Enhanced Performance Delay and Liveness Monitoring in Segment Routing Networks

draft-gandhi-spring-sr-enhanced-plm-03

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Agenda

- Requirements and Scope
- Summary
- Next Steps

Requirements and Scope

Requirements:

- Performance Delay Monitoring & Liveness Monitoring in SR networks
  - ✓ End-to-end P2P/P2MP SR paths
  - ✓ Applicable to SR-MPLS/SRv6 data planes
- Running single protocol in SR networks
  - ✓ Simplify implementations and reduce development cost
  - ✓ Simplify deployment and reduce operational complexity
- No reflector dependency
  - ✓ Stateless on reflector (e.g. reflector unaware of the monitoring protocol)
    - ✓ State is in the probe message - spirit of SR
  - ✓ Higher scale and faster detection interval

Scope:

- RFC 5357 (TWAMP Light) compatible probe message
- RFC 8762 (Simple TWAMP (STAMP)) compatible probe message

History of the Draft

- March 2020
  - Draft was published
- April 2020
  - Presented version 00 in IETF 107 Virtual MPLS WG Meeting
- July 2020
  - Presented version 02 in IETF 108 Online SPRING WG meeting
- September 2020
  - Presented version 02 in MPLS WG Interim meeting

PM Probes in Loopback Mode for SR Policy

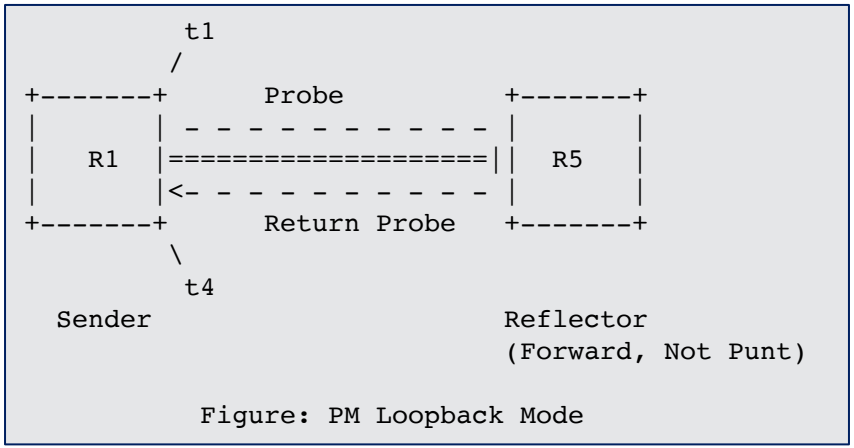
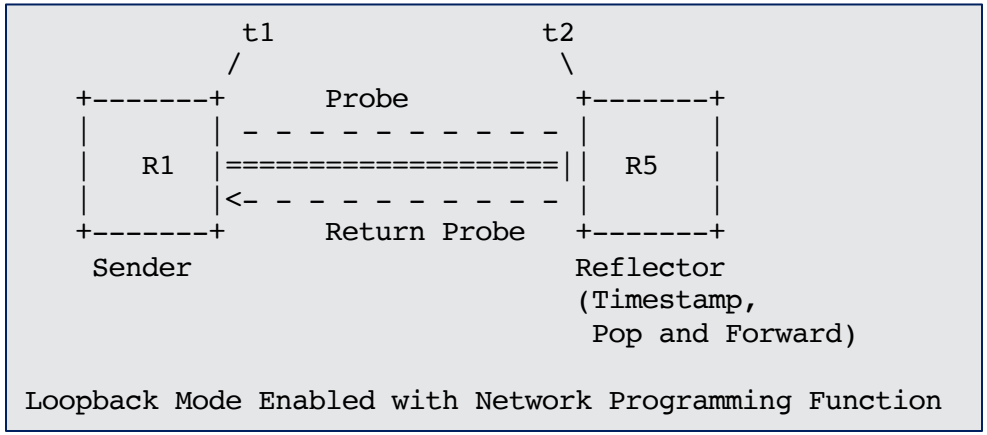


Figure: PM Loopback Mode

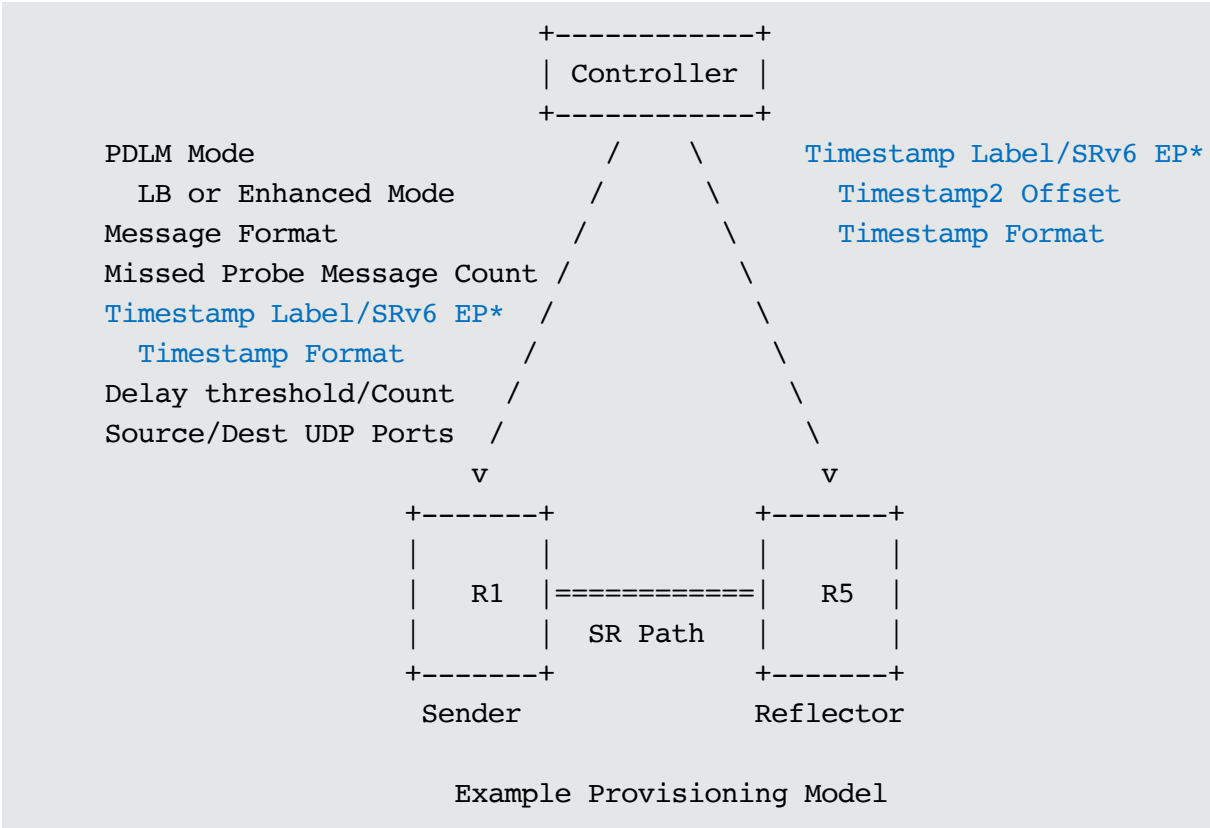
- Using PM delay measurement probe messages in Loopback Mode
- Probe messages are sent using Segment List(s) of the SR Policy Candidate Path(s)
- Probe messages are not punted on the reflector node out of fast-path in forwarding
- Reflector is agnostic to the monitoring protocol
- Round-trip delay = (t4 - t1)

Loopback Mode Enabled with Network Programming Function



- PM probes sent in loopback mode enabled with network programming function
  - The network programming function optimizes the "operations of punt and inject the probe packet" on the reflector node
  - As probe packets are forwarded in fast-path, higher scale with faster interval is possible resulting in faster failure detection
- Reflector node adds the receive timestamp at a specific location in the payload of the received probe message in fast-path
  - Only adds the receive timestamp if the source address or destination address in the probe message matches the local node address
  - Ensure loopback probe packets return from the intended reflector node
- One-way delay = (t2 – t1)

Example Provisioning Model

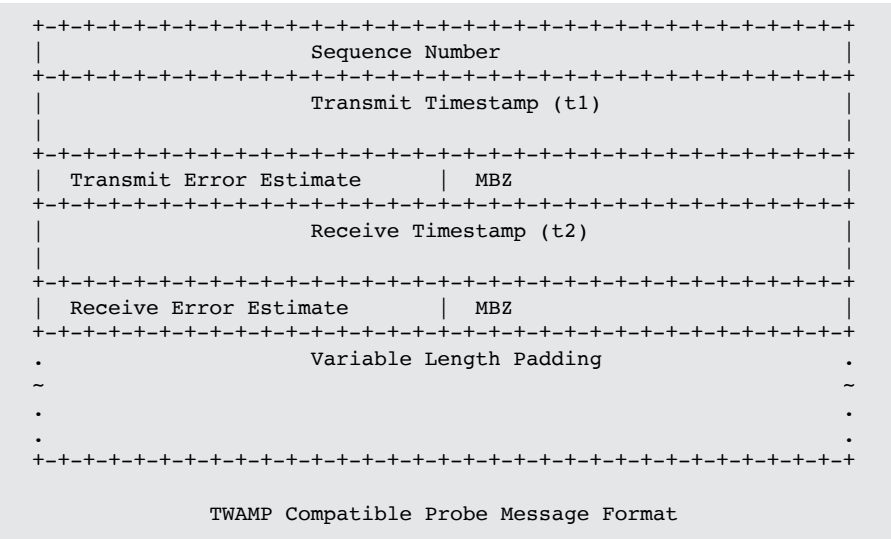


Example Provisioning Model

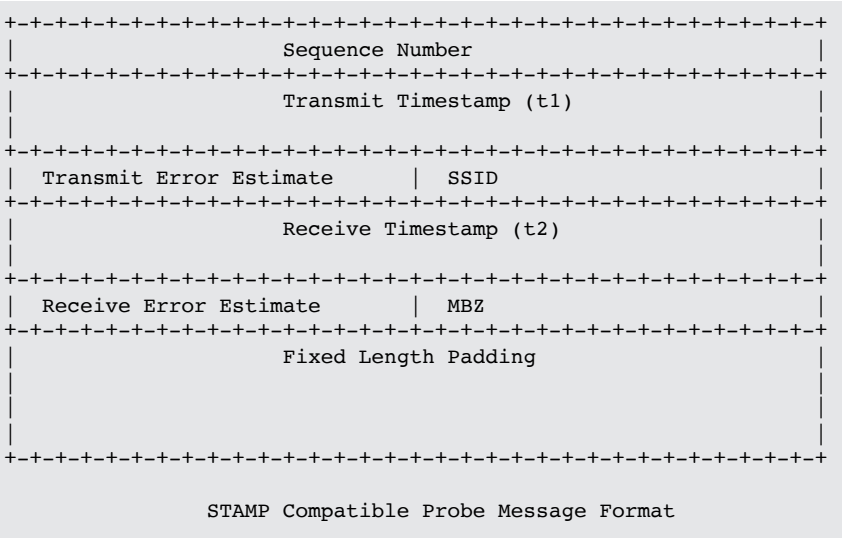
* Provisioned, Flooded/Signaled or IANA Allocated

Probe Message Formats

- Leverage existing TWAMP implementations and deployments using compatible probe message format
- Sender adds Transmit Timestamp (t1)
- Reflector adds Receive Timestamp (t2) at offset-byte location in payload
  - offset-byte 16 from the start of the payload, or
  - locally provisioned location (consistently in the network)

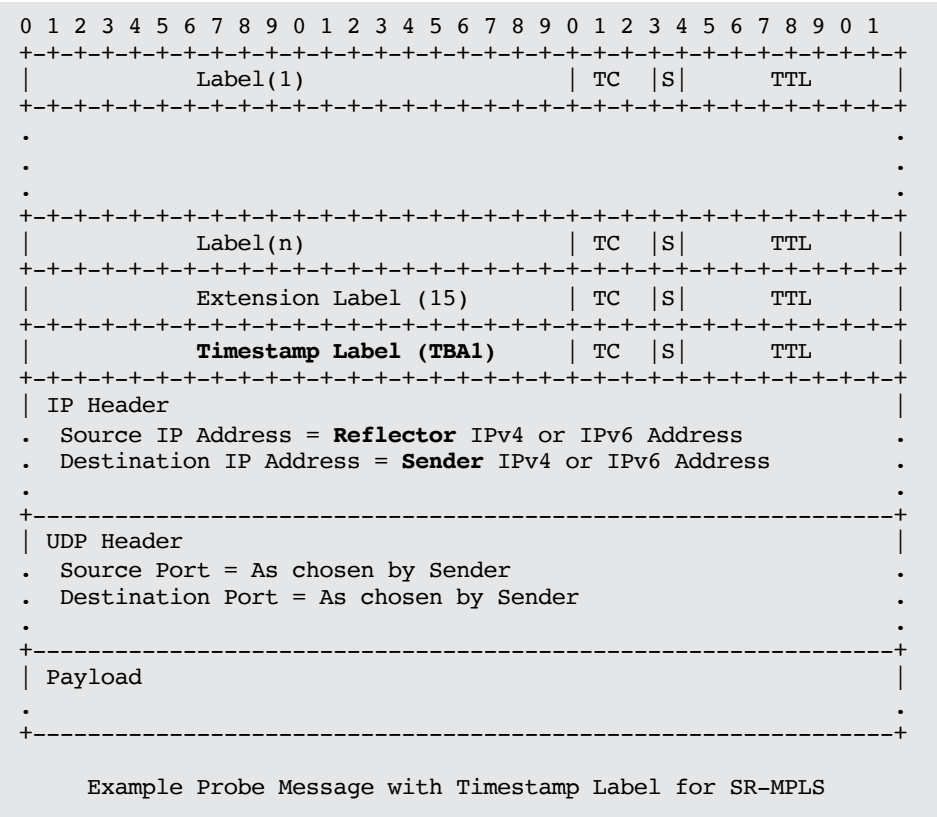


TWAMP Compatible Probe Message Format



STAMP Compatible Probe Message Format

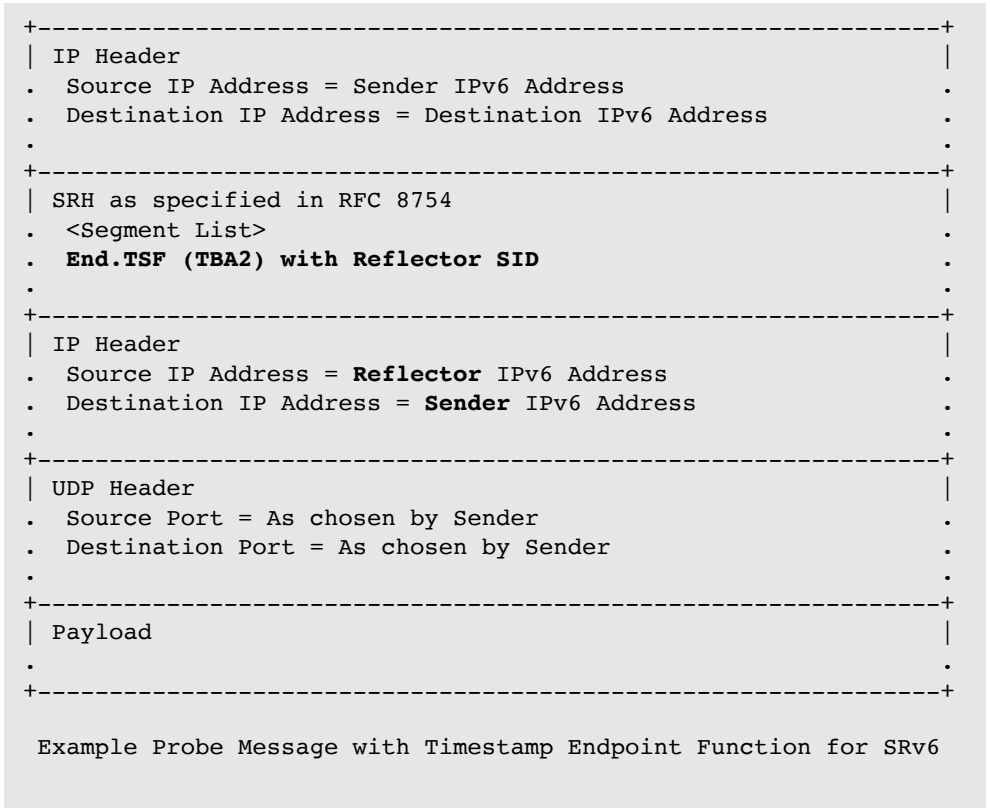
SR-MPLS with Timestamp Label



Example Probe Message with Timestamp Label for SR-MPLS

- Timestamp label (TBA1) is defined for Timestamp, Pop and Forward function
- Reverse Path can be IP or SR-MPLS
- Source and Destination Addresses are swapped that represent the Reverse direction path

SRv6 with Timestamp Endpoint Function



Example Probe Message with Timestamp Endpoint Function for SRv6

- Timestamp Endpoint Function End.TSF (TBA2) is defined for Timestamp and Forward and is carried with the Reflector node SID
- Reverse path can be IP
  - Reflector node removes SRH
- Reverse path can be SR
  - Reverse direction SR path Segment-list carried in SRH
  - Reflector node does not remove the SRH
- Source and Destination Addresses are swapped that represent the Reverse direction path in the inner IPv6 header

ECMP Support for SR Paths

- SR Paths can have ECMPs between the ingress and transit nodes, between transit nodes and between transit and egress nodes.
- PM probe messages can take advantage of the hashing function in forwarding plane to explore ECMP paths.
- Existing forwarding mechanisms are applicable to PM probe messages. Examples are:
  - For IPv4 when return path is also SR-MPLS
    - Sweeping destination address in IPv4 header (e.g. 127/8)
  - For IPv6
    - Sweeping flow label in IPv6 header

Notifications

- Delay metrics are notified as an example, when consecutive M number of probe messages have delay values exceed the configured thresholds
- Liveness failure (bring-down - loss of heart beats) is notified when consecutive N number of return probe messages are not received at the sender node
- Liveness success (bring-up - success of heart beats) initially is notified as soon as one or more return probe messages are received at the sender node

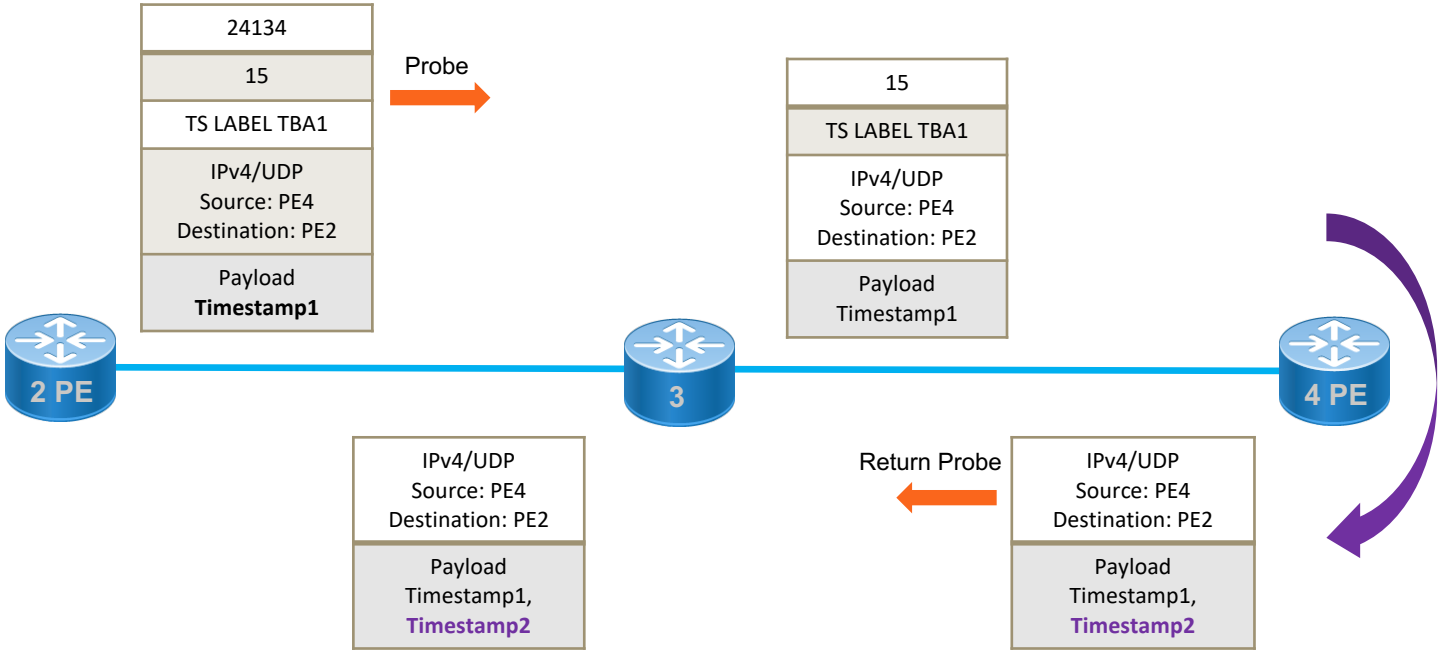
Next Steps

- Welcome your comments and suggestions
- Requesting SPRING WG adoption

Thank you

Backup

Loopback Mode with Timestamp and Forward for SR-MPLS Policy



Thank you