

# IPv6 Datagram Header

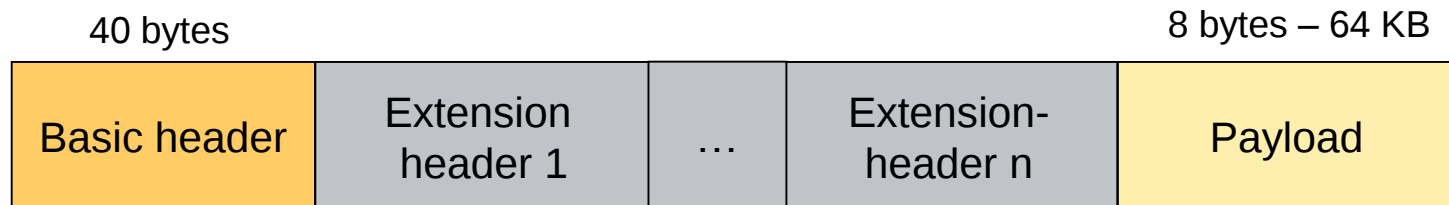
1

## Observation:

- In old IPv4 headers many fields are often empty or not relevant
  - Waste of space
  - Increased router load

New idea of IPv6 design:

- Use of smaller headers that are also better adapted to the respective situation



optional

**IPv6 data packet**

# IPv6 Basic Header

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## IPv6 basic header:

Contains two 128 bit addresses - is however only 40 bytes long!

| Version             | Transport Class | Flow Label  |           |
|---------------------|-----------------|-------------|-----------|
| Payload Length      |                 | Next Header | Hop Limit |
| Source Address      |                 |             |           |
| Destination Address |                 |             |           |

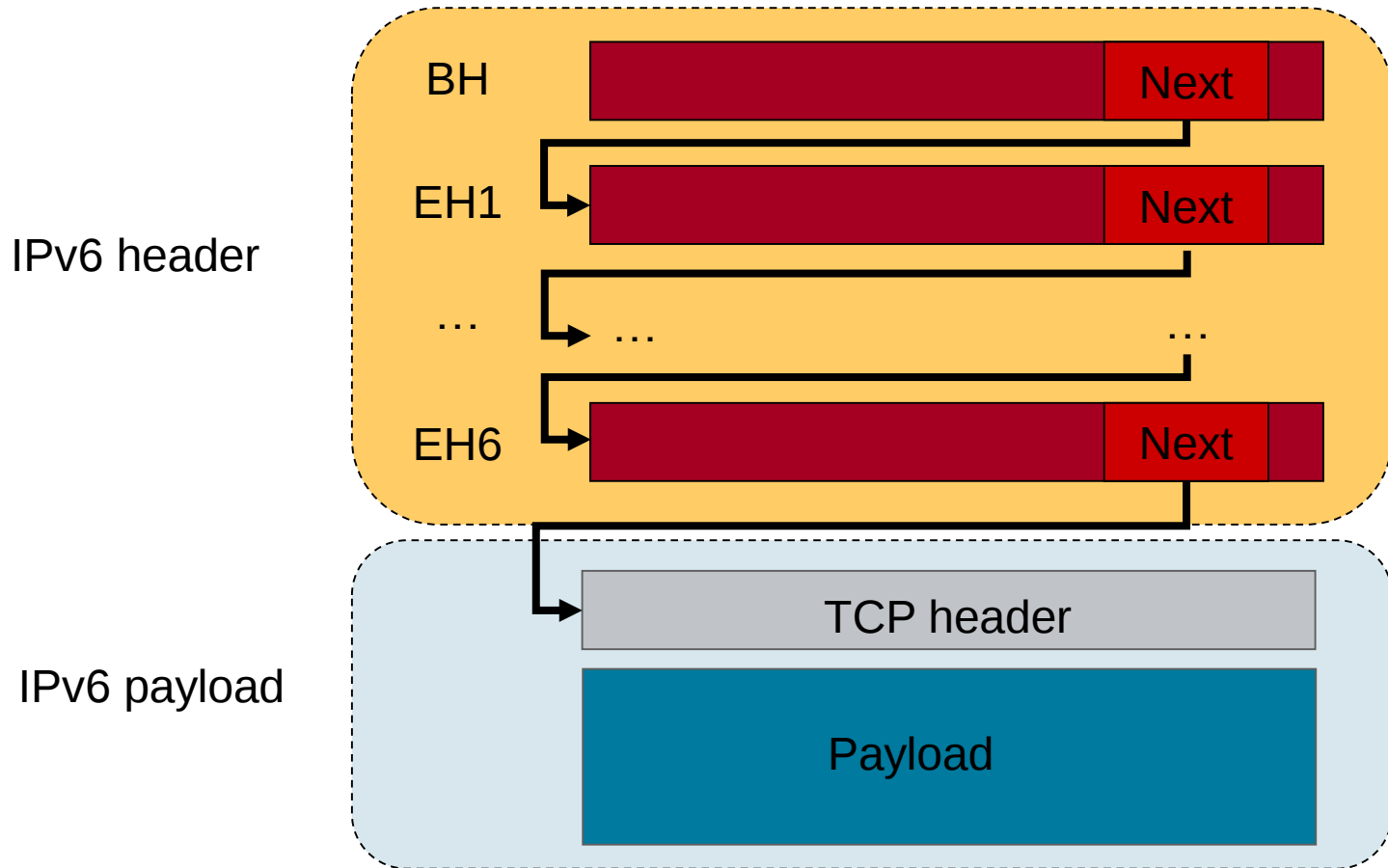
**Transport Class:** (0-7) → normal communication, (8-15) → audio/video

**Flow Label:** ID for virtual end-to-end connection, reduction of router load(!)

**Next Header:** Type of subsequent header (extension header/TCP)

# IPv6 Extension Header (1/3)

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# IPv6 Extension Header (2/3)

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## **Hop-by-hop header**

- Contains information (TLV – Type-Length-Value) that is interpreted by every router on the way to the receiver
- Always the first extension header after the basic header
- Variable length (application specific)

## **Destination options header**

- Contains (TVL) information for router and/or for receiving computer
- Router informationen → directly after the basic header
- Receiver information → directly before the payload

## **Routing header**

- Gives lists of routers that must be passed in part or in whole (strict/loose source routing)

# IPv6 Extension Header (3/3)

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## **Fragment header**

- Information about the fragmentation of a data packet if the MTU of the network to be traveled is exceeded

## **Authentication header**

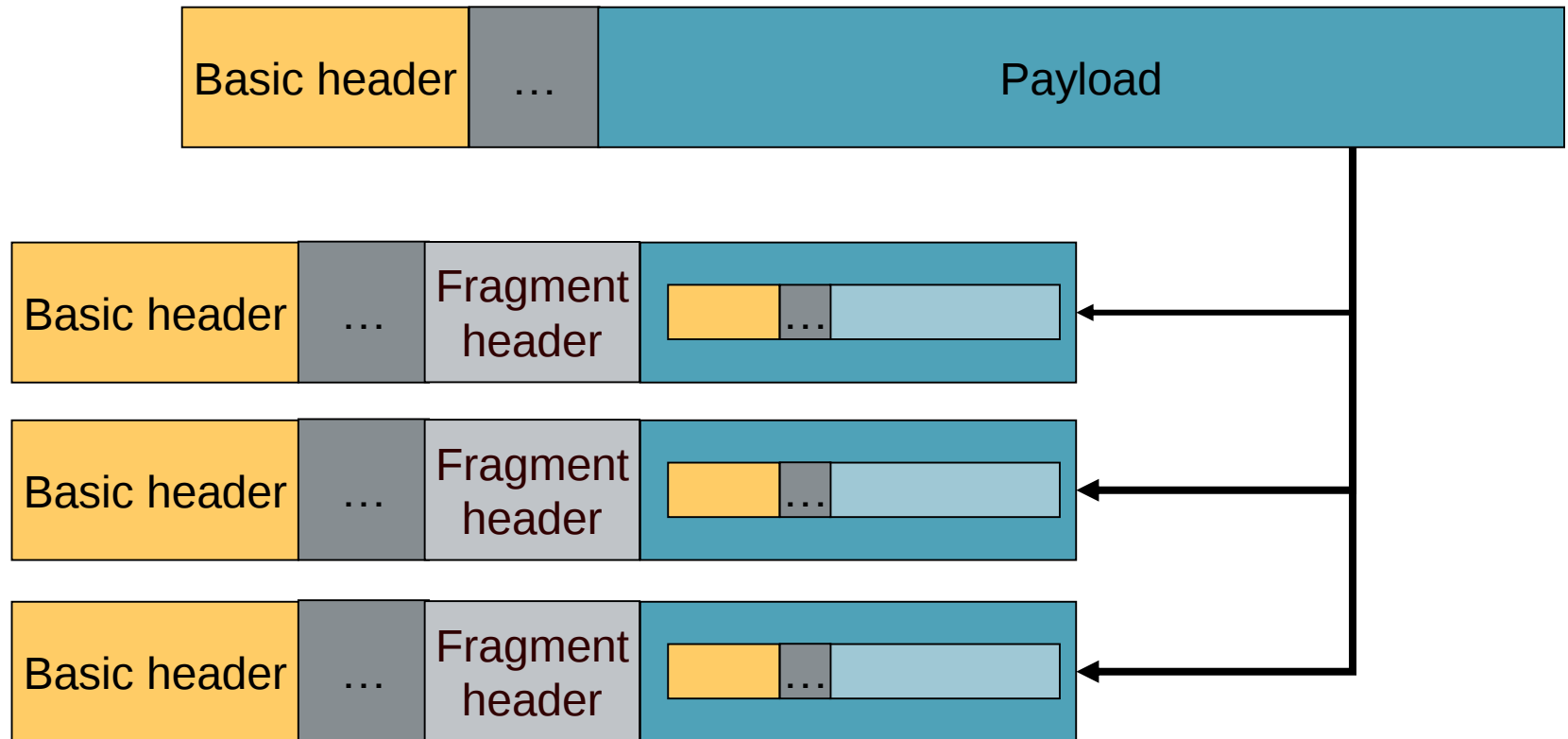
- Checksum/signature for the authentication of the sender

## **Encapsulation security payload**

- Key number for encryption of the payload/header

# IPv6 Fragmentation (1/3)

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# IPv6 Fragmentation (2/3)

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## End-to-end fragmentation

- IPv6 routers expect correctly sized IPv6 datagrams
  - → Eases the load on the router
- Sender takes over fragmentation
- Matching fragment size?
  - Minimum MTU (Maximum Transmission Unit) 1280 bytes
  - Path MTU Discovery

## Problems:

- Limited flexibility
- Re-routing of datagrams is no longer possible without effort
- Requires new MTU calculation

# IPv6 Fragmentation (3/3)

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## Path MTU Discovery

IPv6 router do not carry out fragmentaion, thus sender must be able to determine whether package size is too large

- Sender estimates the Path MTU, i.e. the minimum MTU on the route to the receiver (initial: MTU of its own LAN)
- If a router determines that the packet is too big for the LAN link to the next router, it answers the sender with the ICMPv6 message "Packet Too Big"
  - ICMPv6 is a protocol for status and error message
  - "Packet Too Big" message contains the (smaller) MTU of the next link
- Sender can start a new attempt with a smaller MTU from the error message

# IPv6 Jumbo Payload

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IPv6 offers the possibility of transporting datagrams with a payload length  $> 65.535$  bytes – “**jumbo gram**”

Identification proceeds with help of the hop-by-hop extension header

