

# Computer Networks

## Exercise Session 06

Prof. Dr. Oliver Hahm

Frankfurt University of Applied Sciences  
Faculty 2: Computer Science and Engineering  
[oliver.hahm@fb2.fra-uas.de](mailto:oliver.hahm@fb2.fra-uas.de)  
<https://teaching.dahahm.de>

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# General Schedule

All exercises will follow this general schedule

- Identify potential understanding problems
  - Ask your questions
  - Recap of the lecture
- Address the understanding problems
  - Answer your questions
  - Repeat certain topics
- Walk through the exercises/solutions → Some hints and guidance
  - Work time or presentation of results

# Framing

You have seen . . .

- the main services of the Data Link Layer
- what link layer **frames** are and how they can be **marked**
- the specific design of **IEEE 802.3 (Ethernet)** and **IEEE 802.11 (WLAN)** frames

# Addresses

You have seen . . .

- which network components typically can be **addressed** on the Data Link Layer
- the **representation** of **MAC addresses**
- how MAC addresses are composed (→ **EUI-64** and **OUI**)

# Switching

You have seen . . .

- what functionality is provided by **Bridges** and **Switches**
- how these devices **learn** about the topology
- which **forwarding** strategies exist
- that **loops** on the Data Link Layer can cause serious problems
- how loops can be avoided by creating a logical hierarchy with the **Spanning Tree Protocol**

# Contention-based Medium Access

You have seen ...

- that participants must **compete for medium access** in contention-based MAC protocols
- **collisions** reduce the **performance** of the network
- they should be **detected** and **avoided**
- the trade-off between **throughput** and **latency**

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Fiber-optic cables offer a higher bandwidth (→ higher data rate) and a lower bit error rate because they are less affected by noise.

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WLAN access points, for instance, typically provide network access for multiple users in parallel. Omnidirectional transmissions allows the users to move more freely.

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Because of the reflections (→ multipath-fading) → Faraday cage

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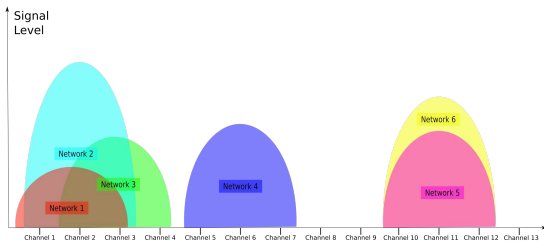
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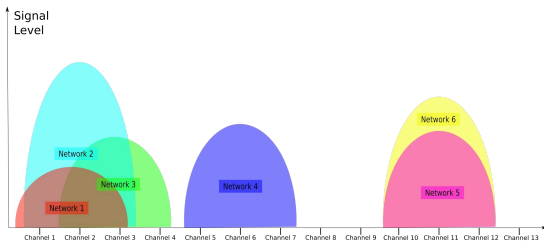
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WLAN is targeted for longer ranges than Bluetooth and devices have typically less energy limitations.

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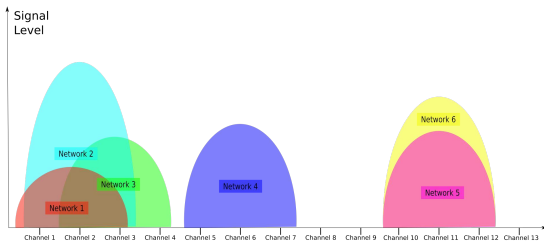


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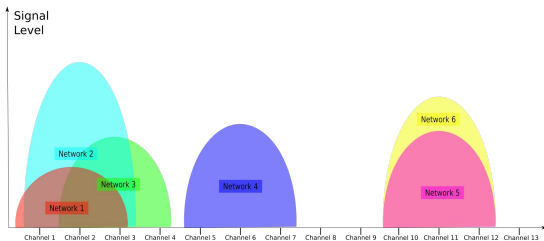


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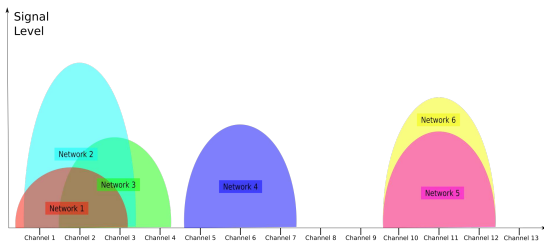
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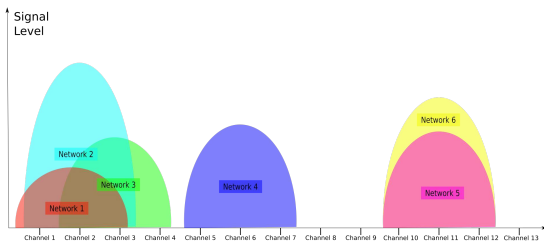
You don't have the credentials.

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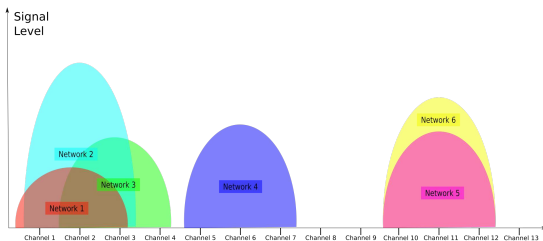
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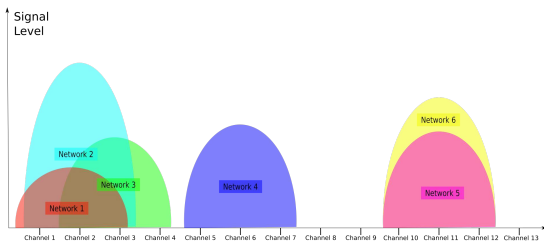


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Network 1, 2, and 3 use overlapping channels. Typically selecting other channels than 1, 6, 11, and 14 is not recommended.

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The information, which network devices are accessible via which port in local forwarding tables.

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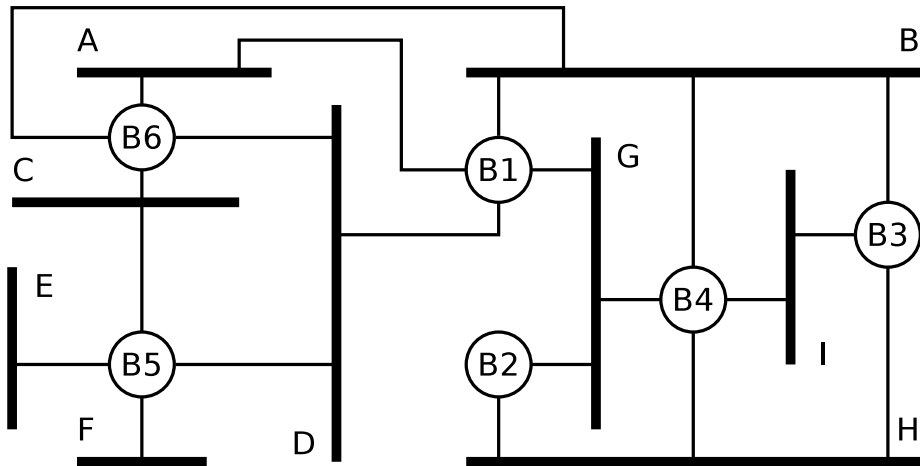
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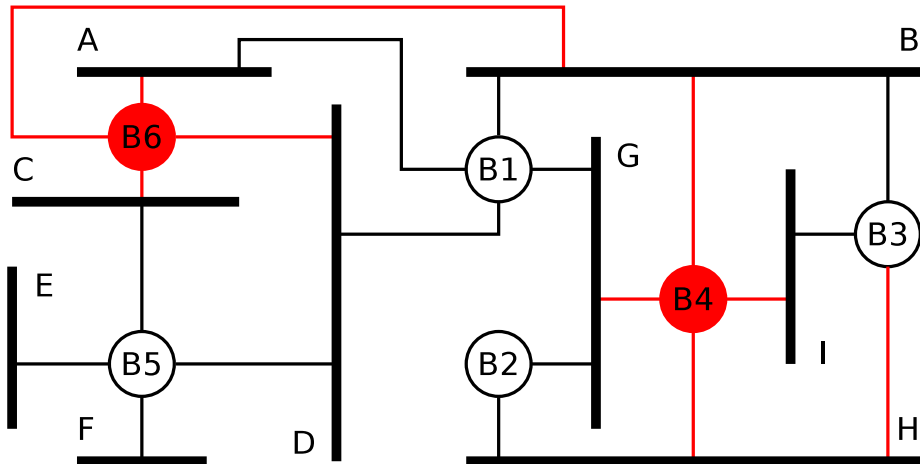
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The Bridge ID consists of the Bridge priority (2 bytes) and MAC address (6 bytes) of the Bridge port with the lowest port ID.



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This address is the MAC broadcast address. Every participant in the local/physical network receives this frame.



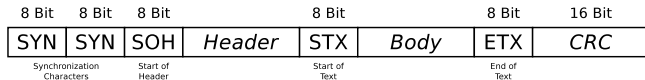
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This address is the MAC broadcast address. Every participant in the local/physical network receives this frame.
- 4 What is **MAC spoofing**?

## Exercise 7: Addressing in the Data Link Layer

- 1 The format of what **addresses** is defined by Data Link Layer protocols?  
physical network addresses
- 2 How are **physical network addresses** called?  
MAC addresses
- 3 Who receives a frame with the **destination address** FF-FF-FF-FF-FF-FF?  
This address is the MAC broadcast address. Every participant in the local/physical network receives this frame.
- 4 What is **MAC spoofing**?  
Changing the MAC address of a device to fake its identity.

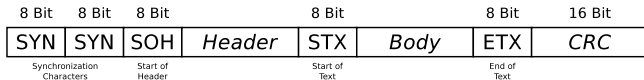
# Exercise 8: Byte Stuffing



<b>Control character</b>	SOH	STX	ETX	DLE	SYN
<b>Hexadecimal notation</b>	01	02	03	10	16

1 16 16 01 99 98 97 96 95 02 A1 A2 A3 A4 A5 03 A0 B7

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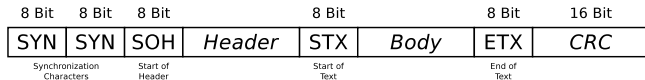


<b>Control character</b>	SOH	STX	ETX	DLE	SYN
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2 16 16 01 99 98 97 96 95 02 05 04 10 03 02 01 03 76 35

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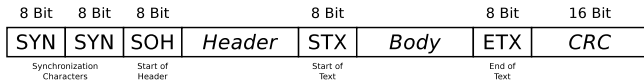


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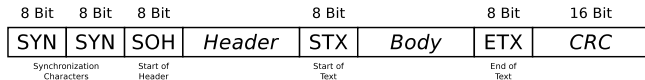
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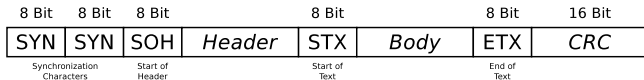
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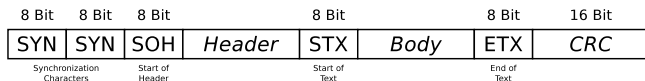
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B2

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B2  
10 10 03 01 02 A1

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**1** 01111110 10100111 11111000 11110010 10011111 10111111 11100101

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Jumbo frames can carry up to 9000 bytes of payload. Even though many Ethernet devices support these frames they are not part of the standard and may lead to errors if not all devices in a network support them.