

# Enhanced Performance Measurement and Liveness Monitoring in Segment Routing Networks

*draft-gandhi-spring-sr-enhanced-plm-01*

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# Agenda

- Requirements and Scope
- Summary
- Next Steps

# Requirements and Scope

## Requirements:

- Performance Delay Measurement & Liveness Monitoring in SR networks
  - ✓ End-to-end P2P/P2MP SR paths
  - ✓ Applicable to SR-MPLS/SRv6 data planes
  - ✓ Support ECMP SR paths
- Running single protocol for liveness detection and performance measurement in SR networks
  - ✓ Simplify deployment and reduce operational complexity
- No endpoint dependency
  - ✓ Stateless on endpoint (e.g. endpoint unaware of the probe protocol)
  - ✓ Higher scale and faster detection interval (e.g. packets not punted out of fast-path)

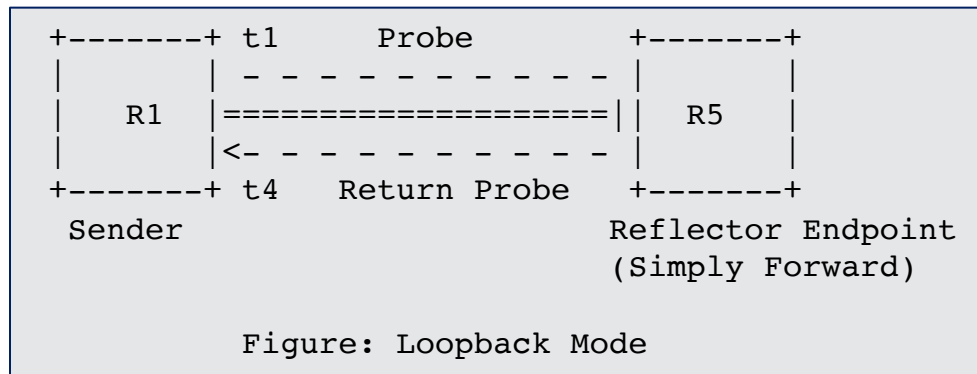
## Scope:

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

# History of the Draft

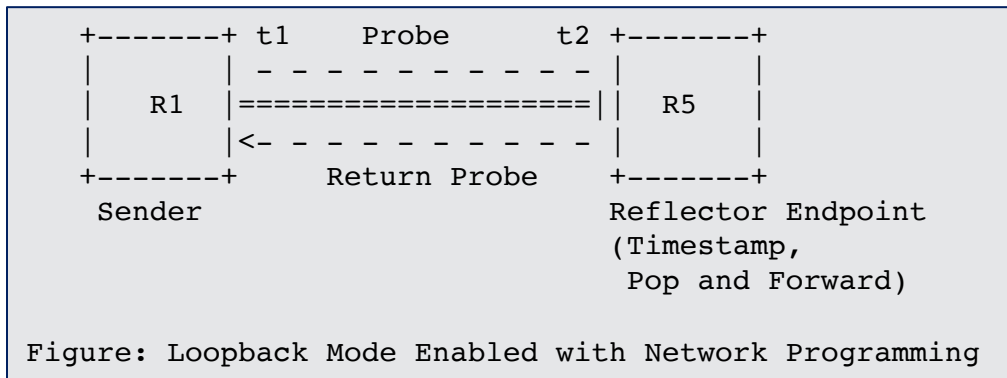
- March 2020
  - Draft was published
- April 2020
  - Presented *version 00* in IETF MPLS WG Virtual Meeting

# Liveness and Performance 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) out of fast-path
- 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
- Round-trip delay metrics are notified when consecutive M number of probe messages have delay values exceed the configured thresholds

# Enhanced Liveness and Performance 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
- One-way delay metrics are notified when consecutive M number of probe messages have delay values exceed the configured thresholds

# Probe Message – Enhanced Loopback Mode

- Sender adds the Transmit Timestamp
- Reflector adds the Receive Timestamp at fixed offset locally provisioned (consistently in the network)
  - E.g. offset-byte 16 from the start of the payload

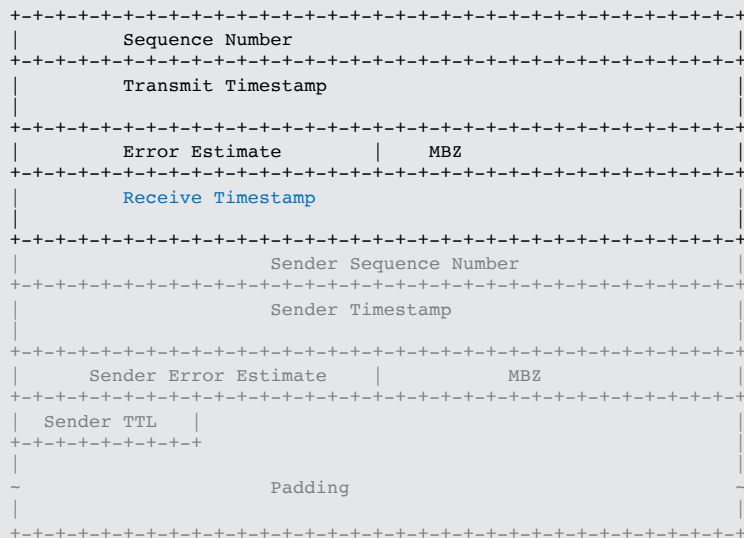


Figure: TWAMP Light Probe Message Format

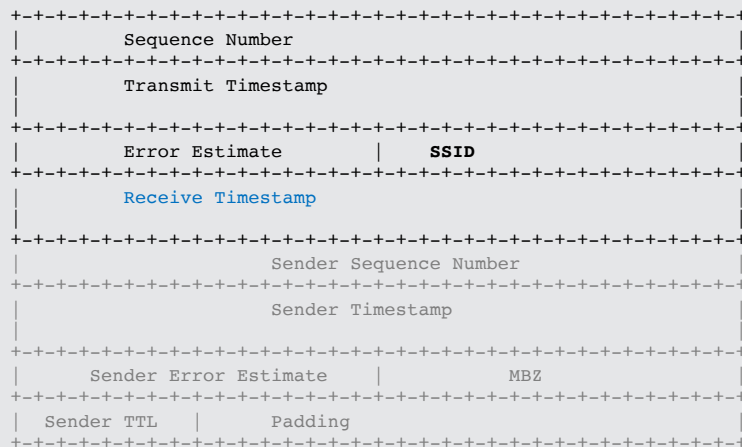


Figure: STAMP Probe Message Format

# SR-MPLS with Timestamp and Forward Function

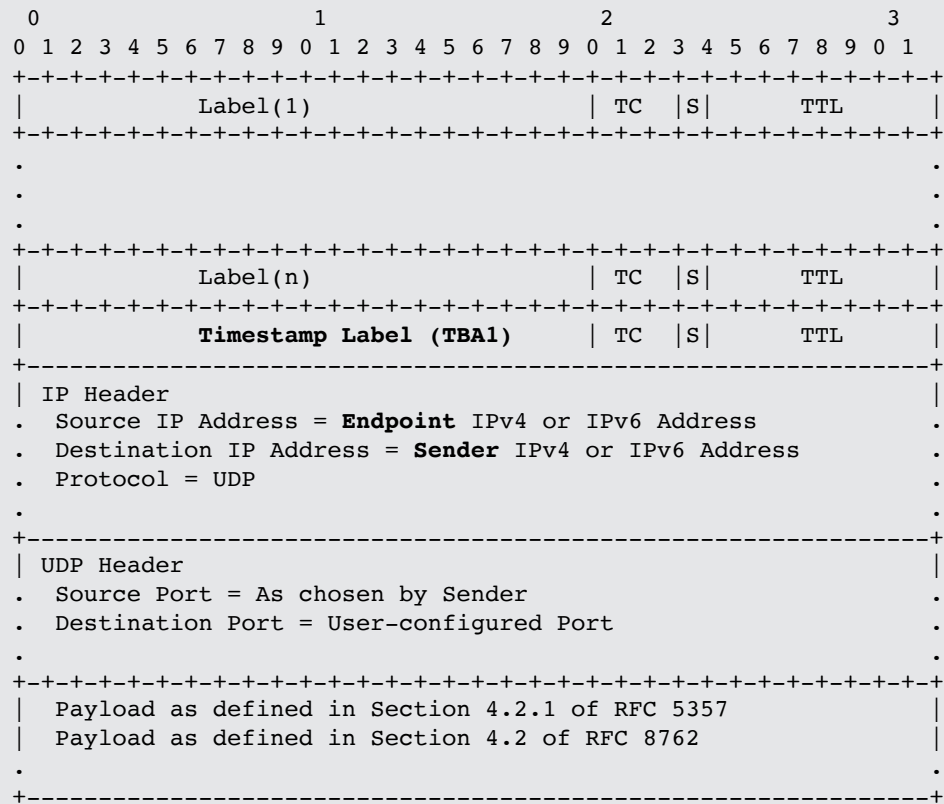


Figure 6: Example Probe Message for SR-MPLS with Timestamp Label

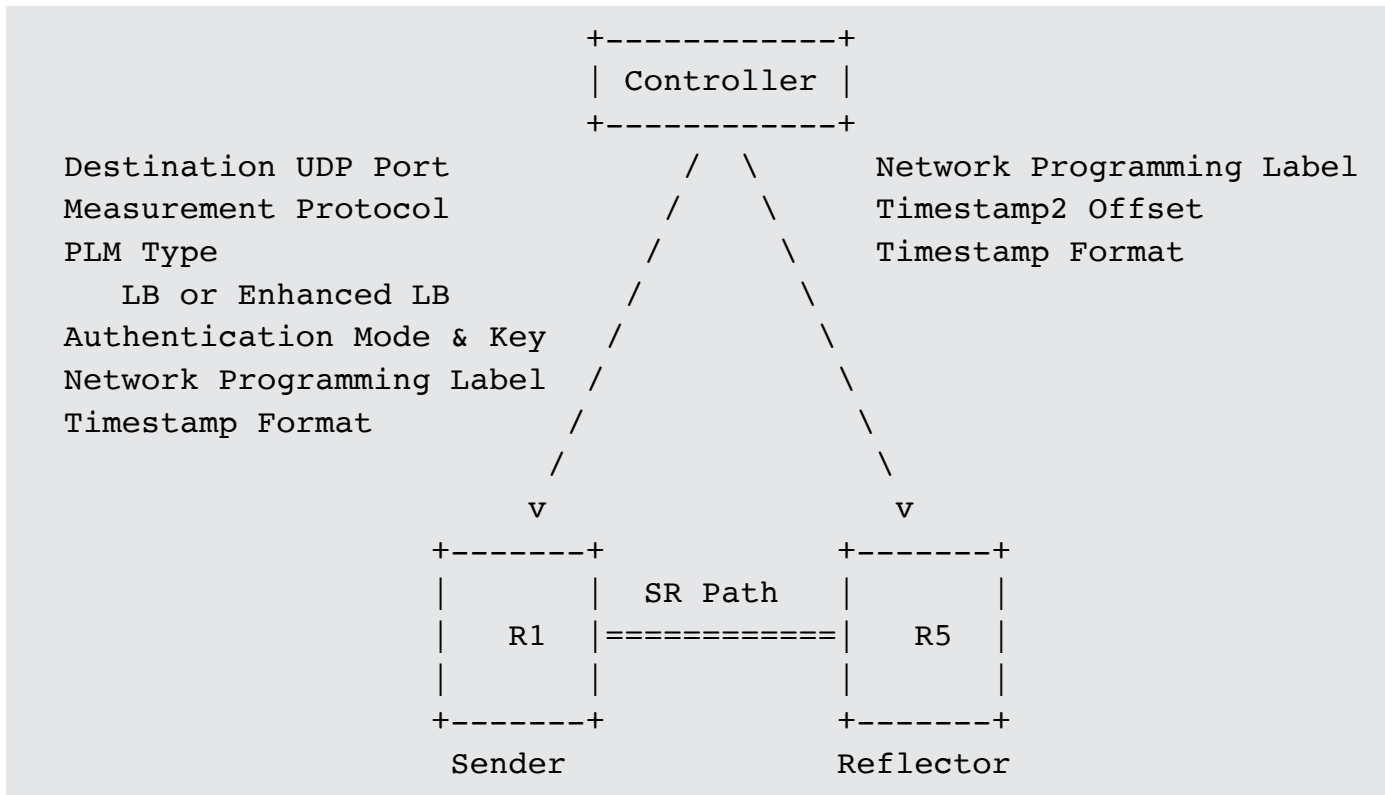
- Extended Special-purpose label (TBA1) is defined for Timestamp and Forward network function
- Reverse Path can be IP or SR-MPLS
- Source and Destination Addresses are swapped to represent the Reverse direction path



# ECMP Support for SR Paths

- SR Paths 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. Examples are:
  - For IPv4
    - Sweeping destination address in IPv4 header (e.g. 127/8) when return path is SR-MPLS
  - For IPv6
    - Sweeping 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 Example 1

```

+-----+
| IP Header |
+-----+
| Source IP Address = Sender IPv6 Address |
| Destination IP Address = Next IPv6 Address |
| |
+-----+
| SRH as specified in RFC 8754 |
| <Segment List> |
| END.TSF with Target SID |
| |
+-----+
| IP Header |
+-----+
| Source IP Address = Reflector IPv6 Address |
| Destination IP Address = Sender IPv6 Address |
| |
+-----+
| 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 |
| |
+-----+

```

- Endpoint Function END.TSF is defined for Timestamp and Forward and carried for the Reflector node SID
- Reverse Path is IP
- Reflector node removes SRH
- Inner IPv6 header is required
  - Source and Destination Addresses are swapped to represent the Reverse direction path in the inner IPv6 header

### Example 1: Probe Message for SRv6 with Endpoint Function **IP** Return Path

## SRv6 with Timestamp and Forward Function Example 2

```

| IP Header
. Source IP Address = Sender IPv6 Address
. Destination IP Address = Next IPv6 Address
.
+-----+
| SRH as specified in RFC 8754
. <Segment List>
. END.TSF with Target SID
.
+-----+
| IP Header (Optional)
. Source IP Address = Reflector IPv6 Address
. Destination IP Address = Sender IPv6 Address
.
+-----+
| 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
.
+-----+

```

- Endpoint Function END.TSF is defined for Timestamp and Forward and carried for the Reflector node SID
- Reverse direction SR path carried in SRH
- Reflector node does not remove the SRH
- Inner IPv6 header is optional and not required
  - Source and Destination Addresses are swapped to represent the Reverse direction path in the inner IPv6 header

### Example 2: Probe Message for SRv6 with Endpoint Function **SR** Return Path

# Thank you