IPv6 [RFC 2460]

Mainly to have more IP addresses

Also to fix many problems with IPv4

128 bit addresses (instead of 32 bits)

Header format simplifications

Flow labeling and traffic class capabilities

Authentication and privacy capabilities

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### Fields

- **Version = 6**
- **Class:** DiffServ Packet Priority
- **Flow Label:** packets needing special handling
- **Payload length:** Packet length-IPv6 header in bytes
- **Next Header:** Type of extension if any; demux key for higher layer protocols

### Fields continued

- **Hop limit:** Instead of TTL

IPv6 header is always 40 bytes long

Options, if present, must appear in a certain order

Routers need not look at all optional headers [will know when to look]

Option processing is very fast
Headers

- Order of extension headers or options
- Extension header processes in the order
- Hop-by-hop option header immediately after IPv6 header (only these are processed by intermediate routers; other headers by the destination only)
- Discard packet and send ICMP message to source if expected header is missing
- Each extension header is integral X 8 bytes

Type of extension headers

- Hop-by-hop
- Routing
- Fragment
- Destination options
- Authentication
- ESP [Encapsulated Security Payload]
### Options

<table>
<thead>
<tr>
<th>Option Type</th>
<th>Option Data Length</th>
<th>Option Data</th>
</tr>
</thead>
</table>

First 2 bits of option type:

- 00 : skip this option
- 01 : discard the packet
- 10 : Send an ICMP packet to source
- 11 : If dest is not a multicast address, send ICMP packet to destination

Third bit of option type:

- 0 : option data cannot change en route
- 1 : option data can change en route

### Options Headers

1. Hop-by-hop (Next header = 0 in IPv6 header)

2. Routing Header:
   - List one/more intermediate routers to be visited (like source routing in IPv4; source specifies route)
Read

- Fragmentation Header
- Destination Options Header

From RFC

Addresses

<table>
<thead>
<tr>
<th>Address Prefixes</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000 0000</td>
<td>Reserved</td>
</tr>
<tr>
<td>0000 0001</td>
<td>Unassigned</td>
</tr>
<tr>
<td>0000 001</td>
<td>Reserved</td>
</tr>
<tr>
<td>0000 010</td>
<td>Reserved</td>
</tr>
<tr>
<td>0000 011</td>
<td>Unassigned</td>
</tr>
<tr>
<td>0000 1</td>
<td>Unassigned</td>
</tr>
<tr>
<td>001</td>
<td>Reserved</td>
</tr>
<tr>
<td>1111 1110 10</td>
<td>Link local use addresses</td>
</tr>
<tr>
<td>1111 1110 11</td>
<td>Site local use addresses</td>
</tr>
<tr>
<td>1111 1111</td>
<td>Multicast address</td>
</tr>
</tbody>
</table>
IP Address Configuration

- Stateless Address Configuration (no need for DHCP)
- How?
  - Get interface ID that is unique on that link [using locally available info]
  - Correct network prefix (from router)
  - IP address = Subnet prefix + Interface ID
  - Perform duplicate address detection if needed

<table>
<thead>
<tr>
<th>Subnet prefix (n)</th>
<th>Interface ID (128-n)</th>
</tr>
</thead>
</table>

Address assignment

- IP address of an interface has finite lifetime
- On expiry, assignment is gone