

# Structure of IPv4 Packets (1/7)

- **Version (4 bits)**

- Protocol version

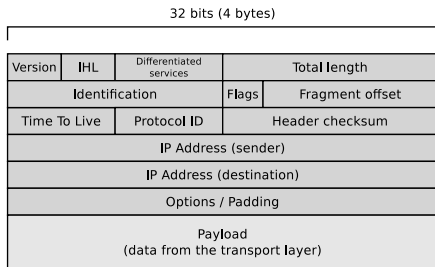
- Version = 4  $\Rightarrow$  IPv4
    - Version = 6  $\Rightarrow$  IPv6

- **IHL = IP Header Length (4 bits)**

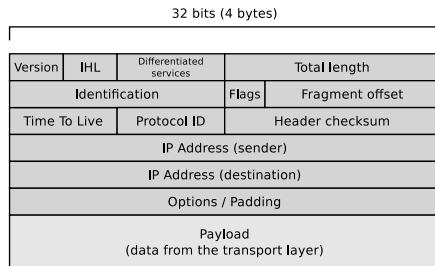
- Header length, represented as the number of 4 byte words
    - Example: IHL = 5  $\Rightarrow$  5 \* 4 bytes = 20 bytes
  - Indicates where the payload begins

- **Differentiated services (8 bits)**

- Prioritization of IP packets is possible with this field (Quality of Service)
  - The field slightly changed over the years (RFC 791, RFC 2474, RFC 3168)



## Structure of IPv4 Packets (2/7)

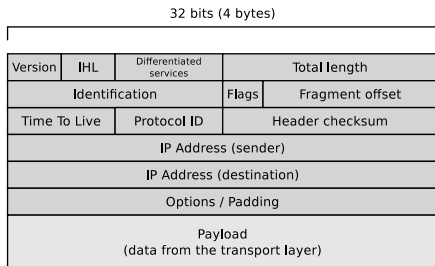


- **Total length (16 bits)**

- This field defines the entire packet size (header and payload)
  - This length of the field is 16 bits and therefore the maximum possible IPv4 packet length is 65,535 bytes

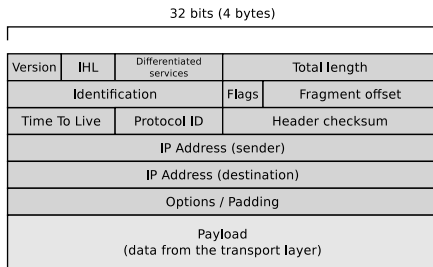
## Structure of IPv4 Packets (3/7)

- The fields **Identification**, **Flags** and **Fragment offset** control the assembly of fragmented IP packets
- **Identification** (16 bits)
  - Contains a unique identifier of the IP packet



- **Flags** (3 bits)
  - Here the sender informs whether the packet can be fragmented and the receiver is informed whether more fragments follow
- **Fragment Offset** (13 bits)
  - Contains a number which states for fragmented packets, from which position of the unfragmented packet the fragment begins

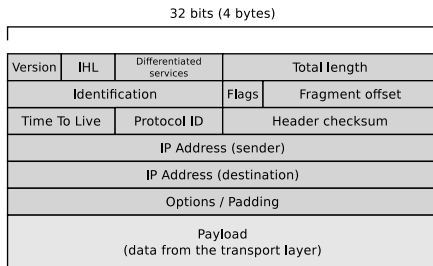
# Structure of IPv4 Packets (4/7)



## ● Time To Live (8 bits)

- Specifies the maximum lifetime of an IP packet during transmission in seconds
- If the value is zero, the packet is discarded by the Router
- In practice, the field is used as a hop count and each Router on the route to the destination decrements the TTL field by one
- Prevents that undeliverable IP packets endlessly go in cycles on the network

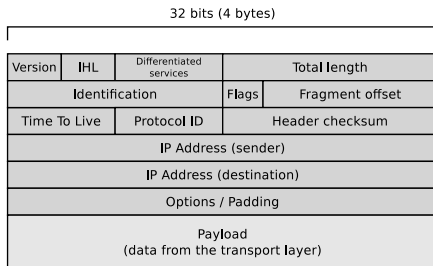
# Structure of IPv4 Packets (5/7)



## ● Protokoll ID (8 bits)

- Contains the number of the Transport Layer protocol used
- For TCP segments, the value is 6
- For UDP segments, the value is 17
- If the payload contains an ICMP message, this field contains the value 1
- If the payload contains an OSPF message, this field contains the value 89

# Structure of IPv4 Packets (6/7)

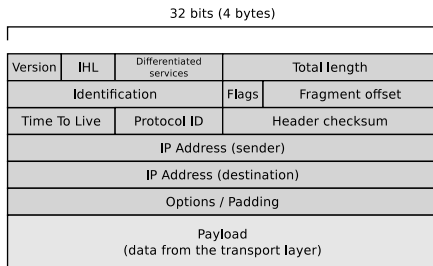


- Each IPv4 packet contains a checksum (16 bits) of the header
  - Because at each Router on the way to the destination, the content of the field **Time To Live** changes, each Router need to verify the checksum, recalculate and insert it into the header

Routers usually ignore the checksum to speedup the packet forwarding

Therefore, IPv6 packets contain no checksum field

# Structure of IPv4 Packets (7/7)



- The field **IP address (sender)** (32 bits) contains the source address and **IP address (destination)** contains the destination address
- The field **Options / Padding** can contain additional information such as a time stamp
  - This last field before the payload area is filled with padding bits (0 bits) if necessary, to ensure that the header size is an integer number of 32 bit words
- The last field contains the data from the Transport Layer