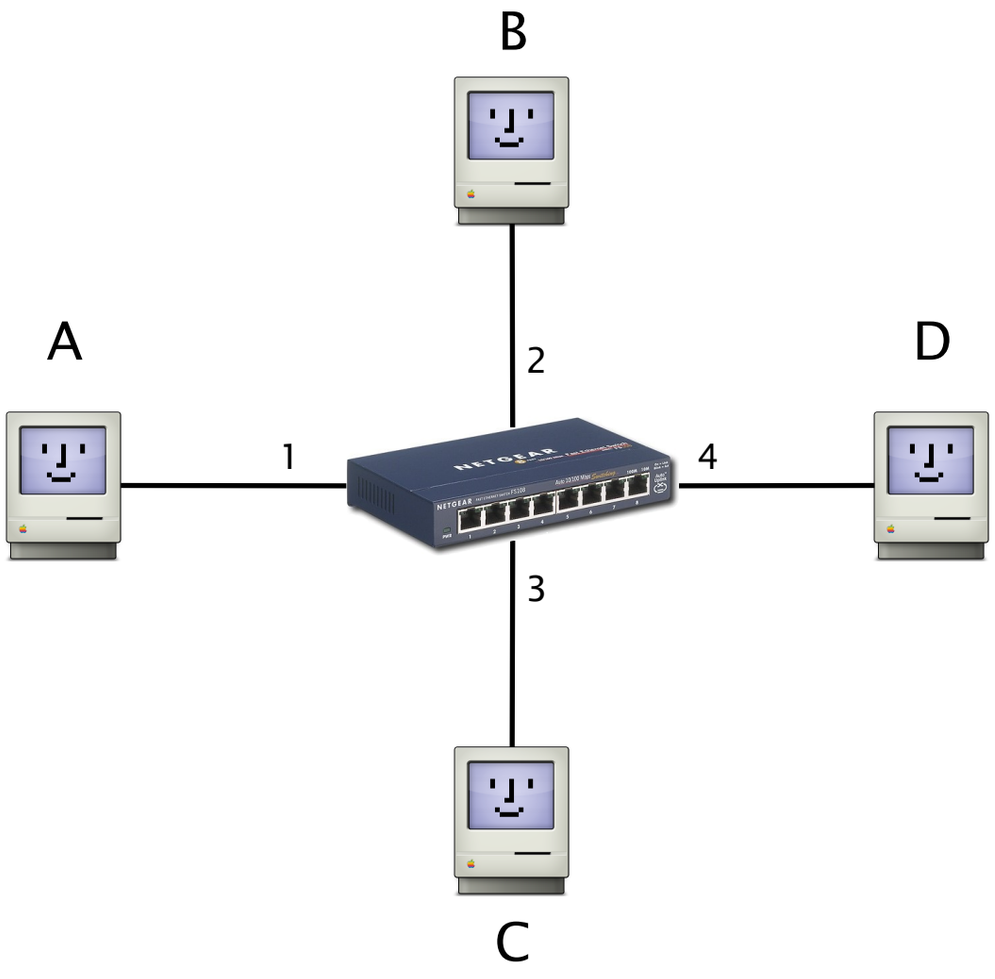
We do not know the network topology, except for nodes

Additionally we know Dijkstra’s output

Figure out the links and their weights?

And three questions related to Ethernet & Switching

Task 3.3: Duplicate MAC Address

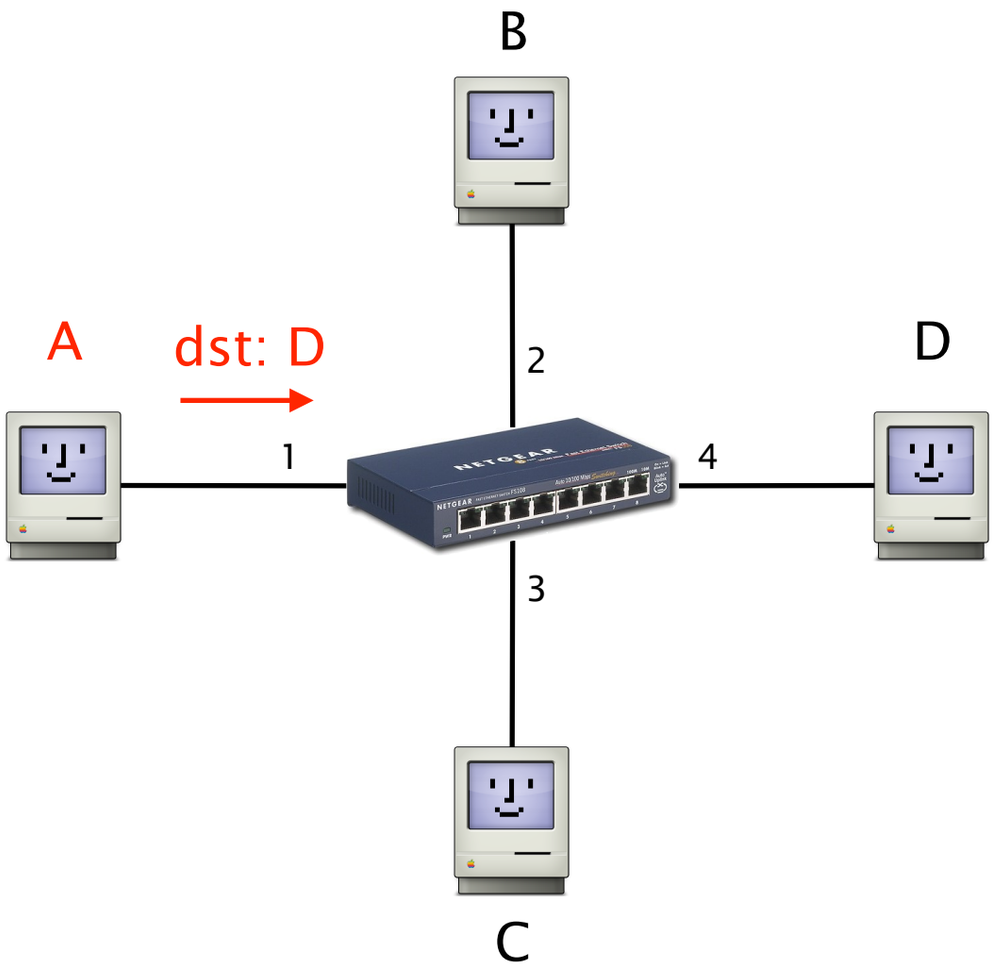


dst	port

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

A switch learns how to map MACs to ports

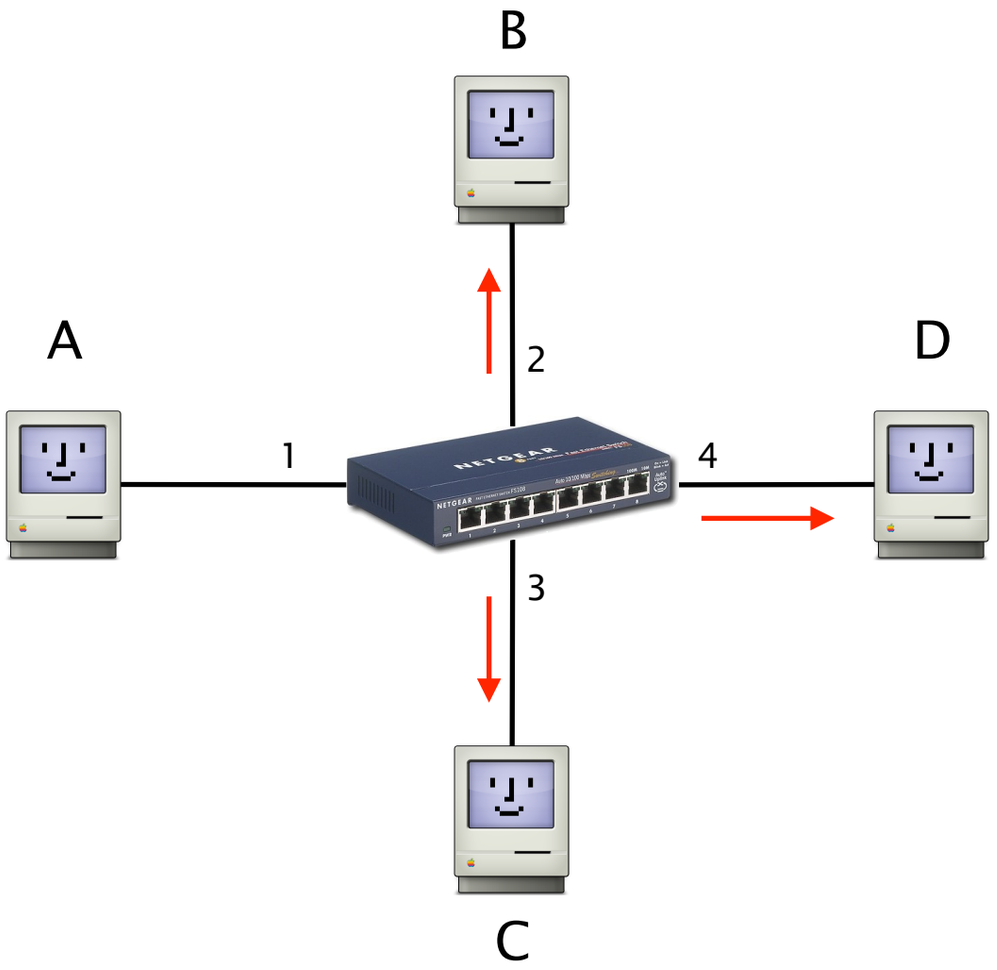
Task 3.3: Duplicate MAC Address



dst	port
A	1

Switch learns how to map A to port 1

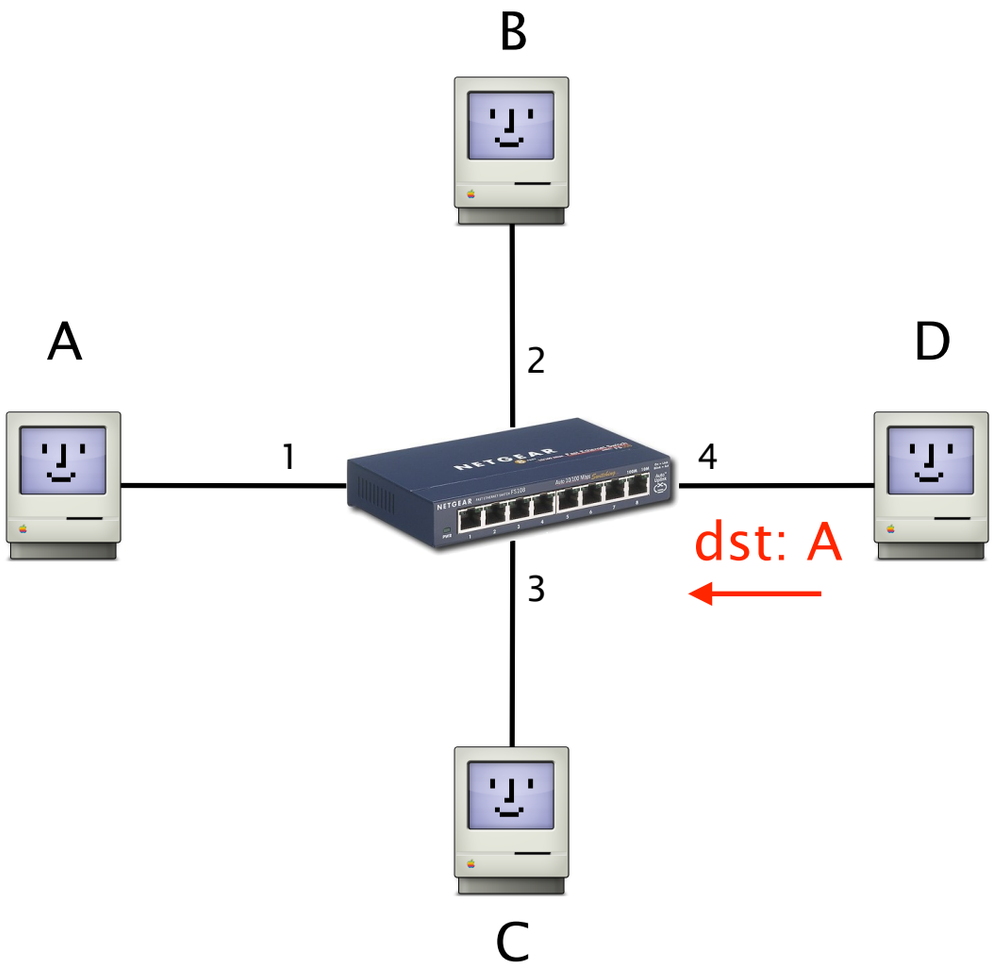
Task 3.3: Duplicate MAC Address



dst	port
A	1

Dst D unknown: broadcast

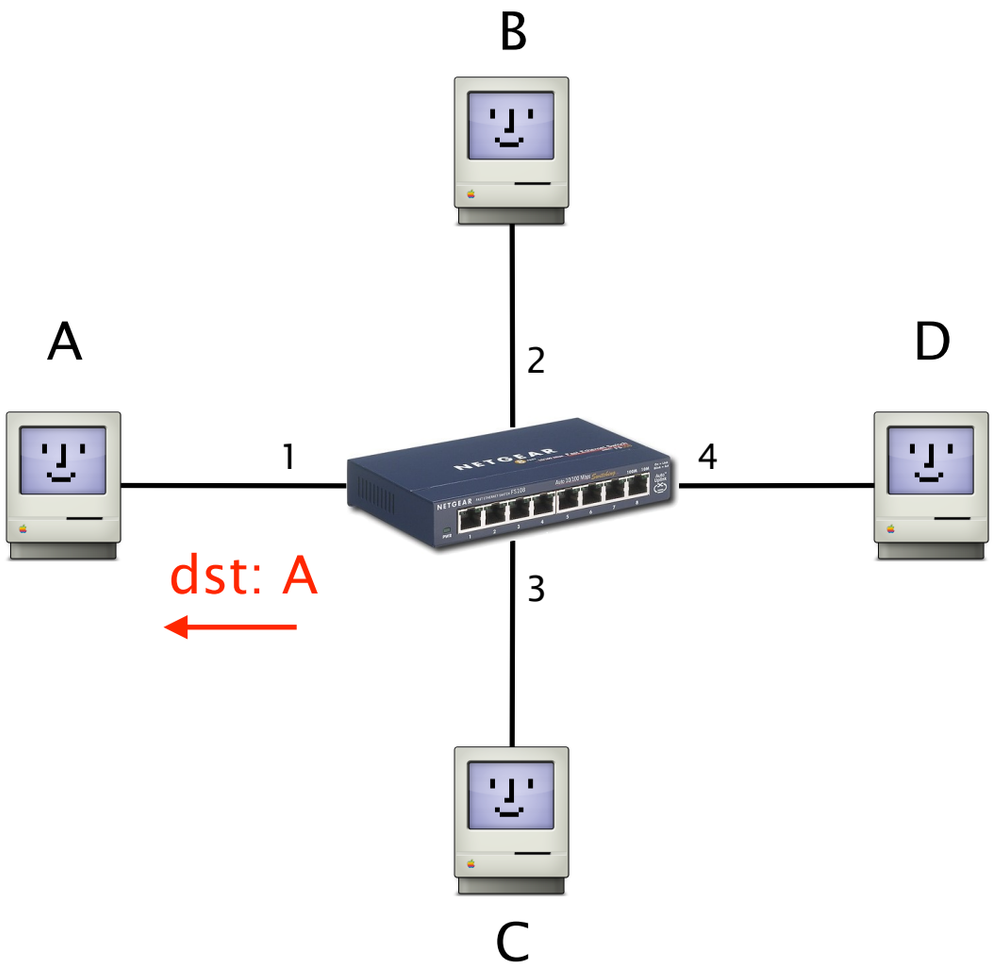
Task 3.3: Duplicate MAC Address



dst	port
A	1
D	4

Switch learns how to map D to port 4

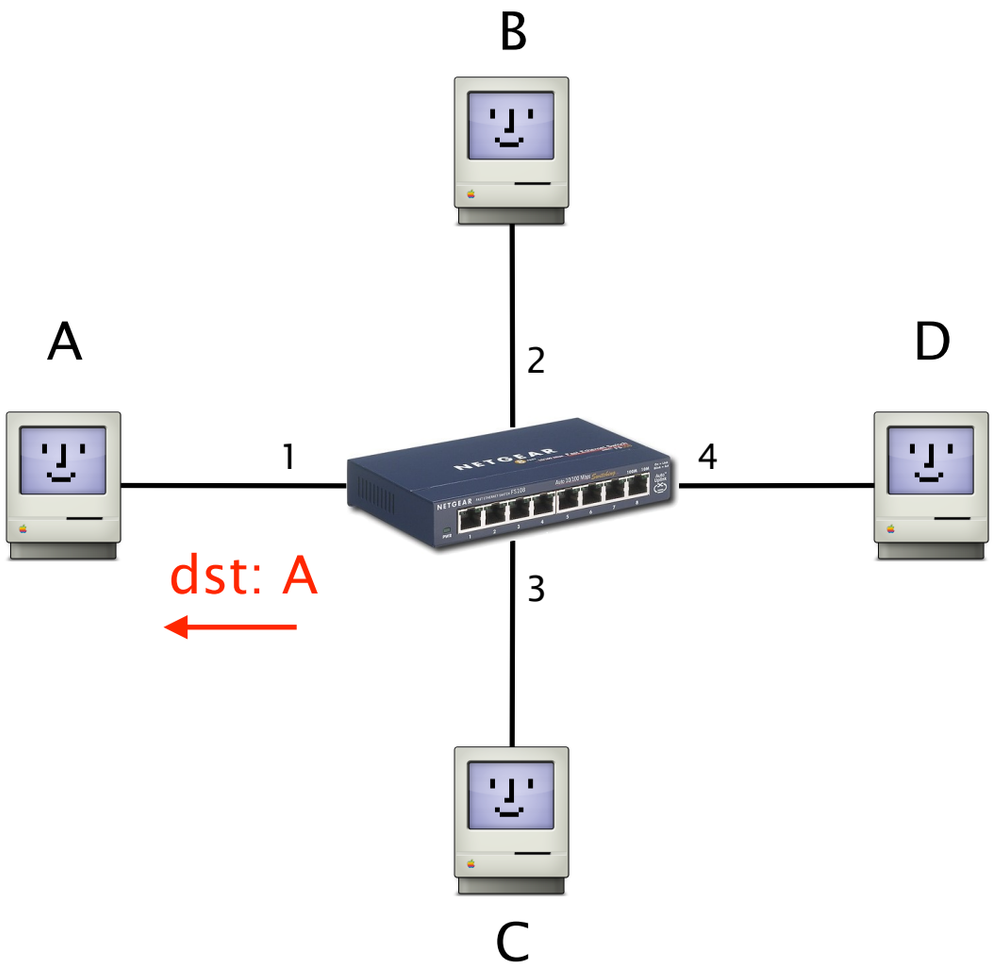
Task 3.3: Duplicate MAC Address



dst	port
A	1
D	4

Dst A known, no broadcast required

Task 3.3: Duplicate MAC Address



dst	port
A	1
D	4

What happens if there are duplicate MAC addresses?

Task 3.4: Impostor

Put your knowledge about DHCP and ARP together

Who am I?	How do I acquire an IP address?
MAC-to-IP binding	Dynamic Host Configuration Protocol (DHCP)
Who are you?	Given an IP address reachable on a link,
IP-to-MAC binding	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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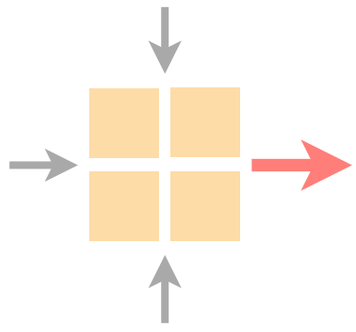

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