

Enhanced Performance Measurement and Liveness Monitoring in Segment Routing Networks

draft-gandhi-spring-sr-enhanced-plm-00

Rakesh Gandhi - Cisco Systems (rgandhi@cisco.com) - Presenter

Clarence Filsfils - Cisco Systems (cfilsfil@cisco.com)

Navin Vaghamshi - Reliance (Navin.Vaghamshi@ril.com)

Moses Nagarajah - Telstra (Moses.Nagarajah@team.telstra.com)

Agenda

- Requirements and Scope
- Summary
- Next Steps

Requirements and Scope

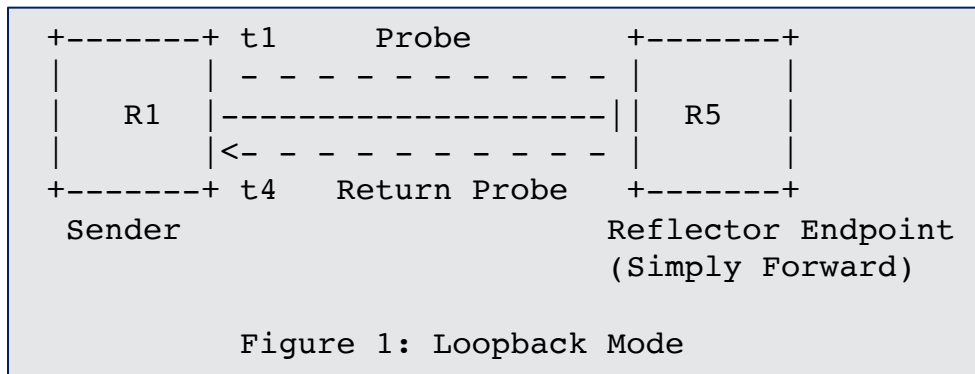
Requirements:

- Performance Measurement & Liveness Monitoring
 - ✓ End-to-end P2P/P2MP SR Paths
 - ✓ Applicable to SR-MPLS/SRv6 data planes

Scope:

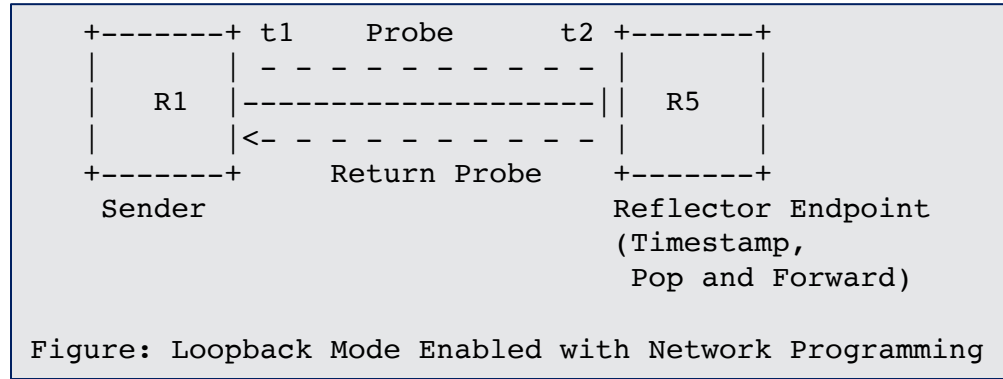
- RFC 5357 (TWAMP) defined probe messages - TWAMP Light
- RFC 8762 (STAMP) defined probe messages
- User-configured IP/UDP path for probe messages

Liveness Monitoring of SR Policy



- Liveness monitoring for SR Policy uses PM probes (TWAMP Light/STAMP delay measurement messages) in Loopback Mode
- Probe messages sent using Segment List(s) of the SR Policy Candidate Path(s)
- Probe messages are not punted on the remote node (endpoint/reflector)
- Return path can be IP or SR
- Liveness failure is notified when consecutive N number of probe messages are not received back at the sender

Enhanced Liveness Monitoring of SR Policy



- Use PM probes in loopback mode enabled with network programming function.
 - The network programming function optimizes the "operations of punt, add receive timestamp and inject the probe packet" on the reflector node.
- The endpoint node adds the receive timestamp in the payload of the received TWAMP Light or STAMP probe message without punting the probe message.
 - Only add the receive timestamp if the source address in the probe message matches the local node address
- Liveness failure is notified when consecutive N number of probe messages are not received back at the sender
- Delay metrics are notified when consecutive N number of probe messages have delay values exceed the configured thresholds

TWAMP Light/STAMP Probe Message

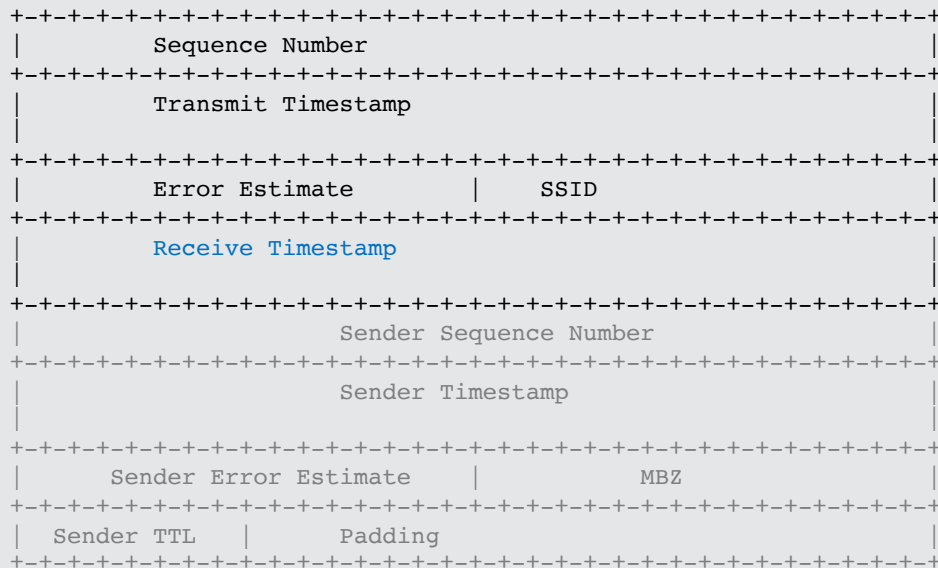


Figure: Probe Message Format

Enhanced Loopback Mode

- Sender adds the Transmit Timestamp
- Reflector adds the Receive Timestamp at fixed offset locally provisioned (consistently in the network)
 - For TWAMP Light and STAMP packets, it is at offset-byte 16 from the start of the payload
- Reflector does not copy Sender Sequence Number, Sender Timestamp, Sender Error Estimate and Sender TTL in response message
 - I.e. Sender Sequence Number, Sender Timestamp, Sender Error Estimate and Sender TTL in the TWAMP Light and STAMP messages are not used.

SR-MPLS with Timestamp Label

```

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           |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                               Timestamp Label (TBA1)                | TC | S |           TTL           |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| IP Header                                                            |
. Source IP Address = Endpoint IPv4 or IPv6 Address .
. Destination IP Address = Sender IPv4 or IPv6 Address .
. Protocol = UDP .
.
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| UDP Header                                                            |
. Source Port = As chosen by Sender .
. Destination Port = User-configured Port .
.
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| Payload as defined in Section 4.2.1 of RFC 5357 |
| Payload as defined in Section 4.2 of RFC 8762
.
.
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+

```

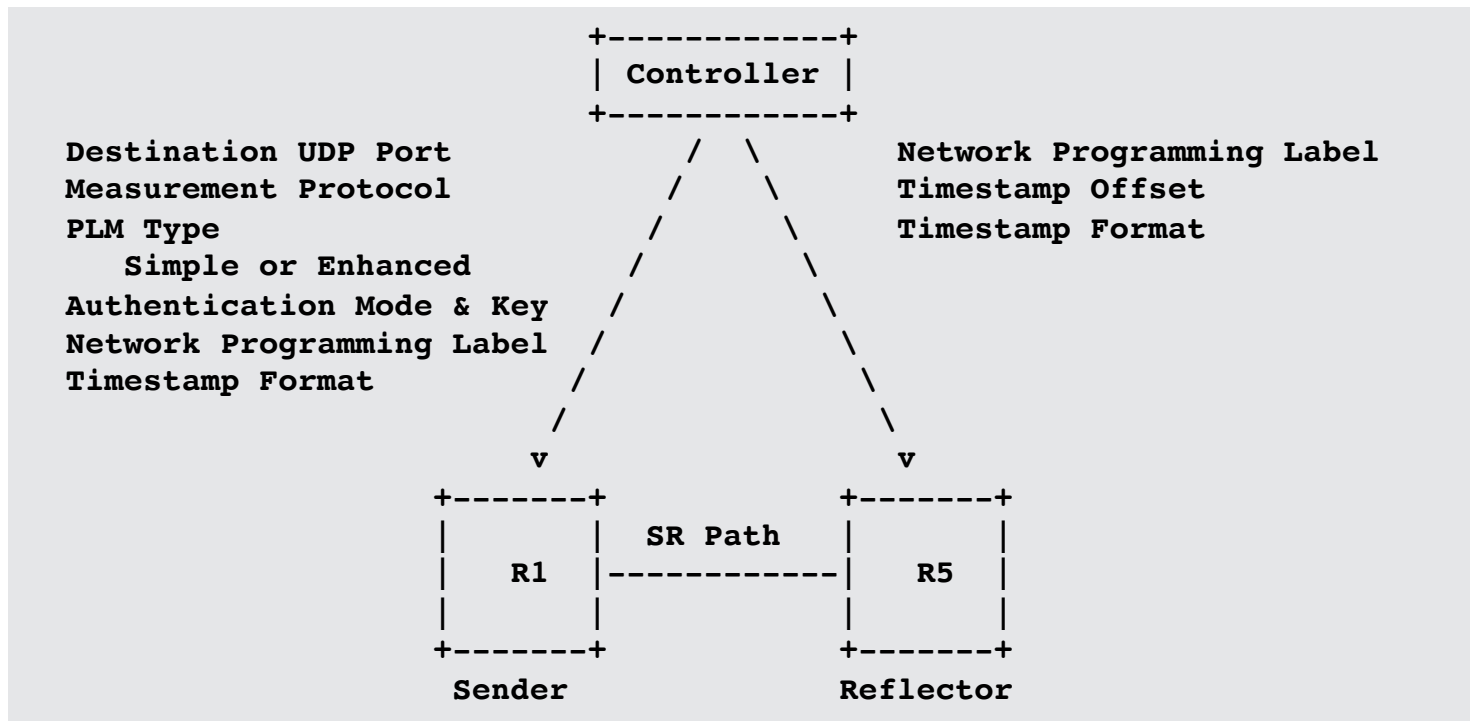
Figure 5: Probe Message Header for SR-MPLS with Timestamp Label

- Timestamp Label (TBA1) allocated by IANA from Extended Special-Purpose MPLS Label Values
 - Used for Timestamp, Pop and Forward network programming function
- Source and Destination Addresses swapped for the Reverse direction path
- Optionally, Reverse direction SR path label stack can follow the Timestamp Label

ECMP Support for SR Policy

- SR Policy can have ECMP between the ingress and transit nodes, between transit nodes and between transit and egress nodes.
- Sending PM probe queries that can take advantage of the hashing function in forwarding plane.
- Existing forwarding mechanisms are applicable to PM probe messages:
 - For IPv4
 - Destination addresses in IPv4 header (e.g. 127/8) when return path is SR-MPLS
 - For IPv6
 - Destination addresses in IPv6 header (e.g. FFFF:7F00/104) when return path is SRv6
 - Flow label in IPv6 header

Example Provisioning Model



Next Steps

- Welcome your comments and suggestions
- Requesting WG adoption

Thank you

Backup

SRv6 with Timestamp and Forward Function

```
+-----+
|                SRH                |
|   <Segment List>                   |
|   END.TSF with Target SID           |
+-----+
| IP Header                          |
|   Source IP Address = Endpoint IPv6 Address |
|   Destination IP Address = Sender IPv6 Address |
|   Protocol = UDP                   |
+-----+
| UDP Header                        |
|   Source Port = As chosen by Sender |
|   Destination Port = User-configured Port |
+-----+
| Payload as defined in Section 4.2.1 of RFC 5357 |
| Payload as defined in Section 4.2 of RFC 8762   |
+-----+
```

Figure 6: Probe Message Header for SRv6 with Endpoint Function

- Endpoint Function END.TSF is defined for Timestamp and Forward
- Source and Destination Addresses swapped for the Reverse direction path in the inner IPv6 header
- Optionally, Reverse direction SR path can be carried in SRH

Thank you