

# Lab 2 - Subnetting, Static routing

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## How network work

### Layers Overview

- **Physical Layer (L1):** Defines how information is transmitted over the medium (e.g., copper, fiber optics, air).
- **Link Layer (L2):** Manages physical addressing with unique **MAC addresses**.
- **Network Layer (L3):** Handles distant addressing and routing using **IP addresses**.
- **Transport Layer (L4):** Adds ports for multiplexing connections (e.g., TCP, UDP).
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### L2 and L3 Addressing

- **MAC Address (L2):** A unique identifier for a network interface, constant throughout the device's lifespan.
- **IP Address (L3):** Assigned logically, can change over time, enabling routing between distant nodes.

## ARP (Address Resolution Protocol)

- Resolves a given IP address to its corresponding MAC address.
- **Process:**
  - ARP Request: Broadcast to discover the MAC address of an IP.
  - ARP Reply: The target responds with its MAC address.
- MAC addresses collected are cached and can be viewed with `ip neigh`.

## IP and routing

### IP Subnetting

- Divides IP addresses into logical groups for better routing and management.
- Example:
  - Subnet `192.168.1.0/24` includes addresses from `192.168.1.0` to `192.168.1.255`.
  - The `/24` indicates 24 fixed bits in the network mask.

### Routing

- **Routing Table:** Guides packets to their destination.
  - Routes can be added using `ip route add [subnet] via [next_hop_ip]`.
- **Decision Process:**
  - Match the destination IP to a subnet in the table.
  - Use the **longest prefix match** for overlapping subnets.
- **Local vs. Non-local:**

- Local: Destination is in the same subnet; send ARP request for MAC address.
- Non-local: Forward to a router using its MAC address.

## Security Considerations

- **MAC Spoofing:** Changing a MAC address (e.g., `ip link set eth0 address xx:xx:xx:xx:xx:xx`) can bypass security mechanisms like MAC-based authentication.
- **Tracking:** MAC addresses can be used for device tracking and localization, even with randomization.