The IPv6 Compressed Routing Header (CRH)

Draft-bonica-6man-comp-rtg-hdr

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Network Programming -> Two SID Classes

**Transport SIDs**
- Steers packets to the terminal segment
- Processed at non-terminal segment endpoints (SL > 0)
- Example: END, END.X
- Relatively few of these
- Simple semantic
  - Carries relatively little information

**Service SIDs**
- Determines behavior at the terminal segment
- Processed at terminal segment endpoint only (SL = 0)
- Example: END.DX4, END.DX6
- Relatively many of these
- Rich semantic
  - Carry many bits of information
IPv6 -> Two Ways To Deliver Instructions To Downstream Nodes

**Routing Extension Header**
- Steers packets from ingress to egress
- Processed at non-terminal segment endpoints (SL > 0)
- Well-positioned to carry Transport SIDs

**Destination Options Header**
- Determines behavior at egress node
- Processed at terminal segment endpoint only (SL = 0)
- Well-positioned to carry Service SIDs
The Problem With Routing Headers

• Too Long
  • Typically 8 bytes of overhead (4 bytes are mandatory)
  • Typically, another 16 bytes per SID
  • Routing header with 3 SIDs is 56 bytes long

• Not ASIC Friendly
  • Processing long extension headers is computationally expensive

• Impose unreasonable bandwidth overhead
  • Short packets (>500) bytes are common on the Internet
  • Routing header with three SIDS may become common
  • > 10% Routing header overhead
Proposal

• Encode Transport SIDs in a new, compressed routing header
  • Draft-bonica-6man-comp-rtg-hdr
  • Topic of this talk

• Encode Service SIDs in new IPv6 Destination Options
  • Draft-bonica-6man-vpn-dest-opt
  • Topic of the next talk
Compressed Routing Header (CRH)

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<td></td>
<td></td>
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</tr>
</tbody>
</table>

+-+-+-+-+-+-+-+--------------------------------------------------------
| Next Header | Hdr Ext Len | Routing Type | Segments Left |
+-+-+-+-+-+-+-+--------------------------------------------------------
| Last Entry   | Com        | Reserved      |
+-+-+-+-+-+-+-+--------------------------------------------------------
| SID List      |
+-+-+-+-+-+-+-+--
Compressed Routing Header (CRH)

- Initial fields are defined in RFC 8200 and common to all Routing headers
  - Next Header, Header Extension Length, Routing Type and Segments Left
- Last Entry is a pointer to the final entry
- Com field indicates whether SIDs are 8, 16, or 32 bits long
- Each SID maps to an IPv6 address
  - Either through a table lookup or an algorithm
- IPv6 address is copied to the Destination Address field of the IPv6 header
Compressed Routing Header (CRH): Com Equals Zero (8-bit SIDs)
Compressed Routing Header (CRH): Com Equals One (16-bit SIDs)
Compressed Routing Header (CRH): Com Equals Two (32-bit SIDs)
Compliance Benefits

• IPv6 address semantics remain unchanged
  • An IPv6 address represents a node's interface to a subnetwork [RFC 4291]
• No need for transit routers to insert or delete extension headers
• No need for two instances of the CRH in the same packet
• Extension headers are processed in the order that they appear in the packet
  • No need to backtrack when Segments Left is equal to zero
Status

• Operators are expressing interest
• Prototypes under development
  • Forwarding plane
  • ISIS Extensions to support SID Advertisement
Next Steps

• Wide review in SPRING and 6man WGs
• Call for adoption in 6man WG