Performance Delay 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 & 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

History of the Draft

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

Performance Delay and Liveness Monitoring of SR Policy

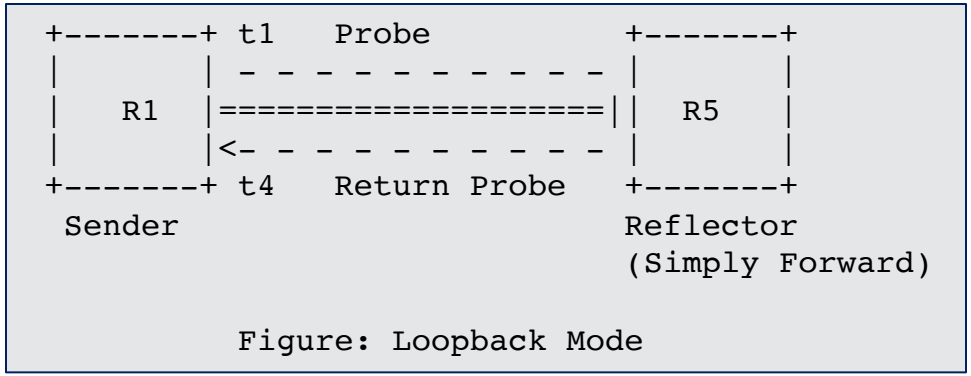


Figure: Loopback Mode

- Using 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 reflector node out of fast-path
- Liveness failure is notified when consecutive N number of probe messages are not received back at the sender
- Round-trip delay (t4 - t1) metrics are notified when consecutive M number of probe messages have delay values exceed the configured thresholds

Enhanced Performance Delay and Liveness Monitoring of SR Policy

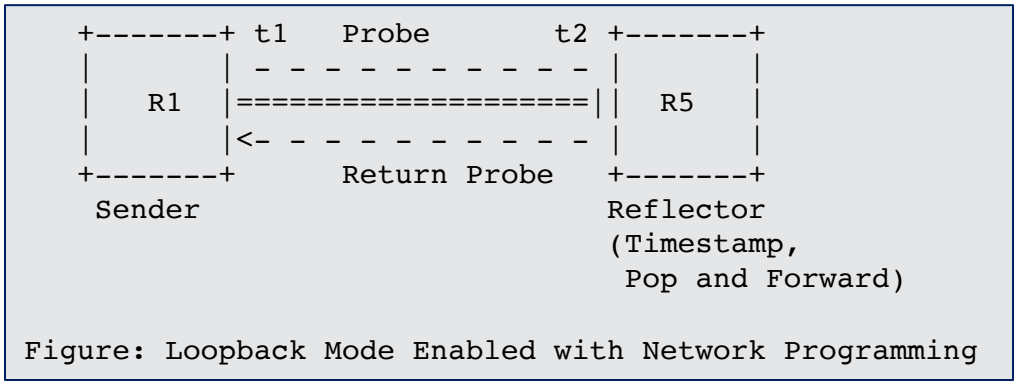


Figure: Loopback Mode Enabled with Network Programming

- Using 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
- Reflector node adds the receive timestamp in the payload of the received probe message without punting the message
  - Only adds the receive timestamp if the source address or destination 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 (t2 – t1) metrics are notified when consecutive M number of probe messages have delay values exceed the configured thresholds

Probe Message with Timestamp and Forward Function

- 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

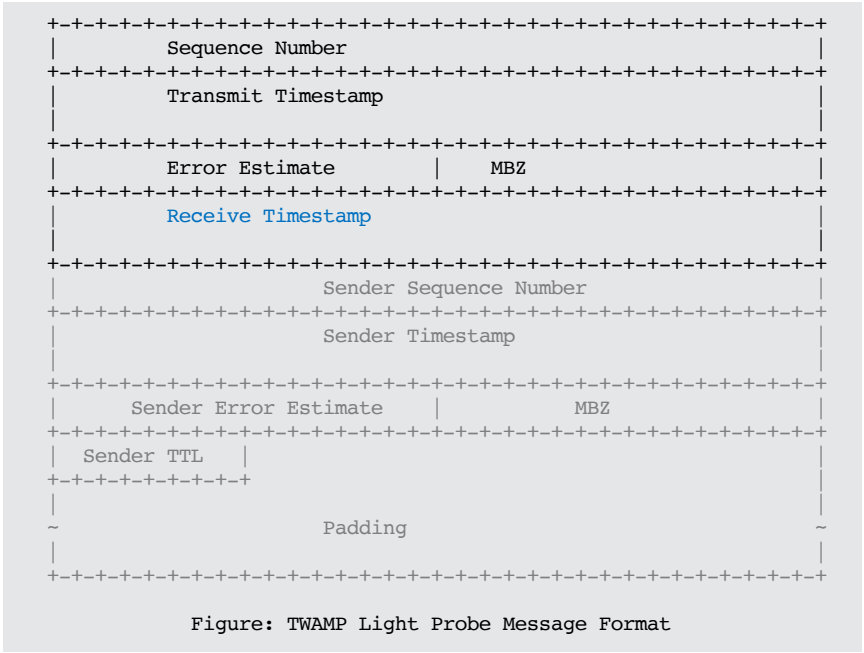


Figure: TWAMP Light Probe Message Format

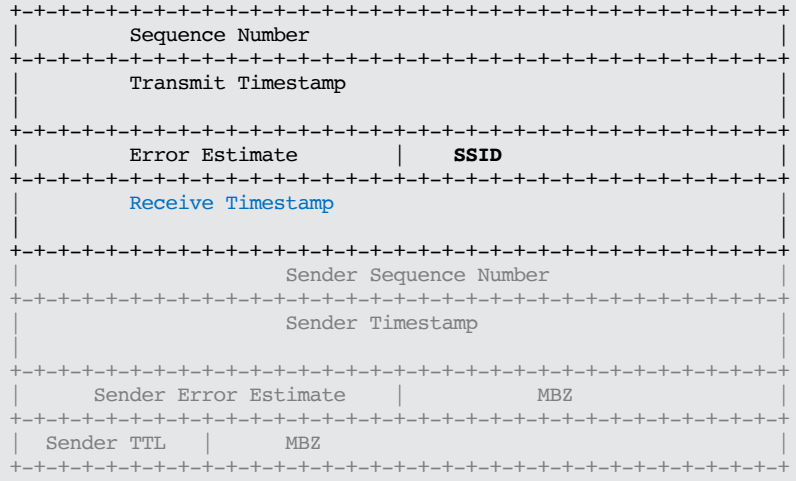
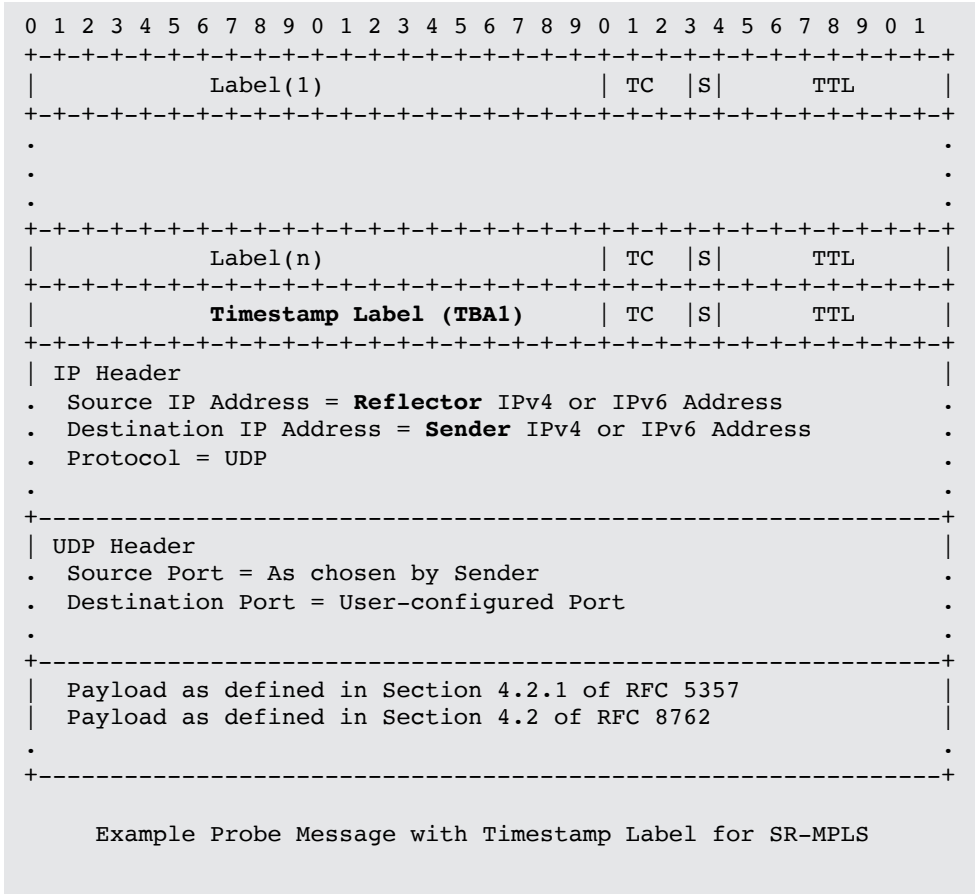


Figure: STAMP Probe Message Format

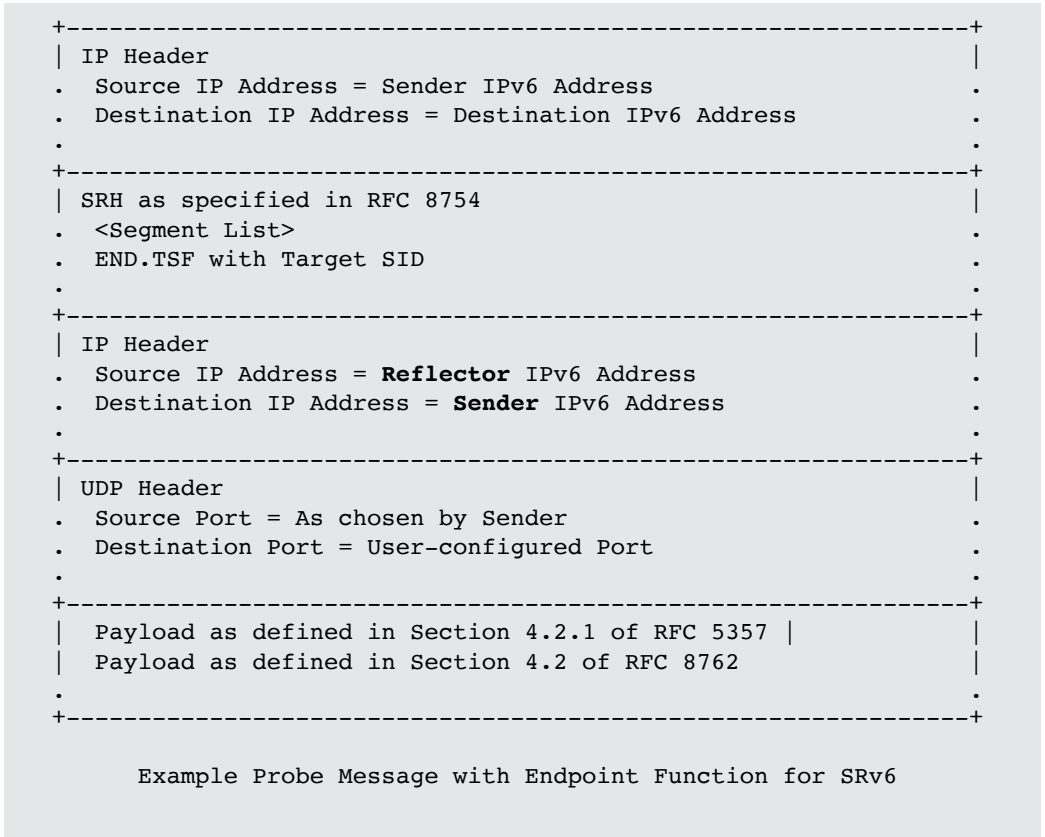
SR-MPLS with Timestamp and Forward Function



Example Probe Message with Timestamp Label for SR-MPLS

- 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

SRv6 with Timestamp and Forward Function



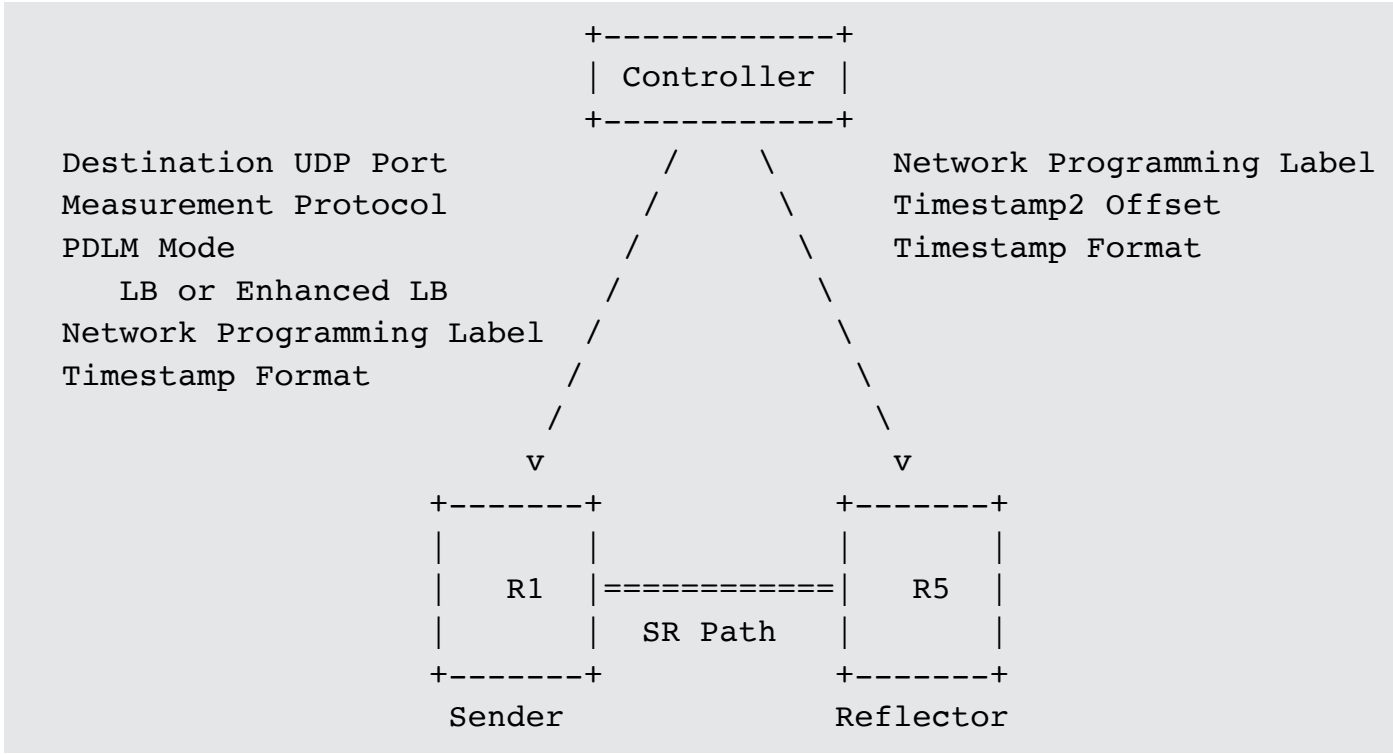
Example Probe Message with Endpoint Function for SRv6

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

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) if 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