Extension header attribution option

draft-herbert-6man-eh-attrib-01

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Motivation

- Annotate packets as they transit limited domain for reasons like QoS, IOAM, source routing
- Basic operation
  - Ingress: insert EH or options into a packet
  - Egress: remove inserted extension or options
- Examples
  - Hop-by-hop options (IOAM, network tokens)
  - Routing headers (SR)
  - Destination options before routing header
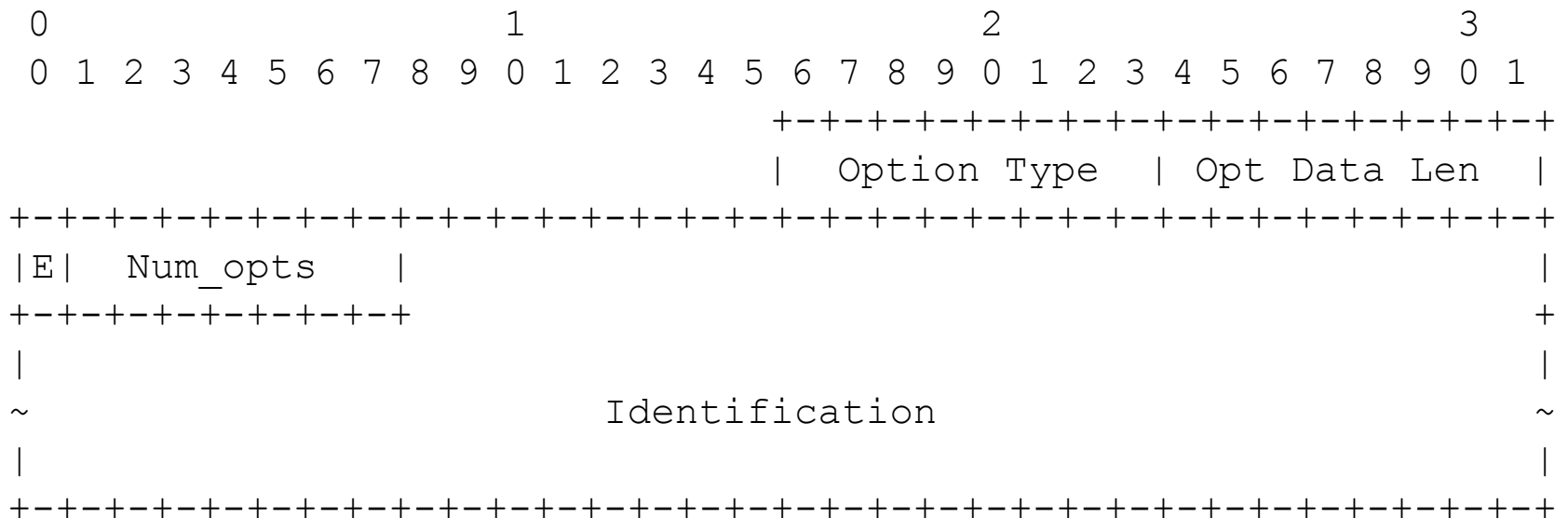
Problems with EH insertion

- A lot of discussion in 6man!
- Breaks fundamental attribution model of IP
- No way to know which headers were inserted
- Break PMTU discovery
- Break ICMP (host get ICMP errors for problems it didn't create)
- No feedback to culprit when a node insert headers than cause packet drops downstream
- Breaks AH if applied to inserted headers

Why not IPIP encapsulation?

- Appropriate destination address may be unknown to encapsulating device
- Consistent routing (ECMP) may be required for annotated and unannotated packets
- Less overhead than encapsulation (worse case is 40 bytes overhead of IPv6 header)

EH attribution option

- Destination or Hop-by-Hop option
- Unambiguously identifies extension headers and options that are inserted in a packet
- Attribute inserted data to responsible node

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
                                +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                                |  Option Type  | Opt Data Len  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|E|  Num_opts    |                                              |
+-+-+-+-+-+-+-+-+-+                                             +
|                                                              |
~                        Identification                        ~
|                                                              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Insertion operation

- Inserting options
  - No DO or HBH EH: insert EH, options are attrib option followed by inserted options
  - Else, make options to be attrib options, inserted options, existing options
- Inserting extension headers (not DO or HBH)
  - Immediately preceded by DestOpt EH
  - DO options are attrib option(EH inserted bit), inserted options, existing options

Removal operation

- Pop extension headers and options in reverse order of insertion
- Modify AH implementations to logically remove inserted data before computation

Stacking

```
+-+-+-+-+-+-+-+-+-+
|  IPv6 header    |
+-+-+-+-+-+-+-+-+-+
|  Hop-by-Hop EH  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+
      |   Attribution Opt |
      +-+-+-+-+-+-+-+-+-+-+
      |  Inserted options |
   +-+-+-+-+-+-+-+-+-+-+-+
   |  DestOpt EH      |
   +-+-+-+-+-+-+-+-+-+-+-+-+
        |    Attribution Opt |---------+    #2 attribution option
        +-+-+-+-+-+-+-+-+-+-+-+        |
        |   Inserted options |        |
        +-+-+-+-+-+-+-+-+-+-+-+        |
        |    Attribution Opt |----+   |    #1 attribution option
        +-+-+-+-+-+-+-+-+-+-+-+    |   |
        |   Original options |    |   |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+    |   |
   |  Inserted EH     |<--------+----+
   +-+-+-+-+-+-+-+-+-+-+         |
   |  Inserted EH     |<---------+
   +-+-+-+-+-+-+-+-+-+
   |  Original EHs    |
   +-+-+-+-+-+-+-+-+-+
```

Next Steps

- Additional comments/feedback
- Request WG adoption