Encapsulation of BFD for SRv6 Policy

draft-liu-spring-bfd-srv6-policy-encap-00

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Monitoring SRv6 Policy

☐ BFD session associated with segment list

• BFD session down --->**segment list** fail---> stop forwarding packet with this segment list

• All segment list fail of active Candidate Path ---> switchover to backup Candidate Path

• All Candidate Path fail --->SRv6 Policy fail

☐ Choice of Address

◆　**S-BFD**

Headend Address:
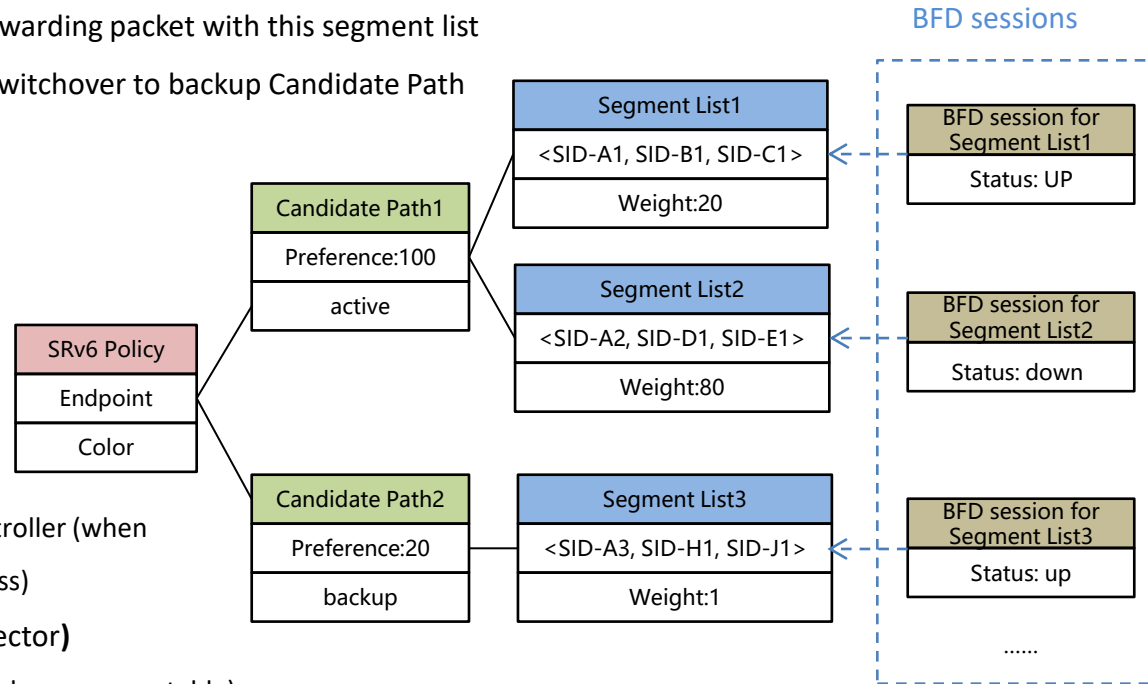
— IPv6 Address of **headend**

Tailend Address:

— endpoint of SRv6 Policy **or**

— specified by local configuration or network controller (when

the endpoint of SRv6 Policy is the unspecified address)

◆　**U-BFD (**for echo packet's U-turn on the reflector**)**

Headend Address: IPv6 address of **headend** (routable or non-routable)

Tailend Address: routable IPv6 address of **headend**

BFD sessions

SRv6 Policy
Endpoint
Color

Candidate Path1
Preference:100
active

Candidate Path2
Preference:20
backup

Segment List1
<SID-A1, SID-B1, SID-C1>
Weight:20

Segment List2
<SID-A2, SID-D1, SID-E1>
Weight:80

Segment List3
<SID-A3, SID-H1, SID-J1>
Weight:1

BFD session for Segment List1
Status: UP

BFD session for Segment List2
Status: down

BFD session for Segment List3
Status: up

……

Encapsulation Mode of BFD packet

BFD packet needs to carry a Segment Routing Header(SRH), which contain a list of SRv6 SID associated with the BFD session.

There are two encapsulation modes:

☐ transport mode

   the SRH is inserted after the IPv6 header

```
                                        Transport mode
+--------------+----------+-------------+------------+
| IPv6 header  |   SRH    | UDP Header  |  Payload   |
+--------------+----------+-------------+------------+
```
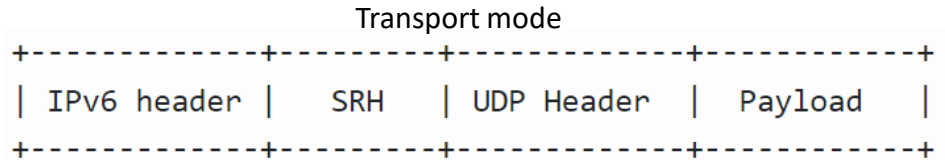
☐ tunnel mode

  an outer IPv6 header with an SRH is encapsulated, which looks like an BFD packet for plain IPv6 is steered into an SRv6 Policy.

```
                                tunnel mode
+--------------+----------+--------------+------------+------------+
| IPv6 header  |   SRH    | IPv6 header  | UDP Header |  Payload   |
+--------------+----------+--------------+------------+------------+
```

3
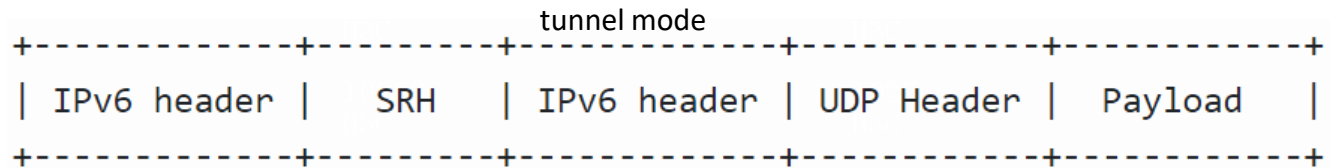
S-BFD in Transport mode

When S-BFD in transport mode:

- Encapsulate **only one IPv6 header** and SRH.

- **Segment List[0]** should be the SRv6 SID or IPv6 address of the tail-end node.

Sometimes, the last segment of Segment list in SRv6 Policy does not belong to the tail-end node, the last segment is

- End.x segment of penultimate hop.

- Binding SID

In such cases

Segment List[0] = IPv6 address or SID of the tail-end node

Segment List[1] = the last segment of the SRv6 Policy Segment-List

```
+-------------------------------------------------------+
| IPv6 Header                                           |
.  Source IP Address = Headend IPv6 Address             .
.  Destination IP Address = Segment List[SL]            .
.  Next-Header = SRH                                    .
.                                                       .
+-------------------------------------------------------+
| SRH                                                   |
.  Segment List[0] = Tail-end IPv6 Address, or          .
.                    Last Segment of SRv6 Policy Segment-List
.  Segment List[1]                                      .
.  Segment List[2]                                      .
.  ...                                                  .
.  Next-Header = UDP                                    .
.                                                       .
+-------------------------------------------------------+
| UDP Header                                            |
.                                                       .
+-------------------------------------------------------+
| Payload                                               |
.                                                       .
+-------------------------------------------------------+
```

S-BFD in Tunnel mode

When S-BFD in tunnel mode:

- Encapsulate **inner IPv6 header** and **Outer SRv6** Encapsulation

- **Segment List[0]** should be the SRv6 SID or IPv6 address of the tail-end node.
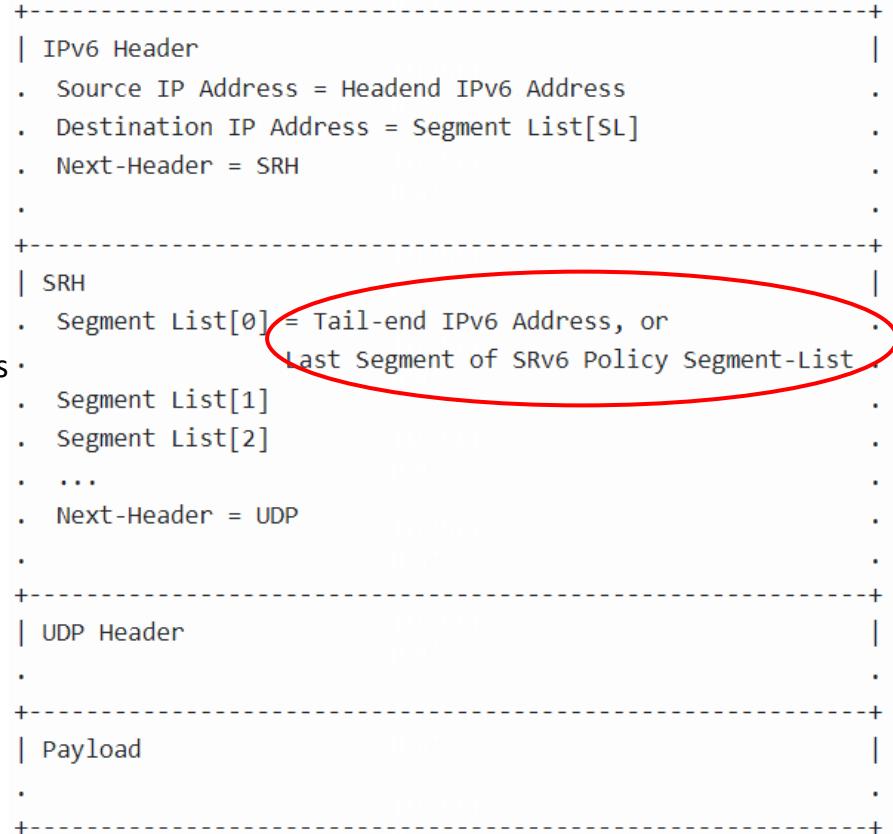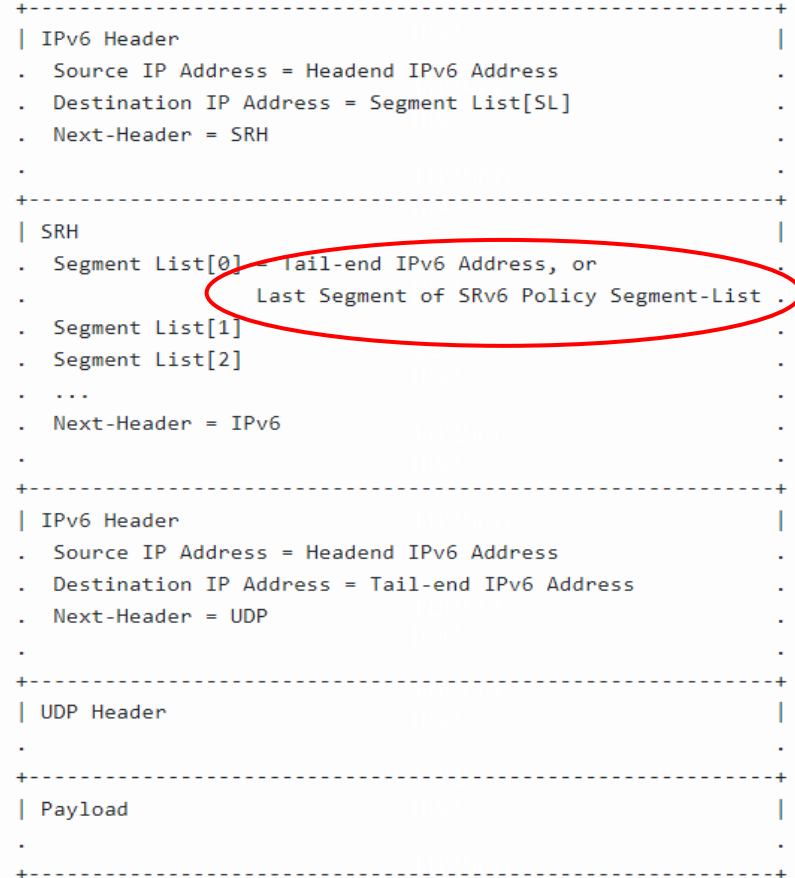
Sometimes, the last segment of Segment list in SRv6 Policy does not belong to the tail-end node, the last segment is

- End.x segment of penultimate hop without USD flavor

- Binding SID

In such cases

Segment List[0] = IPv6 address or SID of the tail-end node

Segment List[1] = the last segment of the SRv6 Policy Segment-List

```
+---------------------------------------------------+
| IPv6 Header                                       |
.   Source IP Address = Headend IPv6 Address        .
.   Destination IP Address = Segment List[SL]       .
.   Next-Header = SRH                               .
.                                                   .
.                                                   .
+---------------------------------------------------+
| SRH                                               |
.   Segment List[0] = Tail-end IPv6 Address, or     .
.                 Last Segment of SRv6 Policy Segment-List .
.   Segment List[1]                                 .
.   Segment List[2]                                 .
.   ...                                             .
.   Next-Header = IPv6                              .
.                                                   .
+---------------------------------------------------+
| IPv6 Header                                       |
.   Source IP Address = Headend IPv6 Address        .
.   Destination IP Address = Tail-end IPv6 Address  .
.   Next-Header = UDP                               .
.                                                   .
+---------------------------------------------------+
| UDP Header                                        |
.                                                   .
+---------------------------------------------------+
| Payload                                           |
.                                                   .
+---------------------------------------------------+
```

U-BFD in Transport mode

When U-BFD in transport mode:

- Only **one IPv6 header** is used to encapsulate echo packet. SRH encapsulates segment list.

- In order that the BFD echo packet can u-turn on the tail-end node and returns to the headend node

✓ **Segment List[0] =** SRv6 SID or IPv6 address of the **Headend**

✓ when the echo packet arrives at the tail-end node, its destination address (**Segment List[0]**) is the headend node address

✓ The tail-end node returns the packet to the head node based on IP route or other ways

```
+-----------------------------------------------------------+
| IPv6 Header                                               |
.   Source IP Address = Headend IPv6 Address                .
.   Destination IP Address = Segment List[SL]               .
.   Next-Header = SRH                                       .
.                                                           .
+-----------------------------------------------------------+
| SRH                                                       |
.   Segment List[0] = Headend IPv6 Address                  .
.   Segment List[1]                                         .
.   Segment List[2]                                         .
.   ...                                                     .
.   Next-Header = UDP                                       .
.                                                           .
+-----------------------------------------------------------+
| UDP Header                                                |
.                                                           .
+-----------------------------------------------------------+
| Payload                                                   |
.                                                           .
+-----------------------------------------------------------+
```

U-BFD in Tunnel mode

When U-BFD in tunnel mode:

- Encapsulate **inner IPv6 header** and **Outer SRv6** Encapsulation

- The **DA** of the inner payload is the address of the headend node

- **Segment List[0]** should be the SRv6 SID or IPv6 address of the **tail-end** node.

If the Last segment of SRv6 Policy segment list is

- End.x segment of penultimate hop without USD flavor

- Binding SID

In such cases

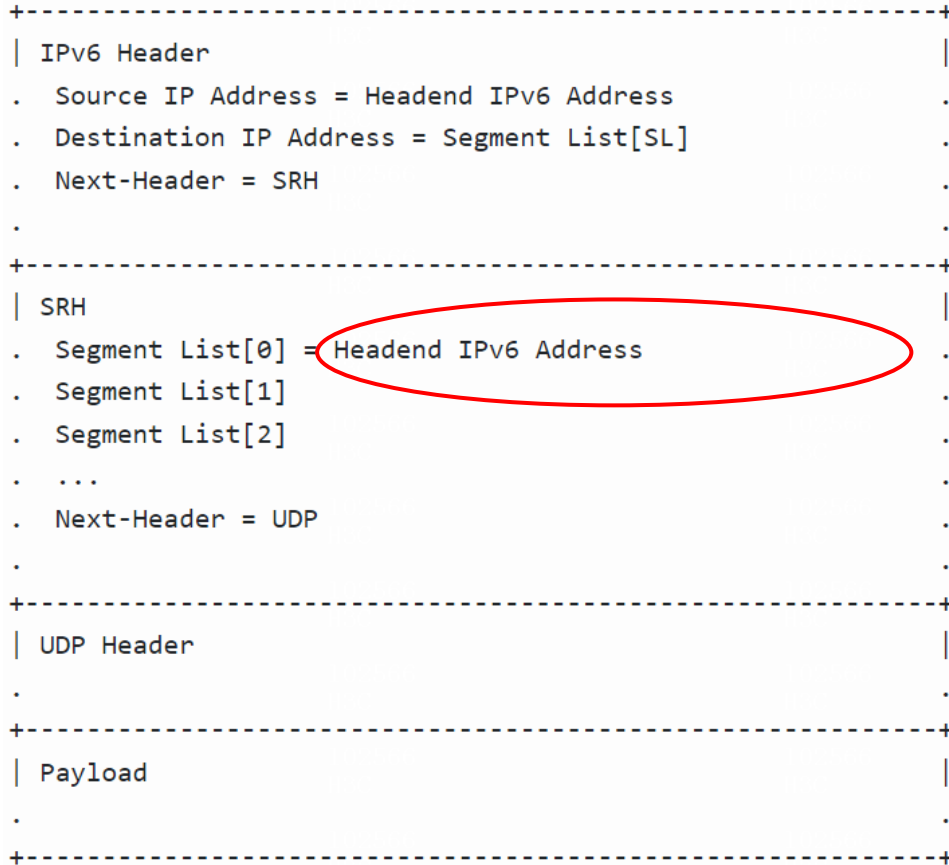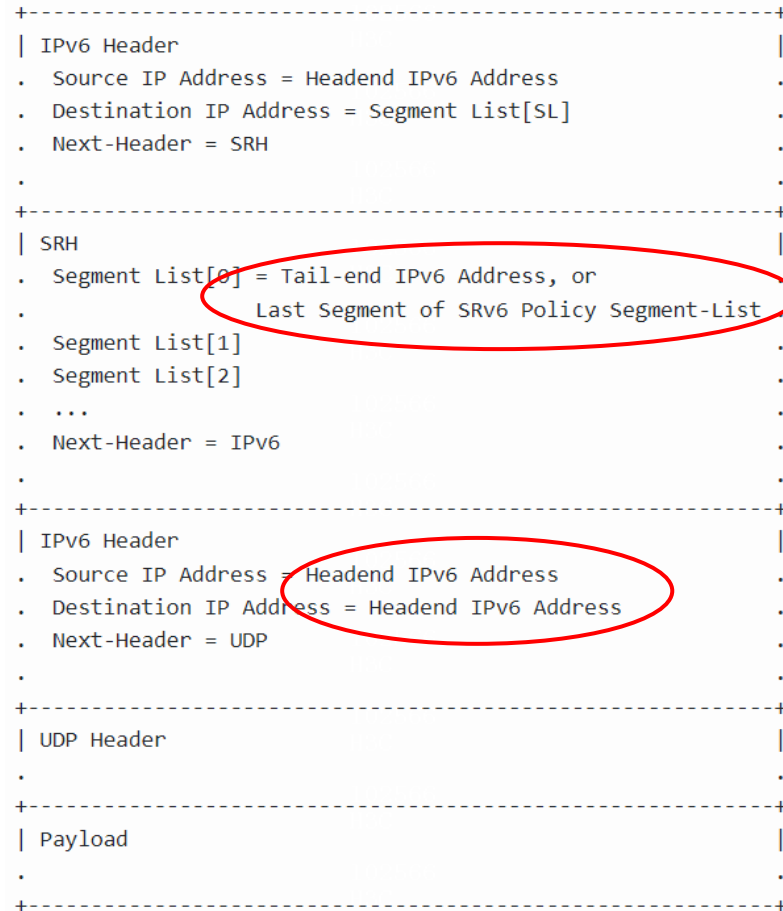- **segment list[0]** = IPv6 address or SID of the tail-end node

- **segment list[1]** = the last segment of the SRv6 Policy Segment-List

```
+--------------------------------------------------+
| IPv6 Header                                      |
.  Source IP Address = Headend IPv6 Address        .
.  Destination IP Address = Segment List[SL]        .
.  Next-Header = SRH                               .
.                                                  .
+--------------------------------------------------+
| SRH                                              |
.  Segment List[0] = Tail-end IPv6 Address, or     .
.                    Last Segment of SRv6 Policy Segment-List
.  Segment List[1]                                 .
.  Segment List[2]                                 .
.  ...                                             .
.  Next-Header = IPv6                              .
.                                                  .
+--------------------------------------------------+
| IPv6 Header                                      |
.  Source IP Address = Headend IPv6 Address        .
.  Destination IP Address = Headend IPv6 Address   .
.  Next-Header = UDP                               .
.                                                  .
+--------------------------------------------------+
| UDP Header                                       |
.                                                  .
+--------------------------------------------------+
| Payload                                          |
.                                                  .
+--------------------------------------------------+
```

Next Steps

- Questions and comments are welcome
- Seeking for feedback from WG