Subject: Computer networks
Topic: IPV6 header format
Name of the teacher: Lisna Thomas
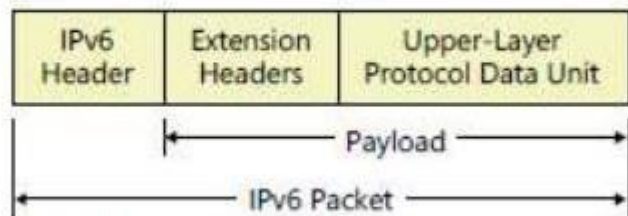Academic year: 2020-2021

# IPV6 HEADER FORMAT
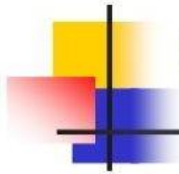
# Components of IPv6 Packet

- An Internet Protocol version 6 (IPv6) packet consists of an IPv6 header, extension headers, and an upper-layer protocol data unit.

| IPv6 Header | Extension Headers | Upper-Layer Protocol Data Unit |
|---|---|---|

Payload

IPv6 Packet

FIGURE 4-1 The structure of an IPv6 packet.

# Components... (contd.)

- **IPv6 Header -** The IPv6 header is always present and is a fixed size of 40 bytes.

- **Extension Headers -** Zero or more extension headers can be present and are of varying lengths.

  - If extension headers are present, a Next Header field in the IPv6 header indicates the first extension header.
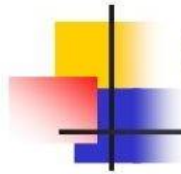
# Components... (contd.)

- **Upper-Layer Protocol Data Unit** The upper-layer protocol data unit (PDU) typically consists of an upper-layer protocol header and its payload (for example, an ICMPv6 message, a TCP segment, or a UDP message)

# IPv6 Header

- The IPv6 header is a streamlined version of the IPv4 header.

- It eliminates fields that are either unneeded or rarely used, and it adds a field that provides better support for real-time traffic.
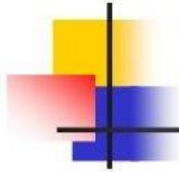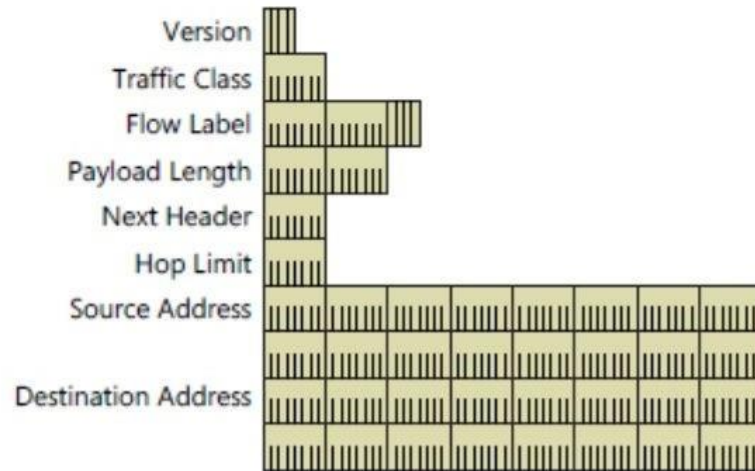
# IPv6 Header (contd.)

- The IPv6 header and extension headers replace the existing IPv4 header and its options.

- The new extension header format allows IPv6 to be enhanced to support future needs and capabilities. Unlike options in the IPv4 header, IPv6 extension headers have no maximum size and can expand to accommodate all the extension data needed for IPv6 communication

# IPv6 Header (contd.)

- ## Structure of an IPv6 Header



**FIGURE 4-3** The structure of the IPv6 header.

# IPv6 Header (contd.)

- **Version** The Version field indicates the version of IP and is set to 6.

- **Traffic Class** The Traffic Class field indicates the IPv6 packet's class or priority. The size of this field is 8 bits. This field provides functionality similar to the IPv4 Type of Service field.

# IPv6 Header (contd.)

- **Flow Label** The Flow Label field indicates that this packet belongs to a specific sequence of packets between a source and destination, requiring special handling by intermediate IPv6 routers.

- The size of this field is 20 bits.

# IPv6 Header (contd.)

- The flow label is used for prioritized delivery, such as delivery needed by real-time data (voice and video).

- For default router handling, the Flow Label field is set to 0. To distinguish a given flow, an intermediate router can use the packet's source address, destination address, and flow label. Therefore, there can be multiple flows between a source and destination, as distinguished by separate non-zero flow labels.
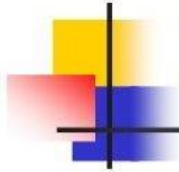
# IPv6 Header (contd.)

- **Payload Length** The Payload Length field indicates the length of the IPv6 payload.

- The size of this field is 16 bits. The Payload Length field includes the extension headers and the upperlayer PDU.
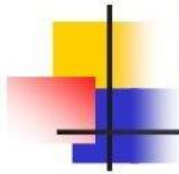
# IPv6 Header (contd.)

- With 16 bits, an IPv6 payload of up to 65,535 bytes can be indicated.

- For payload lengths greater than 65,535 bytes, the Payload Length field is set to 0 and the Jumbo Payload option is used in the Hop-by-Hop Options extension header

# IPv6 Header (contd.)

- **Next Header** The Next Header field indicates either the type of the first extension header (if present) or the protocol in the upper-layer PDU (such as TCP, UDP, or ICMPv6).

- The size of this field is 8 bits.

# IPv6 Header (contd.)

- **Hop Limit** The Hop Limit field indicates the maximum number of links over which the IPv6 packet can travel before being discarded.

- The size of this field is 8 bits.

- When Hop Limit equals 0 at a router, the router sends an ICMPv6 Time Exceeded-Hop Limit Exceeded in Transit message to the source and discards the packet.

# IPv6 Header (contd.)

- **Source Address** The Source Address field indicates the IPv6 address of the originating host.

- The size of this field is 128 bits.

# IPv6 Header (contd.)

- **Destination Address** The Destination Address field indicates the IPv6 address of the current destination node.

- The size of this field is 128 bits.

# IPv6 Header (contd.)

- In most cases, the Destination Address field is set to the final destination address. However, if a Routing extension header is present, the Destination Address field might be set to the address of the next intermediate destination.

# Values for the Next Header Field

- Table 4-1 lists typical values of the Next Header field for an IPv6 header or an IPv6 extension header.

**TABLE 4-1** Typical Values of the Next Header Field

| Value (Decimal) | Header |
|---|---|
| 0 | Hop-by-Hop Options header |
| 6 | TCP |
| 17 | UDP |
| 41 | Encapsulated IPv6 header |
| 43 | Routing header |
| 44 | Fragment header |
| 50 | Encapsulating Security Payload header |
| 51 | Authentication header |
| 58 | ICMPv6 |
| 59 | No next header |
| 60 | Destination Options header |

# Values for the Next Header Field (contd.)

- In looking at the value of the Next Header field to indicate no next header, it would seem to make more sense to set its value to 0, rather than 59. However, the designers of IPv6 wanted to optimize the processing of IPv6 packets at intermediate routers. The only extension header that must be processed at every intermediate router is the Hop-by-Hop Options header. To optimize the test of whether the Hop-by-Hop Options header is present, its Next Header value is set to 0. In router hardware, it is easier to test for a value of 0 than to test for a value of 59.
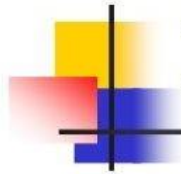
# IPv6 Header vs IPv4 Header

- **IPv6 Headers has been designed to be more efficient than IPv4.**
  - The number of fields that must be processed by an intermediate router has dropped from 6 to 4, making the forwarding of normal IPv6 packets more efficient.
  - Seldom-used fields, such as fields supporting fragmentation and options in the IPv4 header, have been moved to extension headers in the IPv6 header.