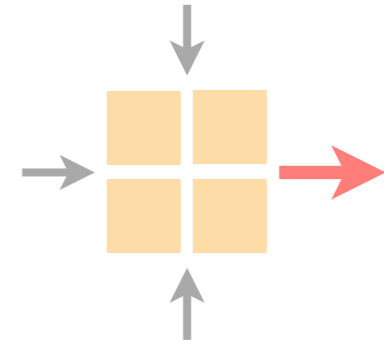


Communication Networks

Spring 2026



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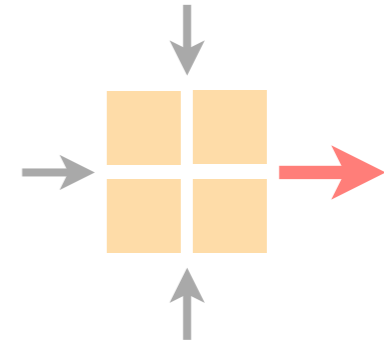
ETH Zürich

19 Mar 2026

Slides adapted from Tobias Bühler

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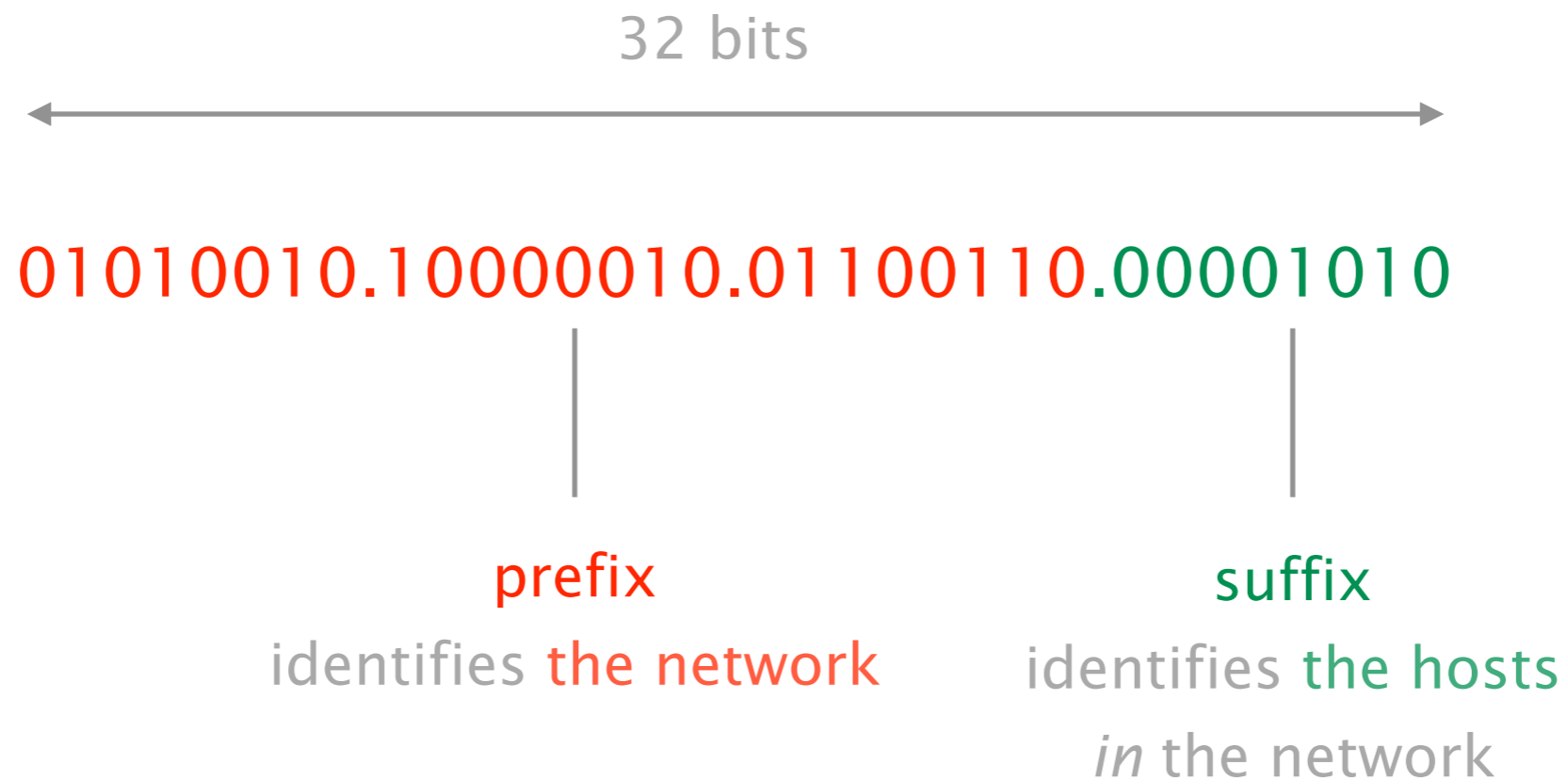


Important lecture topics

Introduction to this week's exercise

Time to solve the exercise

IP(v4) addresses are hierarchical:
prefix (network) part and suffix (host) part



The first and the last IPv4 address of a prefix *cannot* be used to address hosts

The address with the host part being all 0s identifies the network itself

The address with the host part being all 1s identifies the broadcast address

IPv6 solves IPv4 address exhaustion: 128-bit instead of 32-bit addresses

Notation

8 groups of 16 bits each separated by colons (:)

Each group is written as four hexadecimal digits

Simplification

Leading zeros in any group are removed

One section of zeros is replaced by a double colon (::)

Normally the longest section

Examples

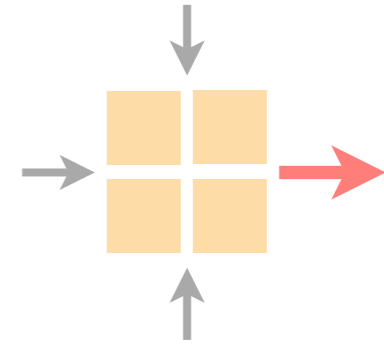
1080:0:0:0:8:800:200C:417A → 1080::8:800:200C:417A

FF01:0:0:0:0:0:0:0101 → FF01::101

0:0:0:0:0:0:0:1 → ::1

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Important lecture topics

Introduction to this week's exercise

Time to solve the exercise

Task 4.1 & 4.2: Computing spanning trees

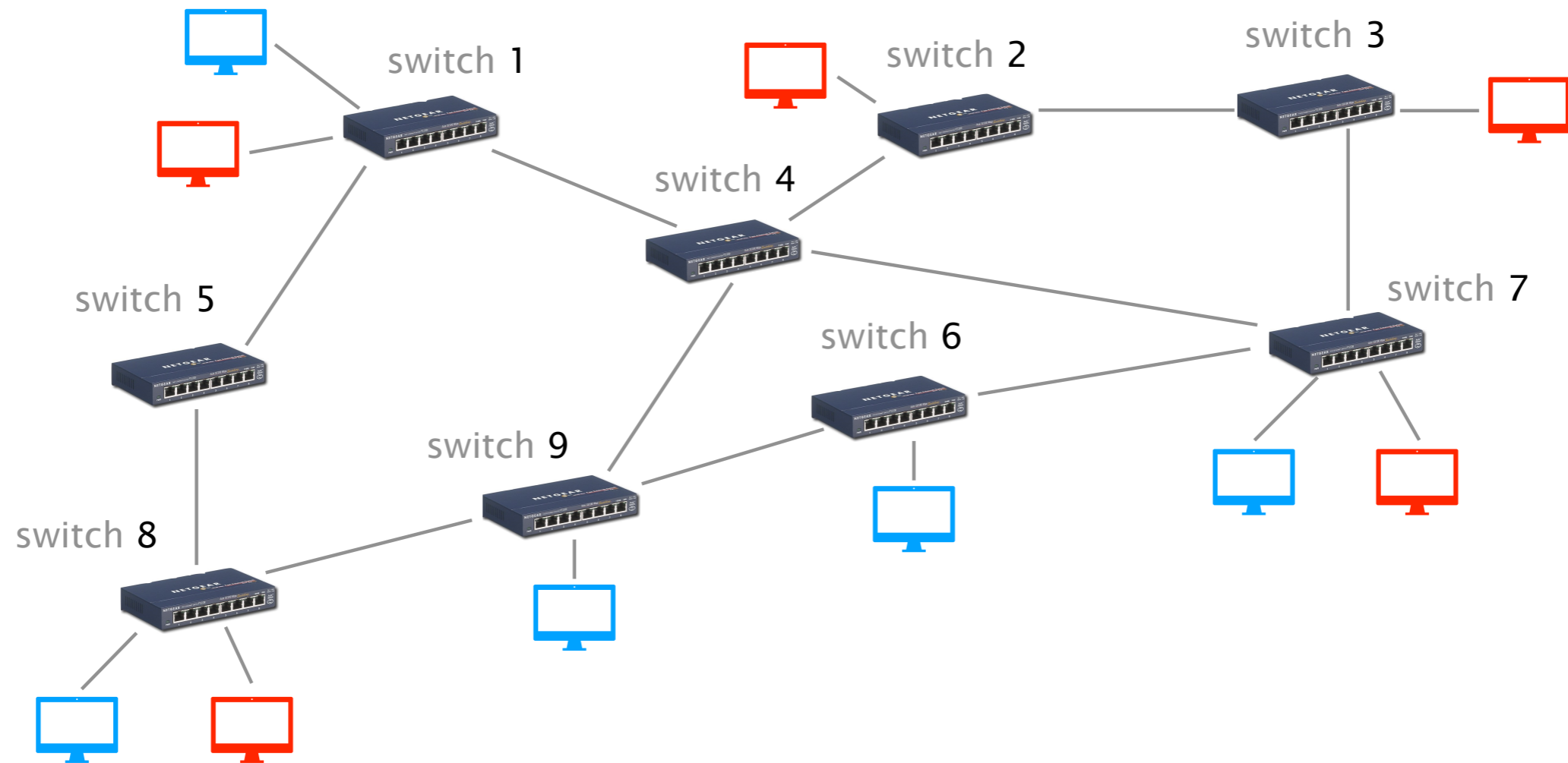
hint

Compared to a switch in the network,
you already have knowledge of the entire topology

i.e., you immediately know which switch
will eventually be the root of the spanning tree

Start from the root rather than thinking
about all the individual BPDU messages

Task 4.3: VLANs separate hosts and allow to better utilize links



Task 4.4 — 4.6: IPv4 and IPv6 computations

Example

given

an address	153.96.0.0
prefix mask	12 (bits)

compute

#addressable hosts

network address

1st host address

last host address

broadcast address

Example

given

an address 153.96.0.0

prefix mask 12 (bits)

compute

#addressable hosts

Example

given

an address 153.96.0.0

prefix mask 12 (bits)

compute

#addressable hosts $2^{(32-12)} - 2$

Example

given

an address 153.96.0.0

prefix mask 12 (bits)

compute

#addressable hosts $2^{(32-12)} - 2$

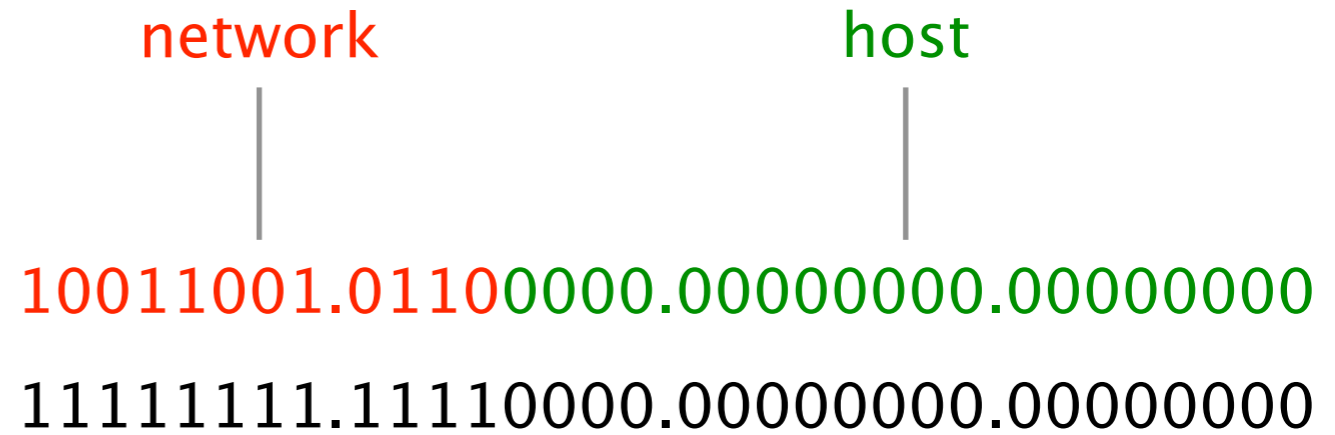
network address

Example

given

an address 153.96.0.0

prefix mask 12 (bits)



compute

#addressable hosts $2^{(32-12)} - 2$

network address 153.96.0.0

10011001.01100000.00000000.00000000

address AND mask

host part all 0s

Example

given

an address 153.96.0.0

prefix mask 12 (bits)

network

host

10011001.01100000.00000000.00000000

11111111.11110000.00000000.00000000

compute

#addressable hosts $2^{(32-12)} - 2$

network address 153.96.0.0

10011001.01100000.00000000.00000000

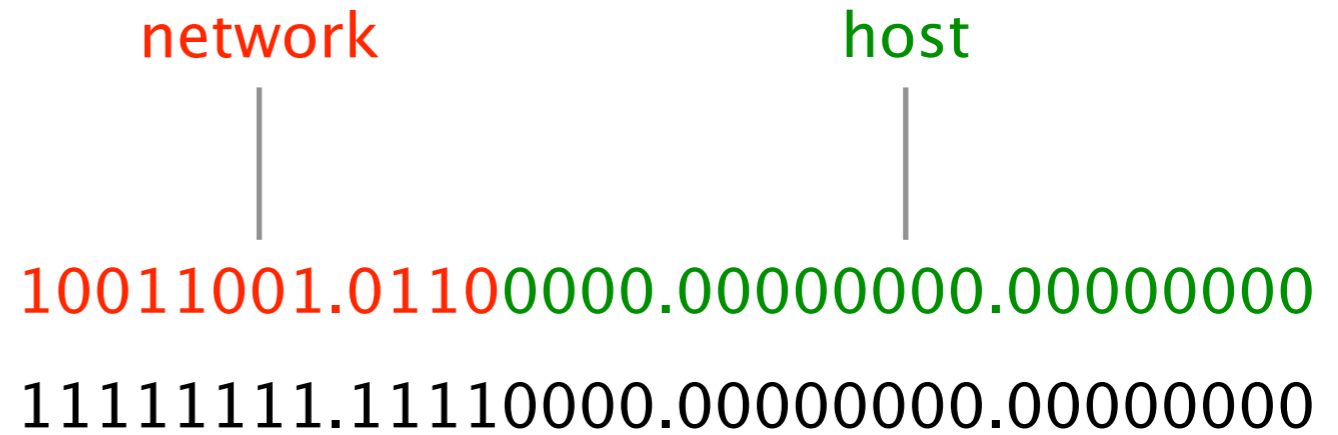
broadcast address

Example

given

an address 153.96.0.0

prefix mask 12 (bits)



compute

#addressable hosts $2^{(32-12)} - 2$

network address 153.96.0.0



broadcast address 153.111.255.255



host part all 1s

Example

given

an address 153.96.0.0

prefix mask 12 (bits)

network

host

10011001.01100000.00000000.00000000

11111111.11110000.00000000.00000000

compute

#addressable hosts $2^{(32-12)} - 2$

network address 153.96.0.0

1st host address 153.96.0.1

last host address 153.111.255.254

broadcast address 153.111.255.255

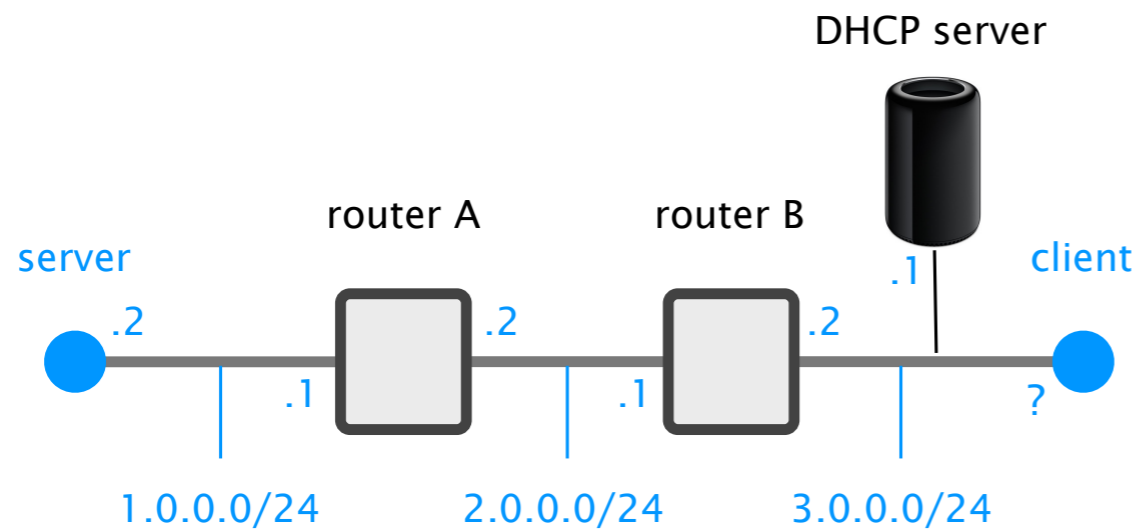
10011001.01100000.00000000.00000000

10011001.01100000.00000000.00000001

10011001.01101111.11111111.11111110

10011001.01101111.11111111.11111111

Task 4.7: Putting everything together

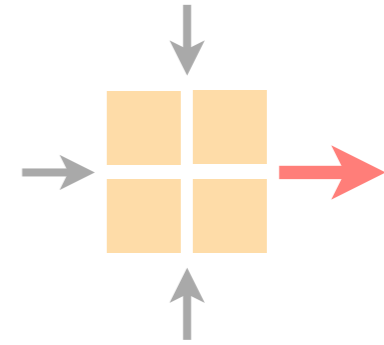


Client with initially empty state issues a ping to a remote server

What packets are generated?
How do the IPs/MACs change along the packets' paths?

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