BFD Path Consistency over SR

draft-lin-bfd-path-consistency-over-sr-01

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Background

• Bidirectional Forwarding Detection (BFD) can be used to monitor paths between nodes.

• U-BFD defined in [I-D.ietf-bfd-unaffiliated-echo] can effectively reduce the device equipment.

• Seamless BFD (S-BFD) provides a simplified mechanism which is suitable for monitoring of paths that are setup dynamically and on a large scale network, with supporting verification on reflector

• Monitoring SR Policy

  U-BFD/S-BFD could be used to monitor SR Policy, a session associated with a segment list.
Requirement of path consistency

- Path inconsistency may cause false positive issue
- To the issue, the consistency of forward and reverse path of the same session should be guaranteed
- This draft describes how to realize the bidirectional path consistency of packet when monitoring SR policy by U-BFD/S-BFD

![Diagram of network paths with nodes labeled A, B, C, D, E and arrows indicating echo and response packets.]
Path consistency for **S-BFD** - Correlating bidirectional path using Path Segment

- **Path Segment** is used to identify an SR path
  
  In SR for MPLS, is defined in [draft-ietf-spring-mpls-path-segment]

  In SR for IPv6, is defined in [draft-ietf-spring-srv6-path-segment]

- [draft-ietf-idr-sr-policy-path-segment] extends BGP SR Policy

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Path Segment is used to identify an SR path

In SR for MPLS, is defined in [draft-ietf-spring-mpls-path-segment]

In SR for IPv6, is defined in [draft-ietf-spring-srv6-path-segment]

[draft-ietf-idr-sr-policy-path-segment] extends BGP SR Policy
Path consistency for **S-BFD** - Correlating bidirectional path using Path Segment(2)

- Using path segment and reverse path segment to establish a mapping table
- Using the mapping table to get segment list by reverse Path segment
Path consistency for **S-BFD** - S-BFD Initiator procedure for **SRv6**

- Encapsulating the segment list associated with SBFD-session session to SRH
- Encapsulating the path segment of segment list1 (i.e. SID-Path-A1) in SRH, and set **SRH.P-Flag**

```
Segment list 1
  SID-A1, SID-B2, SID-C2
  Path Segment: SID-Path-A1
  Reverse Path Segment:
    SID-Path-D1
```

![Diagram](image)
Path consistency for **S-BFD** - S-BFD reflector procedure for **SRv6**

- If SRH.P-flag is set, extracts the path segment (i.e. SID-Path-A1) of the forward path from SRH
- Get segment list of reverse path by the path segment as a reverse path segment from mapping table
- Encapsulating response packet with the reverse segment list
Path consistency for **S-BFD** - S-BFD Initiator procedure for **SR**

- Encapsulating the segment list associated with SBFD-session session to label stack
- Encapsulating the path segment of segment list1

**Segment list1**
- SID-A1, SID-B2, SID-C2
- Path Segment: SID-Path-A1
- Reverse Path Segment: SID-Path-D1

```
+-----------------+   +-----------------+
| ...             |   | ...             |
| Label 1         |   | Label 2         |
| ...             |   | ...             |
| Label n         |   | Path Segment    |
+-----------------+   +-----------------+
| IPv6 Header:    |   | IPv6 Header:    |
| Source IP       |   | Source IP       |
| Destination IP  |   | Destination IP  |
+-----------------+   +-----------------+```

```
+-----------------+   +-----------------+
| SID-A1          |   | SID-A1          |
| ...             |   | ...             |
| SID-B2          |   | SID-B2          |
| ...             |   | ...             |
| SID-C2          |   | SID-C2          |
| ...             |   | ...             |
| SID-Path-1      |   | SID-Path-1      |
+-----------------+   +-----------------+
| SA=A's Ipv6Addr |   | SA=A's Ipv6Addr |
| ...             |   | ...             |
| DA=D's Ipv6Addr |   | DA=D's Ipv6Addr |
| ...             |   | ...             |
| sbfd-payload    |   | sbfd-payload    |
| ...             |   | ...             |```
Path consistency for **S-BFD** - S-BFD reflector procedure for **SR**

- If path-segment exists, Get segment list of reverse path by the path segment as a reverse path segment from mapping table

- Encapsulating response packet with the reverse segment list
Path consistency for U-BFD – Getting reverse segment list

- [draft-ietf-idr-sr-policy-path-segment] extends BGP SR Policy to distribute reverse path information
- The reverse path segment can be used for S-BFD path consistency, and the reverse segment list can be used for U-BFD path consistency
Path consistency for U-BFD - U-BFD for SRv6

- In an SRv6 network, the reverse segment list can be encapsulated in the U-BFD packet.
- When the packet reaches the tailend node, U-BFD can be returned to the head node in the data plane based on the reverse segment list.

- **In Same SRH with forward segment list**
  - IPv6 Header
    - Source IP Address = Node A’s IPv6 Address
    - Destination IP Address = SegmentList[SL]
    - Next-Header = SRH (43)
  - SRH as specified in RFC 8754
    - Next-Header = IPv6
    - Node A’s IPv6 Address
    - <ReverseSegment List>
    - <Segment List>
  - ubfd-payload

- **In different SRH from forward segment list**
  - IPv6 Header
    - Source IP Address = Node A’s IPv6 Address
    - Destination IP Address = SegmentList[SL]
    - Next-Header = SRH (43)
  - SRH as specified in RFC 8754
    - Next-Header = SRH (43)
    - <Segment List>
  - SRH as specified in RFC 8754
    - Next-Header = IPv6
    - Node A’s IPv6 Address
    - <ReverseSegment List>
  - ubfd-payload
Path consistency for U-BFD - U-BFD for SR

- In SR-MPLS, Reverse segment list can be encapsulated in the label
- When the packet reaches the tail node D, the remaining label stack identifies the return path
Next Steps

• This draft has been presented at the IETF-114
• Added Both S-BFD and U-BFD after IETF-115
• Added Both MPLS-SR and SRv6 after IETF-115
• Any questions or comments are Welcomed
• Seeking WG adoption after revision
Thank You