# Computer Networks

## Exercise Session 06

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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 ($\longrightarrow$ 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

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

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3. **Directed** wireless transmission eliminates some of these issues and can achieve higher transmission ranges. Explain why many wireless networks still work with undirected (*omnidirectional*) transmission systems.
   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 ($\rightarrow$ multipath-fading) $\rightarrow$ Faraday cage

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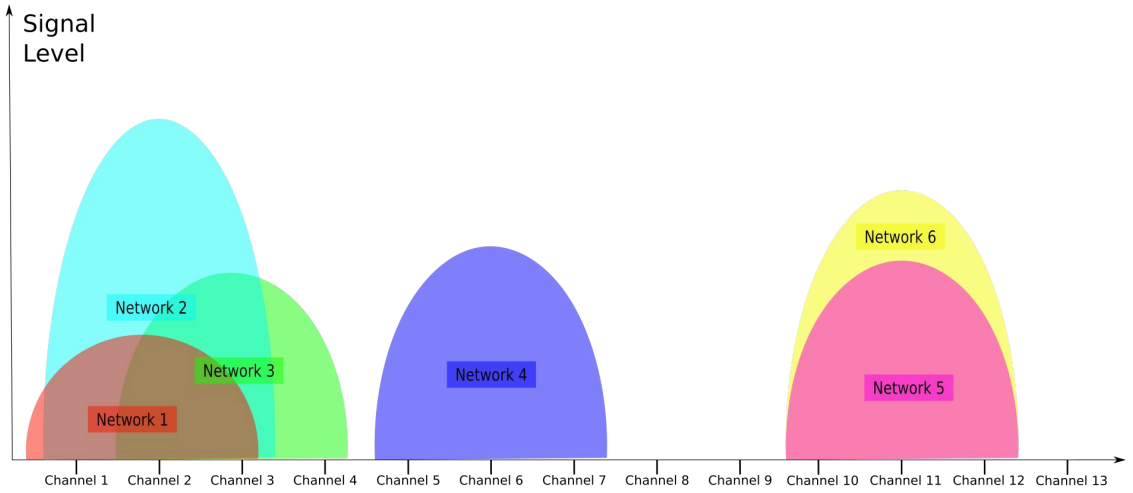
   WLAN is targeted for longer ranges than Bluetooth and devices have typically less energy limitations.

# Exercise 4: WLAN Networks

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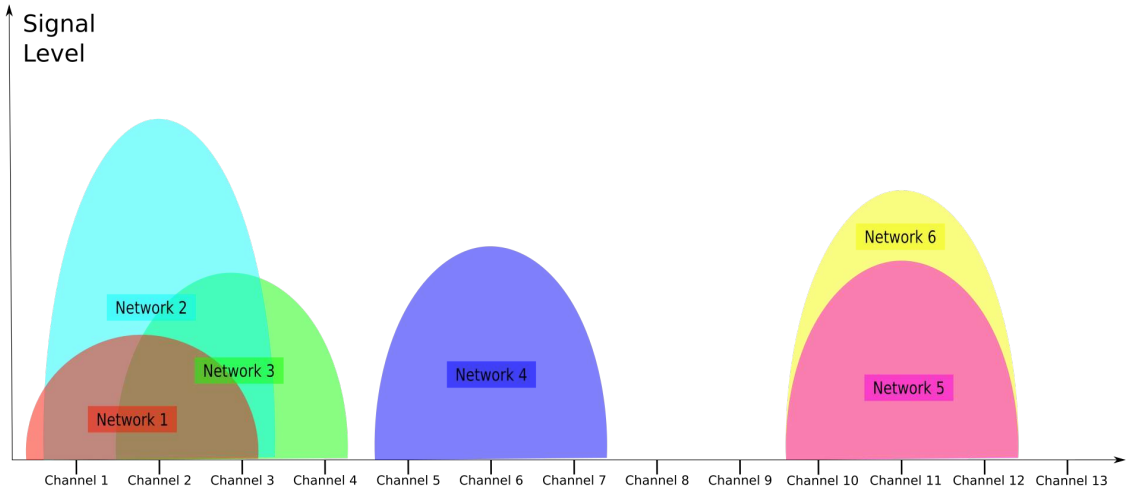


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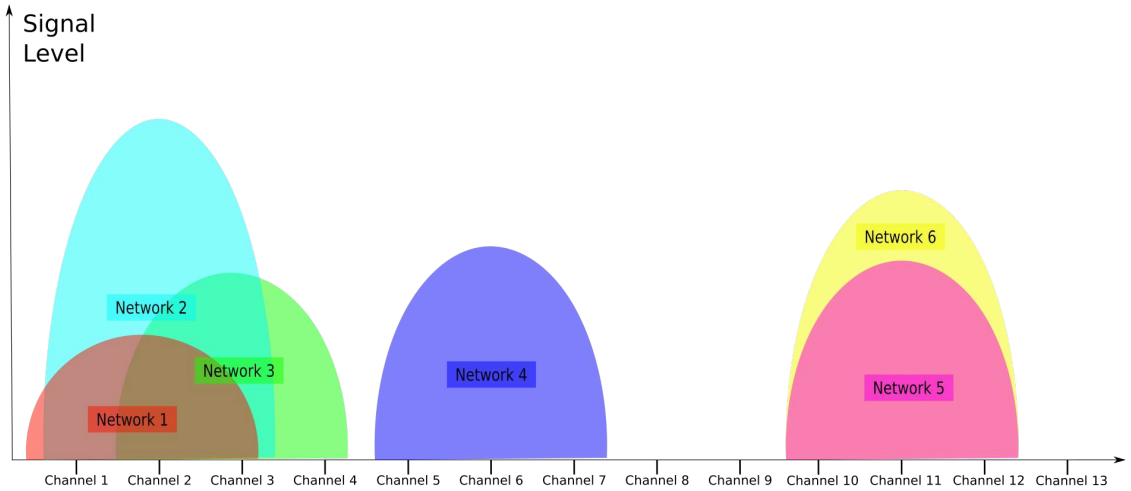


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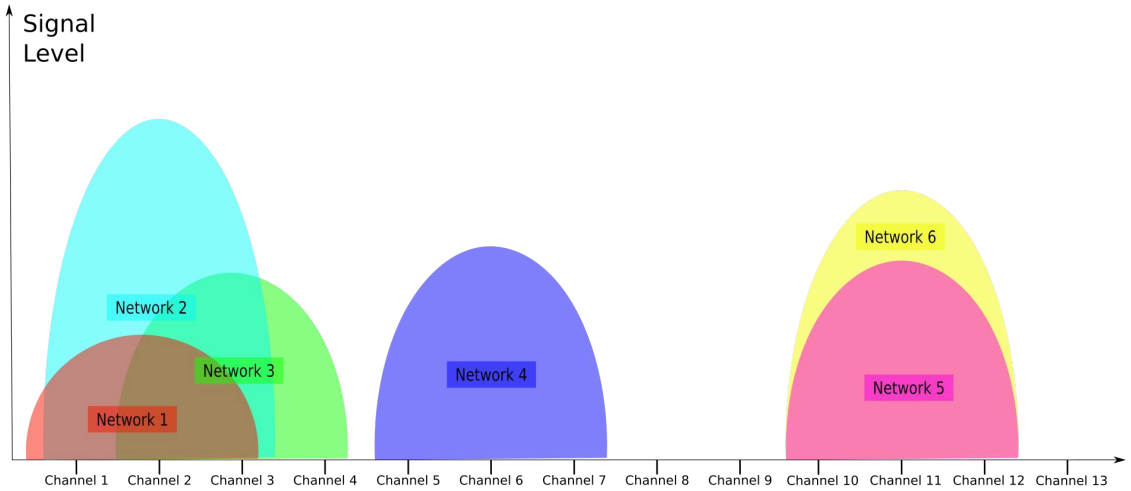


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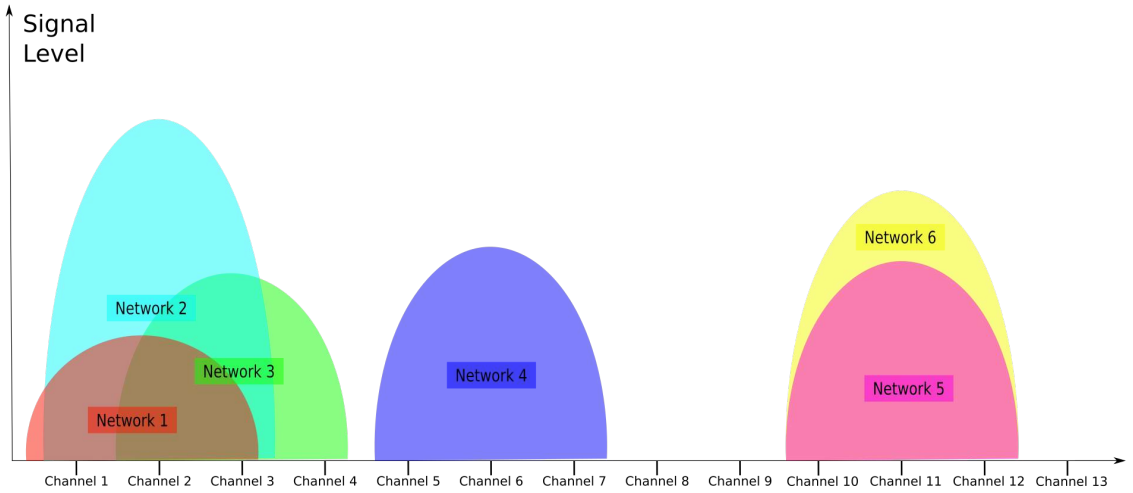


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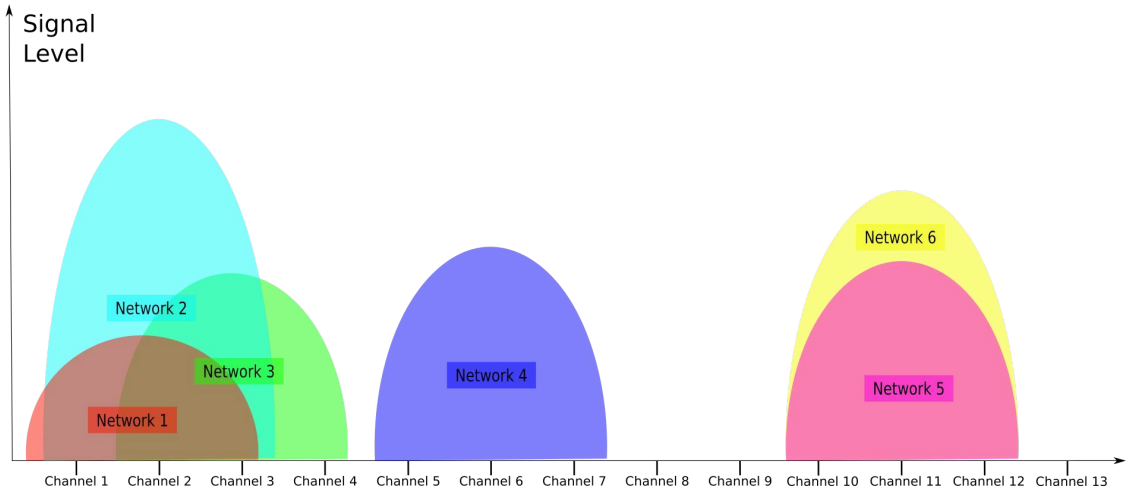


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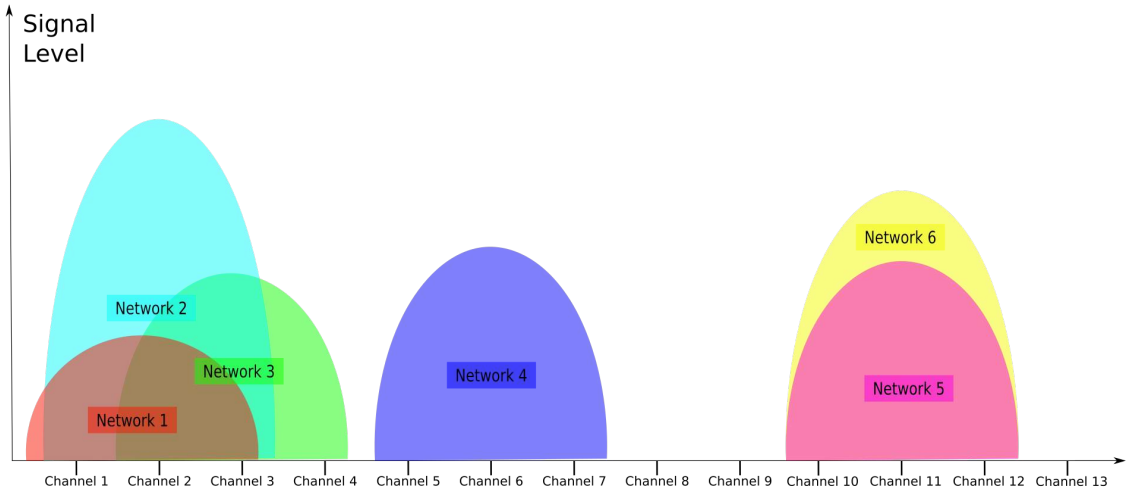


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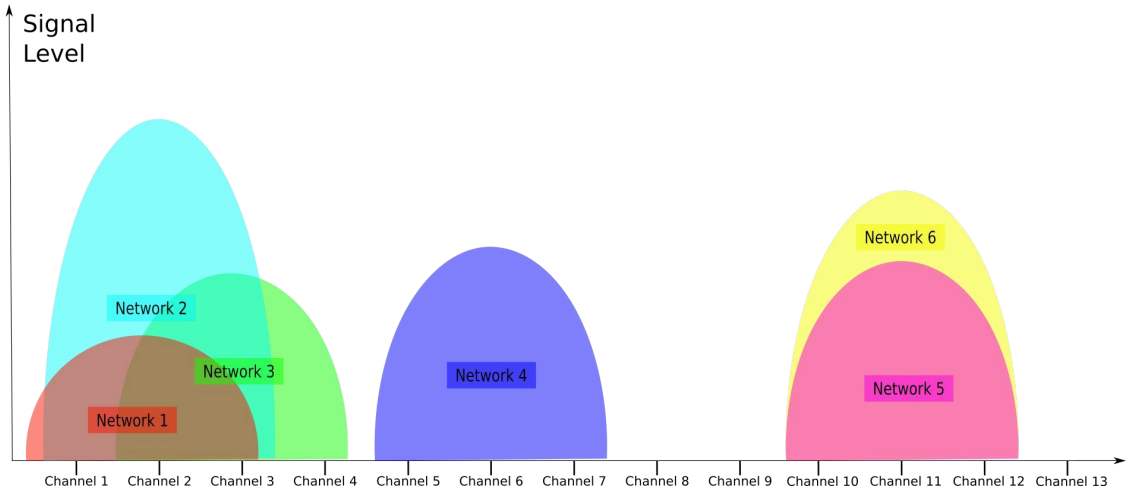


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   Network 1, 2, and 3 use overlapping channels. Typically selecting other channels than 1, 6, 11, and 14 is not recommended.

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

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   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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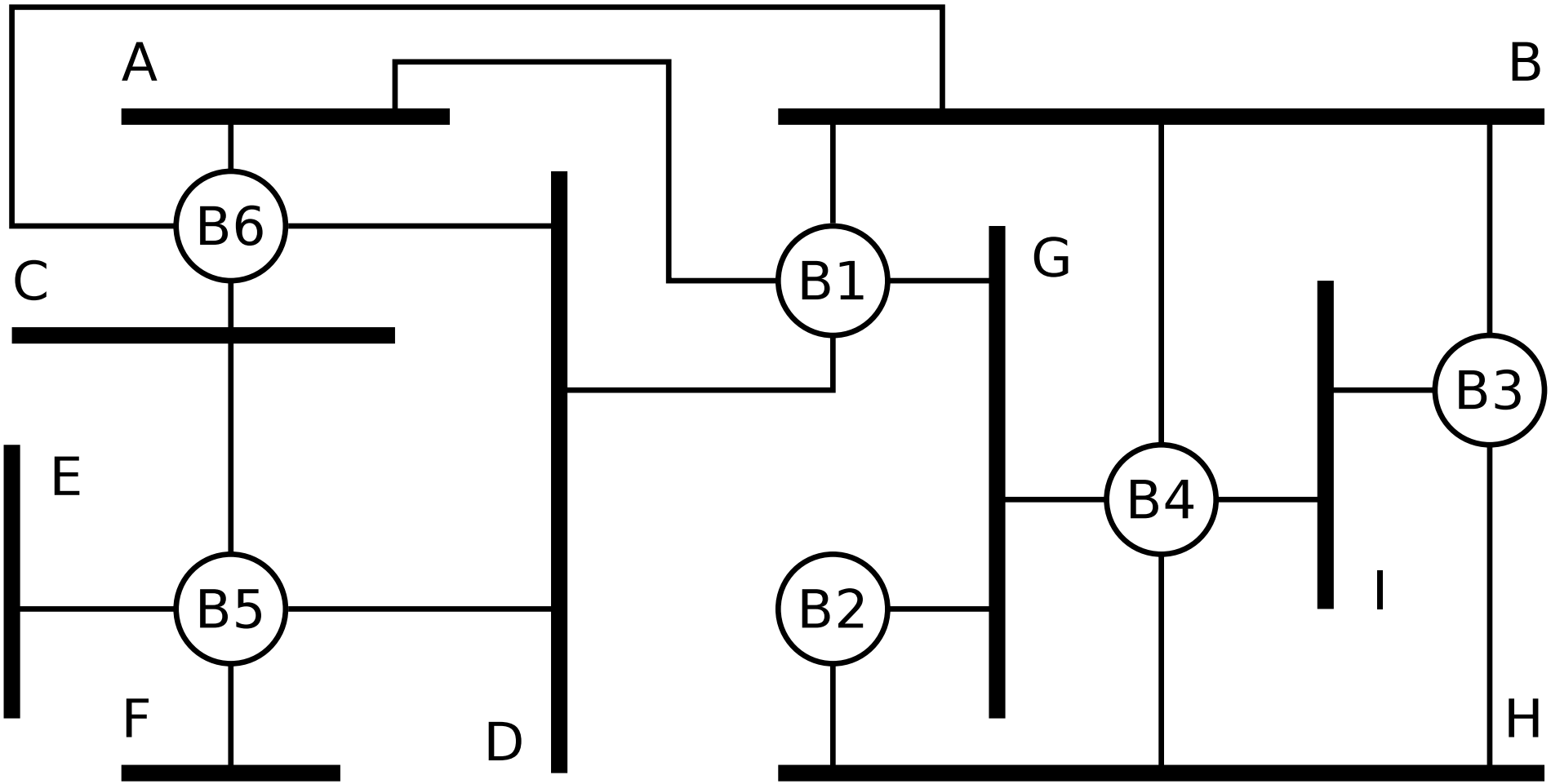

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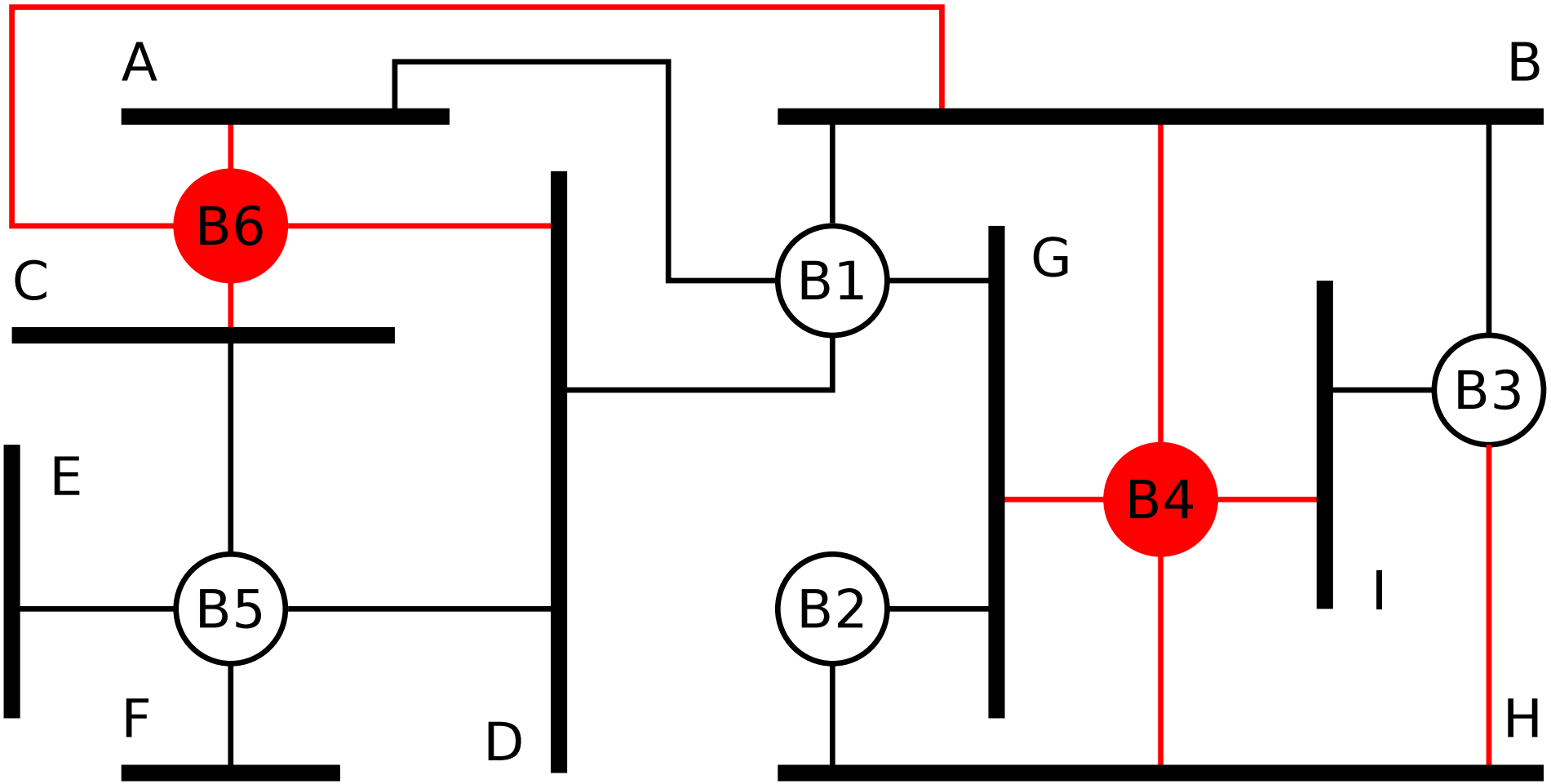

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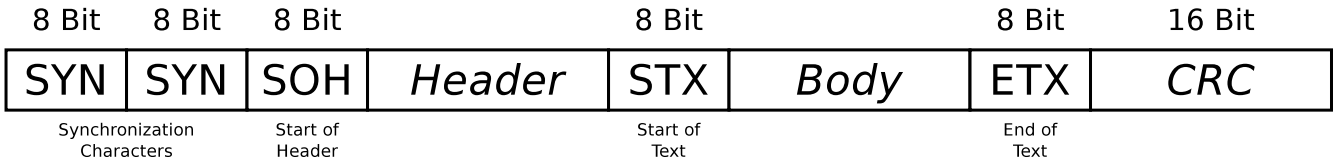
   Changing the MAC address of a device to fake its identity.

# Exercise 8: Byte Stuffing




| **Control character** | SOH | STX | ETX | DLE | SYN |
|---|---|---|---|---|---|
| **Hexadecimal notation** | 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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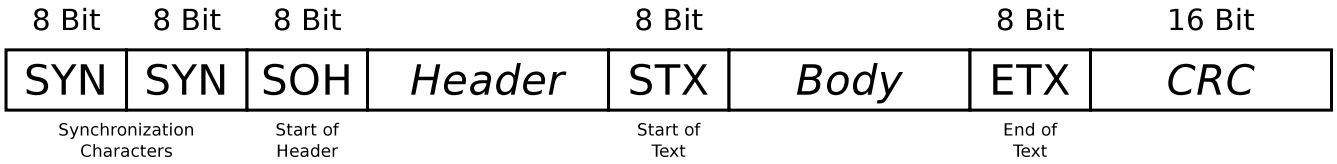


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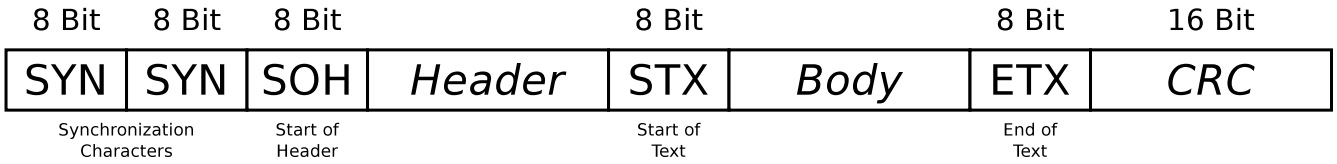


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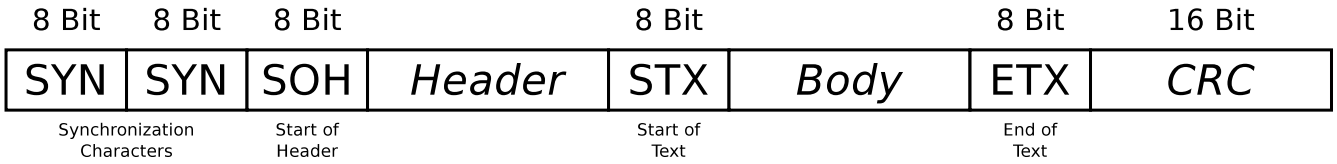


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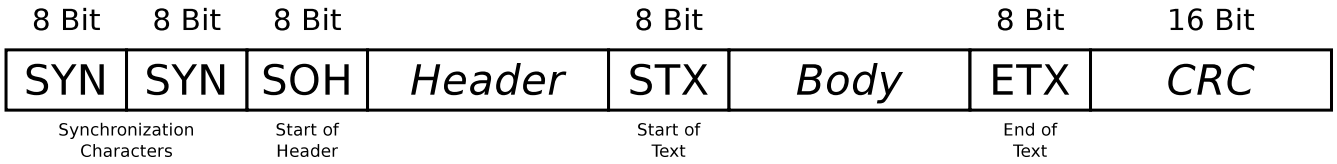


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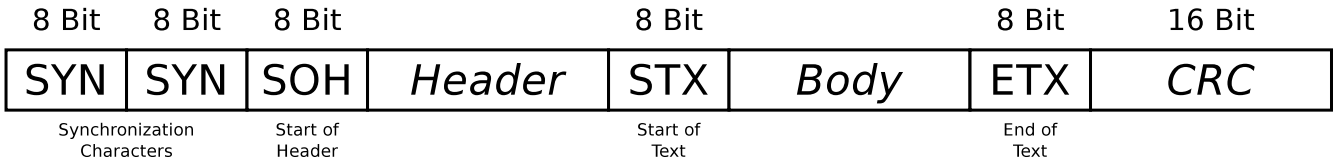


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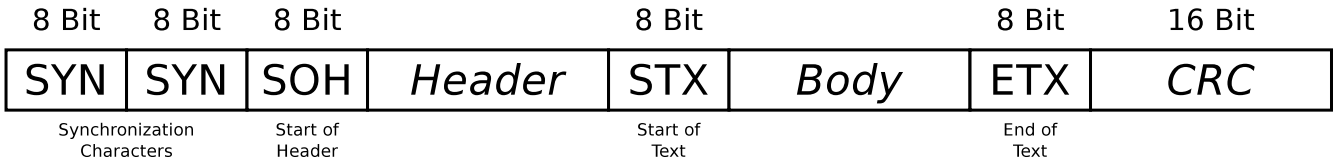


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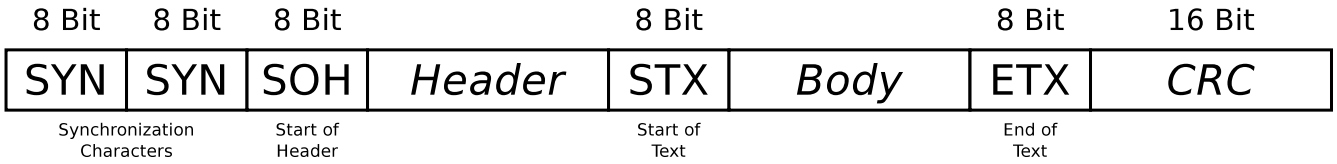


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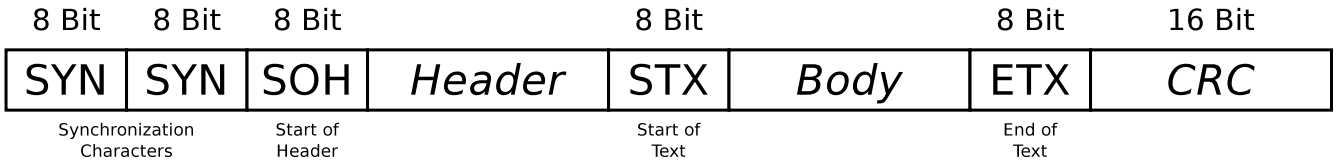


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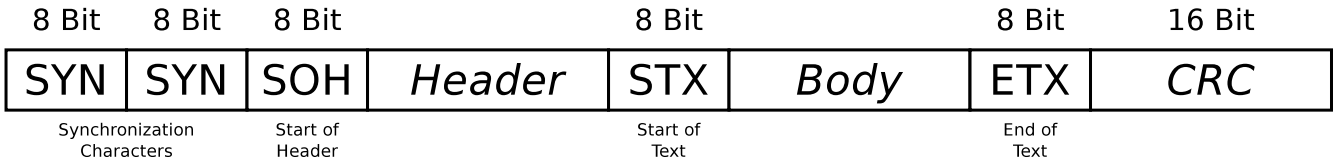


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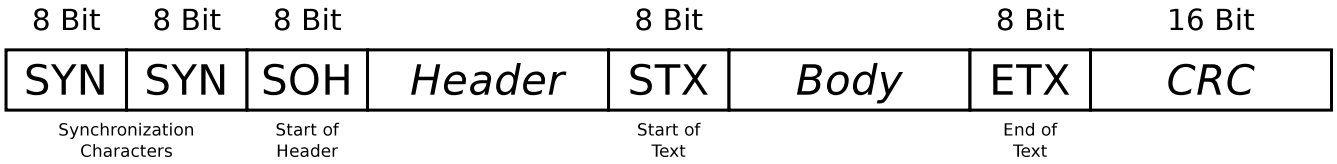


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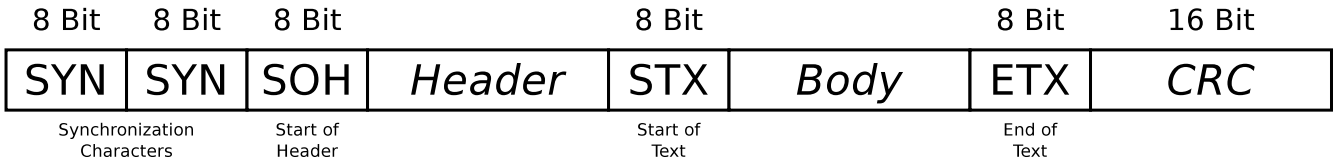


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1. `01111110 10100111 11111000 11110010 10011111 10111111 11100101`

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1. 01111110 10100111 11111000 11110010 10011111 10111111 11100101
   01111101 01010011 11101110 00111100 10100111 11010111 11011110 0101

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1. 01111110 10100111 11111000 11110010 10011111 10111111 11100101
   01111101 01010011 11101110 00111100 10100111 11010111 11011110 0101
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