ICMPv6
Internet Control Message Protocol version 6

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Use Cases

- Diagnostics
- Neighbor Discovery
- Multicast group management
- Issue notification

Includes functions that in IPv4 were in

- ARP (Address Resolution Protocol)
- IGMP (Internet Group Membership Protocol)
Message Format

- Encapsulated in IP packets
- At most 576 bytes

<table>
<thead>
<tr>
<th>8</th>
<th>8</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Code</td>
<td>Checksum</td>
</tr>
</tbody>
</table>

Message Body
Type Field

1  Destination Unreachable
2  Packet too big
3  Time exceeded
4  Parameter Problem
128 Echo Request
129 Echo Reply
130 Multicast Listener Query
131 Multicast Listener Report
132 Multicast Listener Done
133 Router Solicitation
134 Router Advertisement
135 Neighbor Solicitation
136 Neighbor Advertisement
137 Redirect
Error Messages

- Destination Unreachable (type = 1)
- Packet too big (type = 2)
- Time exceeded (type = 3)
- Parameter Problem (type = 4)

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<thead>
<tr>
<th>Type</th>
<th>Code</th>
<th>Checksum</th>
<th>Parameter</th>
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<tbody>
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Header of the IP packet that caused the error
Echo Messages

- Echo request (type= 128)
- Echo reply (type= 129)

<table>
<thead>
<tr>
<th>Type</th>
<th>Code</th>
<th>Checksum</th>
<th>Identifier</th>
<th>Sequence Number</th>
<th>Data</th>
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<td>16</td>
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<td>Data</td>
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</tbody>
</table>
## Neighbor Solicitation

<table>
<thead>
<tr>
<th>Type</th>
<th>Code</th>
<th>Checksum</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reserved</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Target Address</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Options</td>
</tr>
</tbody>
</table>

The Neighbor Solicitation message is used to solicit the link-layer address for a neighbor node. It is sent by a router or a host when it is unable to reach a neighbor node. The message contains a reserved field, the target address of the node being solicited, and an options field that may contain additional information such as the lifetime of the address or the length of time the responding node will cache the address.
Neighbor Advertisement

![Diagram of Neighbor Advertisement]

- Type
- Code
- Checksum
- Reserved
- Target Address
- Options
Multicast Communication in the Internet

[a digression]
What is it?

Packets addressed to a multicast address
How it works

- Within a link, rely on data link layer multicasting service
  - Mapping of IPv6 multicast addresses onto MAC multicast addresses
- Among links, packets routed by routers
  - ICMPv6 to know on-link members
    - Hosts interests in receiving packets
  - Multicast routing protocols to know where there are off-link members
Host Membership Discovery

- R to announce multicast groups G and F
- R to forward packets to G and F
ICMPv6: Group Management

- Multicast Listener Query (type=130)
  - General
  - Multicast group (address) specific
- Multicast Listener Report (type=131)
- Multicast Listener Done (type=132)

<table>
<thead>
<tr>
<th>Type</th>
<th>Code</th>
<th>Checksum</th>
<th>Multicast Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Response Delay</td>
<td>Unused</td>
<td></td>
<td></td>
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</table>
