Performance Measurement Using RFC 6374 for Segment Routing Networks with MPLS Data Plane

draft-gandhi-mpls-rfc6374-sr-04

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Agenda

- Requirements and Scope

- History of the Draft

- Updates Since IETF-107

- Summary

- Next Steps

Requirements and Scope

Requirements:

- Delay and Loss Performance Measurement (PM)
  - SR-MPLS Links and end-to-end P2P/ P2MP SR-MPLS Paths
- Delay and Loss extended TE link metrics advertisement in the network
- One-way, two-way and loopback measurement modes

Scope:

- Segment Routing with MPLS data plane (SR-MPLS)
- RFC 6374 for probe query and response messages
- RFC 7876 (UDP return path) for probe response messages

History of the Draft

- Feb 14, 2018
  - Draft was published *draft-gandhi-spring-sr-mpls-pm-00*
- July 2018
  - Draft *draft-gandhi-spring-sr-mpls-pm-02* was introduced at IETF 102 Montreal in SPRING WG
- Nov 2018
  - Presented *draft-gandhi-spring-sr-mpls-pm-03* at IETF 103 Bangkok in SPRING and IPPM WGs
- Feb 14, 2019
  - Draft was renamed to *draft-gandhi-spring-rfc6374-srpm-mpls-00*
- Mar 2019
  - Presented *draft-gandhi-spring-rfc6374-srpm-mpls-00* at IETF 104 Prague in SPRING WG
- Oct 2019
  - Chairs agreed to progress the work in MPLS WG
  - Draft renamed to *draft-gandhi-mpls-rfc6374-sr-00*
- Nov 2019
  - Presented *draft-gandhi-mpls-rfc6374-sr-00* at IETF 106 Singapore in MPLS WG
- Apr 2020
  - Presented *draft-gandhi-mpls-rfc6374-sr-02* at IETF 107 in MPLS WG Interim

Updates Since IETF-107 (Version 02)

Updates:

- ✓ Addressed MPLS-RT expert review comments
- ✓ Various editorial changes

Open Items:

- ▪ None

Next Steps

- Welcome your comments and suggestions

- Implementation exists

- Requested adoption in MPLS WG

Thank you

Probes for SR-MPLS Links

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|              GAL (value 13)           | TC  |1|      TTL      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|0 0 0 1|Version|   Reserved      | GAL Channel Type            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

       Figure: Probe Message Header for an SR-MPLS Link
```
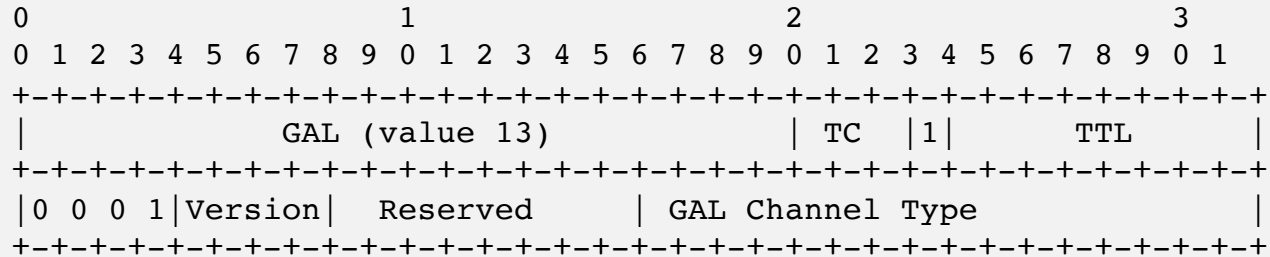
- For SR-MPLS links, the PM probe query messages for link delay and packet loss measurements are sent using MPLS GAL/GAch header as defined in [RFC6374].

SR-MPLS Link Extended TE Metrics Advertisement

- Measure delay and loss performance of SR-MPLS Links.

- Compute SR-MPLS Link Delay metrics (minimum-delay, maximum-delay, average-delay, delay-variance) and SR Link Packet Loss metric.

- SR-MPLS Link extended TE metrics advertised in the network using the TLVs defined in the following RFCs/Drafts:

  – OSPF   [RFC7471]

  – ISIS   [RFC7810] [RFC8570]

  – BGP-LS   [RFC8571]

Probes for SR-MPLS Policy

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                    Label(1)              | TC  |S|      TTL      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
.                                                                .
.                                                                .
.                                                                .
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                    Label(n)              | TC  |S|      TTL      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                     PSID                 | TC  |S|      TTL      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                  GAL (value 13)          | TC  |1|      TTL      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|0 0 0 1|Version|  Reserved      | GAL Channel Type              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

 Figure: Example Probe Message Header for an End-to-end SR-MPLS Policy
```

- For end-to-end measurement of SR-MPLS Policy, the probe query messages for delay and loss measurements are sent on the congruent path with data traffic using MPLS GAL/GAch header as defined in [RFC6374] and SR-MPLS label stack of the SR-MPLS Policy.

Measurement Modes for SR-MPLS Policy

- One-way Measurement Mode

  – Reply sent out of band IP/UDP path using RFC 7876 mechanisms

- Two-way Measurement Mode

  – **Reply sent in-band using the RFC 6374 mechanisms (using Control code)**

  – **Return Path TLV can be used from the probe query message for SR-MPLS Paths**

- Loopback Measurement Mode

  – Probe message carries the return path label stack in the header of the message

Return Path TLV for Two-way Measurement

Sub-TLV Types:

1. Type (value 1): SR-MPLS Segment List (Label Stack) of the Reverse Path

2. Type (value 2): SR-MPLS Binding SID [draft-ietf-pce-binding-label-sid] of the Reverse SR-MPLS Policy

- **TLV is mandatory when carried in a probe query message and if responder does not support, it MUST return Error 0x17: Unsupported Mandatory TLV Object**
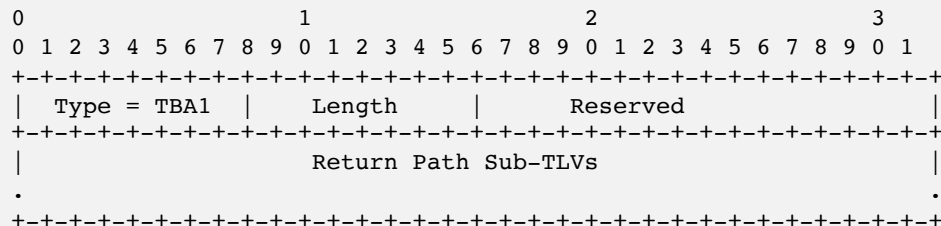
```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|  Type = TBA1  |     Length    |           Reserved            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                    Return Path Sub-TLVs                       |
.                                                               .
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

               Figure: Return Path TLV
```

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     Type      |     Length    |           Reserved            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                         Label(1)                              |
.                                                               .
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
.                                                               .
.                                                               .
.                                                               .
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                         Label(n)                              |
.                                                               .
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

         Figure: Segment List Sub-TLV in Return Path TLV
```
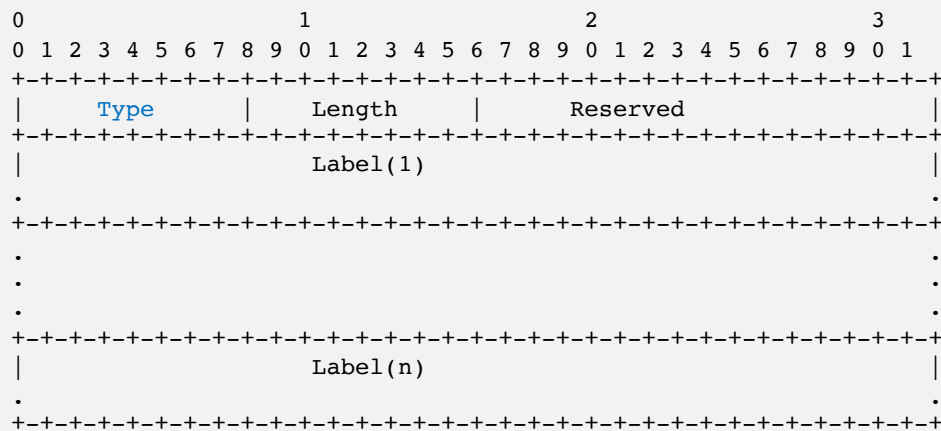
Destination Address TLV (Type 129) Handling

- To ensure that the probe query message is processed by the intended responder node, Destination Address TLV [RFC6374] can be sent in the probe query message.

- The responder node only replies with Success in Control Code if it is the intended destination for the probe query.

- Otherwise, it MUST return 0x15: Error - Invalid Destination Node Identifier.
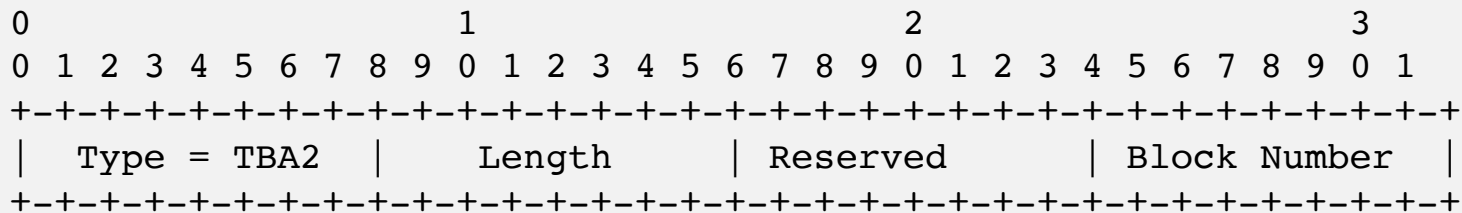
Block Number TLV for Loss Measurement

```
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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|   Type = TBA2   |      Length      |   Reserved    | Block Number  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

                 Figure: Block Number TLV
```

- Carry the Block Number (8-bit) of the traffic counters in the probe query and response messages for loss measurement
- **Correlate** PM data (e.g. counters) from both endpoints
- **Aggregate** PM data collected in data plane
- **TLV is mandatory when carried in a probe query message and if responder does not support, it MUST return**
  - **Error 0x17: Unsupported Mandatory TLV Object**
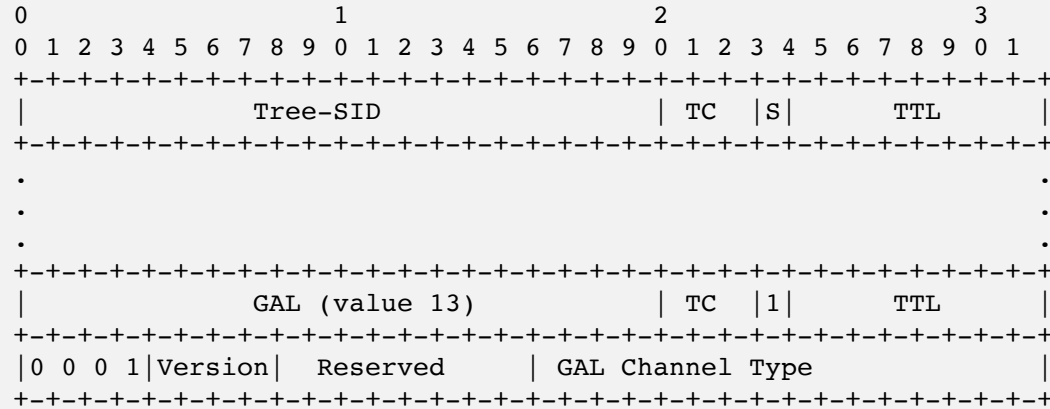
Probe Query for P2MP SR-MPLS Policy

```
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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                Tree-SID               |  TC  |S|    TTL      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
.                                                              .
.                                                              .
.                                                              .
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|              GAL (value 13)           |  TC  |1|    TTL      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|0 0 0 1|Version|  Reserved    | GAL Channel Type             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

Figure: Example Probe Query with Replication Segment for P2MP SR-MPLS Policy
```

- One-way mode for delay and loss measurement for P2MP SR-MPLS Policy as follows:
  - The querier root node sends probe query messages using the Tree-SID for the P2MP SR-MPLS Policy
  - Each responder leaf node adds the "Source Address" TLV (Type 130) [RFC6374] with its IP address in the probe response messages
    - This TLV allows the querier root node to identify the responder leaf nodes of the P2MP SR-MPLS Policy

WG Co-ordination Plan

- IANA code-points to be allocated by MPLS WG

- Draft to progress in MPLS WG

- From Bruno:

  - Please keep SPRING in the loop for the SPRING specific content

Thank you