Performance Measurement Using RFC 6374 with UDP Path for Segment Routing Networks

draft-gandhi-spring-rfc6374-srpm-udp-04

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Agenda

- Requirements and Scope

- History of the Draft

- Updates Since IETF-104

- Summary

- Next Steps

Requirements and Scope

Requirements:

- Delay and Loss Performance Measurement (PM)
  - ✓ Links and End-to-end P2P/ P2MP SR Paths
  - ✓ Applicable to SR-MPLS/SRv6 data planes
- No need to negotiate UDP port to bootstrap PM session - spirit of SR
  - ✓ Stateless on egress node - spirit of SR
- Handle ECMP for SR Paths

Scope:

- Use RFC 6374 defined probe message formats
- Use RFC 7876 (IP/UDP OOB return path) defined probe response messages
- **User defined** IP/UDP path for PM probe messages

History of the Draft

- Mar 2018
  - Draft was published *draft-gandhi-spring-udp-pm-00*
- July 2018
  - Presented *draft-gandhi-spring-udp-pm-01* at IETF 102 Montreal in SPRING WG
- Nov 2018
  - Presented *draft-gandhi-spring-udp-pm-02* at IETF 103 Bangkok in SPRING and IPPM WGs
- Feb 14, 2019
  - Draft was renamed to *draft-gandhi-spring-rfc6374-srpm-udp-00*
- Mar 2019
  - Presented *draft-gandhi-spring-rfc6374-srpm-udp-00* at IETF 104 Prague in SPRING WG

Updates Since IETF-104 (Revision-00)

Updates:

- ✓ Add loopback measurement mode
- ✓ Reference for probe message processing rules
    - ✓ TTL value, UDP Checksum and Router Alert
- ✓ Reference for example provisioning model
- ✓ Align with draft-gandhi-mpls-rfc6374-sr
    - ✓ Return Path TLVs for SR
- ✓ Various editorial changes to address review comments

Open Items:

- ▪ None

Next Steps

- Welcome your comments and suggestions
- Like to request for WG adoption

Thank you

Backup

Probe Query Messages

- IP/UDP path is defined for PM probe query messages for delay and loss measurements for SR links and end-to-end P2P and P2MP SR Paths.
- Payload contains [RFC6374] defined message for DM or LM or Combined LM/DM.
- User-configured UDP port TBA1 is used for identifying DM probe packets.
- User-configured UDP port TBD2 is used for identifying LM probe packets.
- User-configured UDP port TBD3 is used for identifying Combined LM/DM probe packets.

```
+--------------------------------------------------------------+
| IP Header                                                    |
.   Source IP Address = Querier IPv4 or IPv6 Address           .
.   Destination IP Address = Responder IPv4 or IPv6 Address    .
.   Protocol = UDP                                             .
.                                                              .
+--------------------------------------------------------------+
| UDP Header                                                   |
.   Source Port = As chosen by Querier                         .
.   Destination Port = User-configured Port                    .
.                                                              .
+--------------------------------------------------------------+
| Payload = Message as specified in RFC 6374 for DM, LM, LM/DM |
.                                                              .
+--------------------------------------------------------------+
```

Probe Query for SR-MPLS and SRv6 Policy

For **end-to-end** performance delay/loss measurement of SR Policy, the probe query messages are sent on the SR Policy path with:

1. MPLS label stack for SR-MPLS Policy
2. SRv6 SRH [RFC 8754] with SID list for SRv6 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                 Segment(1)                | TC  |S|    TTL     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
.                                                               .
.                                                               .
.                                                               .
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                 Segment(n)                | TC  |S|    TTL     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|   Message for DM or LM or LM/DM Query with IP/UDP Header       |
.                                                               .
+---------------------------------------------------------------+

   Figure: Example Probe Query Message 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
+---------------------------------------------------------------+
| IP Header                                                     |
.  Source IP Address = Querier IPv6 Address                     .
.  Destination IP Address = Destination IPv6 Address            .
.                                                               .
+---------------------------------------------------------------+
| SRH                                                           |
.  <SID List>                                                   .
.                                                               .
+---------------------------------------------------------------+
| IP Header                                                     |
.  Source IP Address = Querier IPv6 Address                     .
.  Destination IP Address = Responder IPv6 Address             .
.                                                               .
+---------------------------------------------------------------+
| UDP Header                                                    |
.  Source Port = As chosen by Querier                           .
.  Destination Port = User-configured Port                      .
.                                                               .
+---------------------------------------------------------------+
|   Message for DM or LM or LM/DM Query                         |
.                                                               .
+---------------------------------------------------------------+
```

Probe Response Messages

- Probe response messages can be sent in-band (two-way measurement) or out-of-band (one-way measurement) for SR links and SR Policies.

- Use the information from the UDP Return Object (URO) TLV [RFC7876] from the received Probe query message payload, otherwise use the IP/UDP information (Source IP Address and Source UDP port) from the received Probe query message header.

```
+------------------------------------------------------+          +------------------------------------------------------+
| IP Header                                            |          | IP Header                                            |
. Source IP Address = Responder IPv4 or IPv6 Address   .          . Source IP Address = Responder IPv4 or IPv6 Address   .
. Destination IP Address = Source IP Address from Query.          . Destination IP Address = URO.Address                 .
. Protocol = UDP                                       .          . Protocol = UDP                                       .
.                                                      .          .                                                      .
.                                                      .          .                                                      .
+------------------------------------------------------+          +------------------------------------------------------+
| UDP Header                                           |          | UDP Header                                           |
. Source Port = As chosen by Responder                 .          . Source Port = As chosen by Responder                 .
. Destination Port = Source Port from Query            .          .  Destination Port = URO.UDP-Destination-Port         .
.                                                      .          .                                                      .
+------------------------------------------------------+          +------------------------------------------------------+
| Message as specified in Section 3.2 of RFC 6374 for DM, or |    | Message as specified in Section 3.2 of RFC 6374 for DM, or |
. Message as specified in Section 3.1 of RFC 6374 for LM, or .    . Message as specified in Section 3.1 of RFC 6374 for LM, or .
. Message as specified in Section 3.3 of RFC 6374 for LM/DM  .    . Message as specified in Section 3.3 of RFC 6374 for LM/DM  .
.                                                      .          .                                                      .
+------------------------------------------------------+          +------------------------------------------------------+

        Figure: Probe Response Message                            Figure: Probe Response Message Using URO from Probe Query
```

Return Path TLV for Two-way Measurement

Sub-TLV Types:

- Type (value TBA1): SRv6 Segment List of the Reverse SR Path

- Type (value TBA2): SRv6 Binding SID [draft-ietf-pce-binding-label-sid] of the Reverse SR Policy
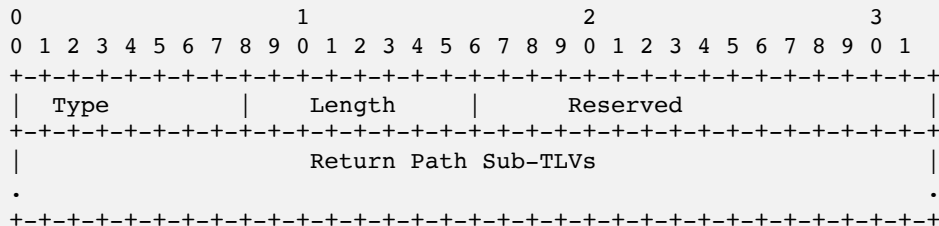
```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| Type           | Length         |        Reserved            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                   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            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                      Segment(1)                               |
.                                                              .
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
.                                                              .
.                                                              .
.                                                              .
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                      Segment(n)                               |
.                                                              .
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

          Figure: Segment List Sub-TLV in Return Path TLV
```
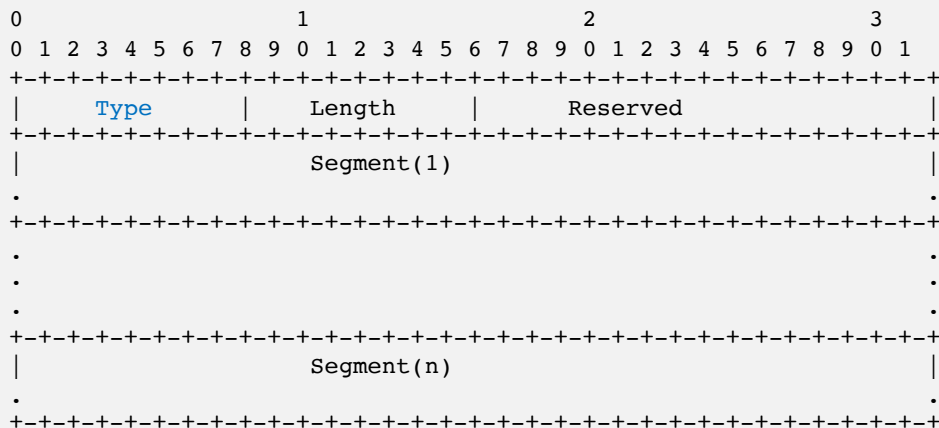
Authenticated Mode

- Define Sequence Number TLV for Probe Query and Response messages.

- Useful when some probe query messages are lost, or they arrive out of order.

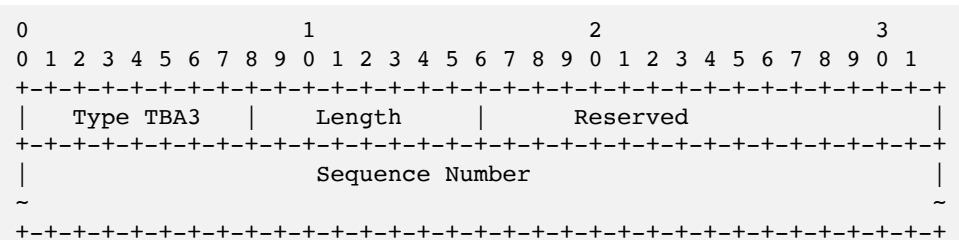- Used for authentication of probe messages.

```
 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 TBA3   |     Length    |           Reserved          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                       Sequence Number                        |
~                                                              ~
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

    Figure: Sequence Number TLV – Unauthenticated Mode
```

```
 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 TBA4   |     Length    |           Reserved          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                       Sequence Number                        |
~                                                              ~
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
~                         Comp.MBZ                             ~
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                       HMAC (16 octets)                       |
|                                                              |
|                                                              |
|                                                              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

    Figure: Sequence Number TLV – Authenticated Mode
```
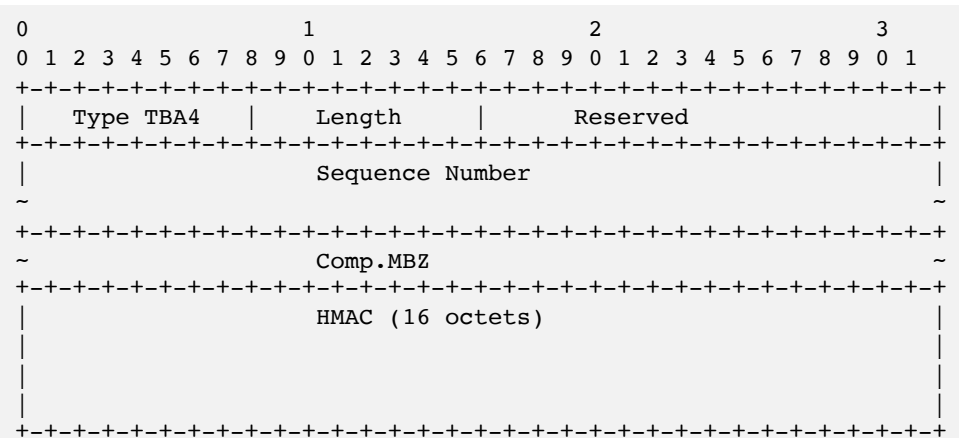
ECMP Support for SR Path

- SR Path can have ECMP between the ingress and transit nodes, between transit nodes and between transit and egress nodes.
- Sending probe queries that can take advantage of the hashing function in forwarding plane.
- Existing forwarding mechanisms are applicable to PM probe messages. Examples are:
  - For IPv4
    - Sweeping destination address in IPv4 header (e.g. 127/8)
  - For IPv6
    - Sweeping flow label in IPv6 header

Thank you