

# Enhanced Performance and Liveness Monitoring in Segment Routing Networks

*draft-gandhi-spring-sr-enhanced-plm-04*

*Rakesh Gandhi - Cisco Systems ([rgandhi@cisco.com](mailto:rgandhi@cisco.com)) - Presenter*

*Clarence Filsfils - Cisco Systems ([cfilsfil@cisco.com](mailto:cfilsfil@cisco.com))*

*Navin Vaghamshi - Reliance ([Navin.Vaghamshi@ril.com](mailto:Navin.Vaghamshi@ril.com))*

*Moses Nagarajah - Telstra ([Moses.Nagarajah@team.telstra.com](mailto:Moses.Nagarajah@team.telstra.com))*

*Richard Foote - Nokia ([footer.foote@nokia.com](mailto:footer.foote@nokia.com))*

# Agenda

- Requirements and Scope
- History and Summary of Updates
- Review of the Procedure
- Next Steps

# Requirements and Scope

## Requirements:

- Performance and Liveness Monitoring (PLM) in SR networks
  - ✓ End-to-end 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 Session-Reflector dependency
  - ✓ Session-Reflector unaware of the monitoring protocol
    - ✓ State is in the test packet - spirit of SR
  - ✓ Higher test session scale and faster failure detection interval

## Scope:

- Leverage RFC 8762 (Simple TWAMP (STAMP)) hardware implementation
  - Same location for timestamp fields in the new test packet formats

# 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

# Updates Since IETF-108 (Version-02)

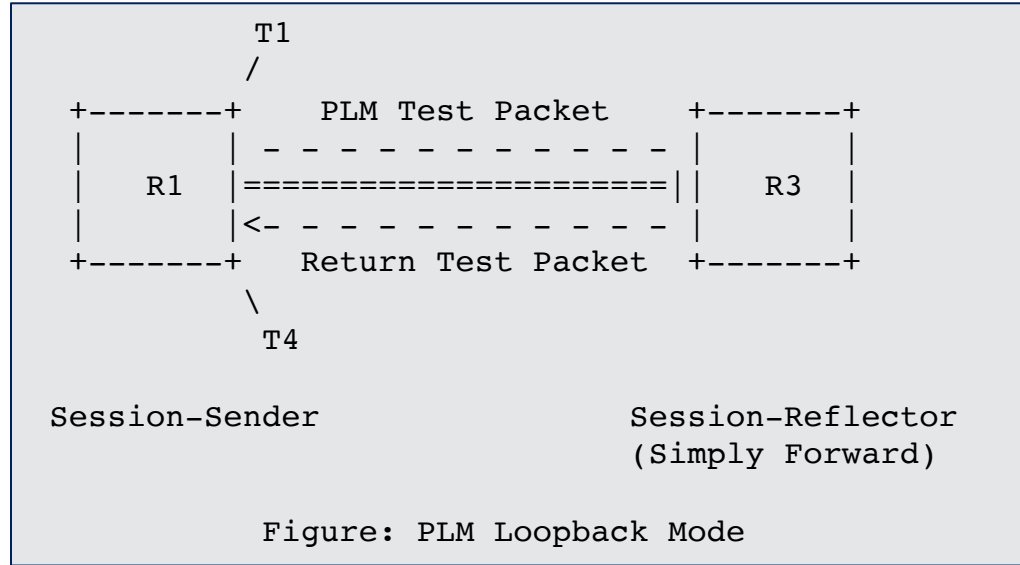
## Updates:

- ✓ Updated terminology
  - ✓ test packets, consistent terms for MPLS Timestamp Label and SRv6 Timestamp Endpoint
- ✓ Added authentication mode
- ✓ Added SRv6 Timestamp Endpoint function assignment and Node Capability section
- ✓ Added synthetic packet loss section
- ✓ Updated IANA section
- ✓ Various editorial changes

## Open Items:

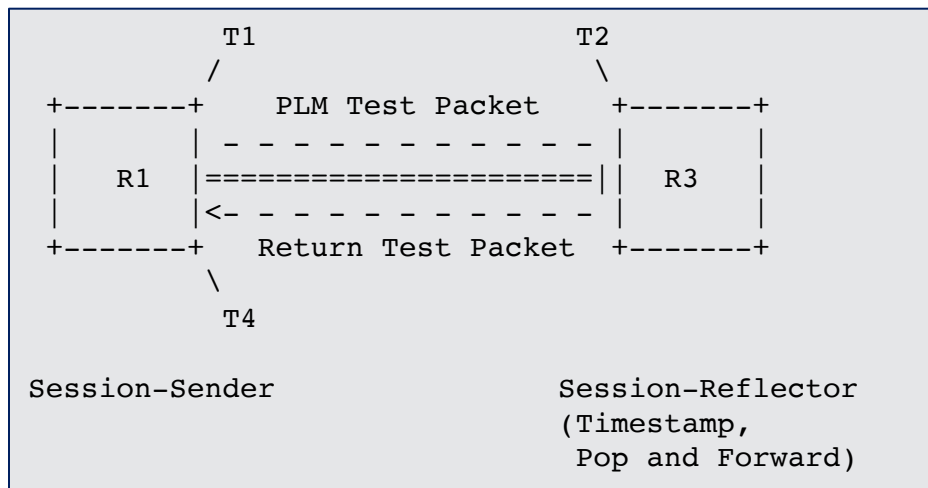
- None

# Loopback Mode for SR Policy



- PLM test packets in Loopback Mode
- PLM test packets are transmitted for each Segment List(s) of the SR Policy Candidate Path(s)
- PLM test packets are forwarded in fast-path just like data traffic on Session Reflector - not punted to slow-path
- Session-Reflector is agnostic to the PLM protocol
- Round-trip delay = (T4 - T1)

# Loopback Mode Enabled with Network Programming Function



- PLM test packets transmitted in loopback mode enabled with network programming function
  - The network programming function optimizes the "operations of punt and generate the test packet" on Session-Reflector
  - As PLM test packets are forwarded in fast-path, higher session scale with faster failure detection interval is achieved
- Session-Reflector adds receive timestamp at a specific location in the payload of the received test packet in fast-path
  - Only adds the receive timestamp if the source address or destination address in the received test packet matches the local node address
  - Ensure loopback PLM test packets return from the intended Session-Reflector
- One-way delay =  $(T2 - T1)$

# Example Provisioning Model

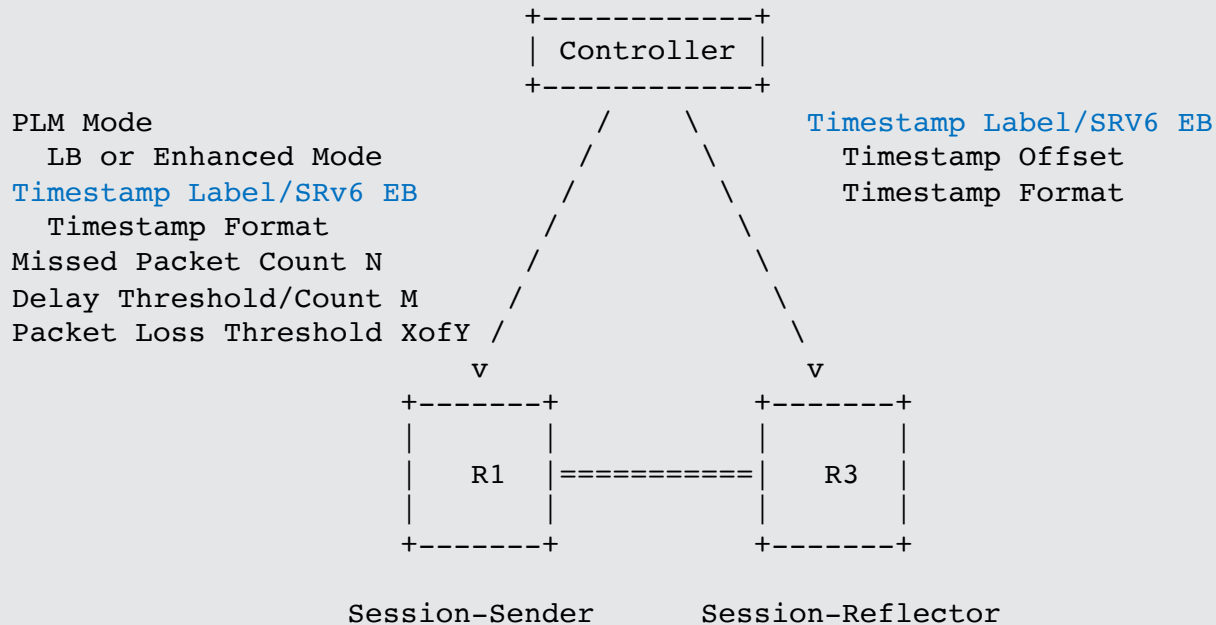


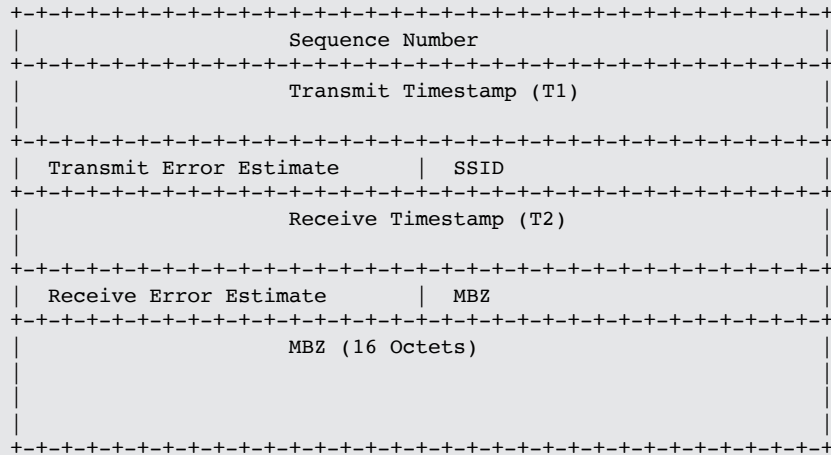
Figure: Example Provisioning Model

\* Provisioned, Flooded/Signaled or IANA Allocated



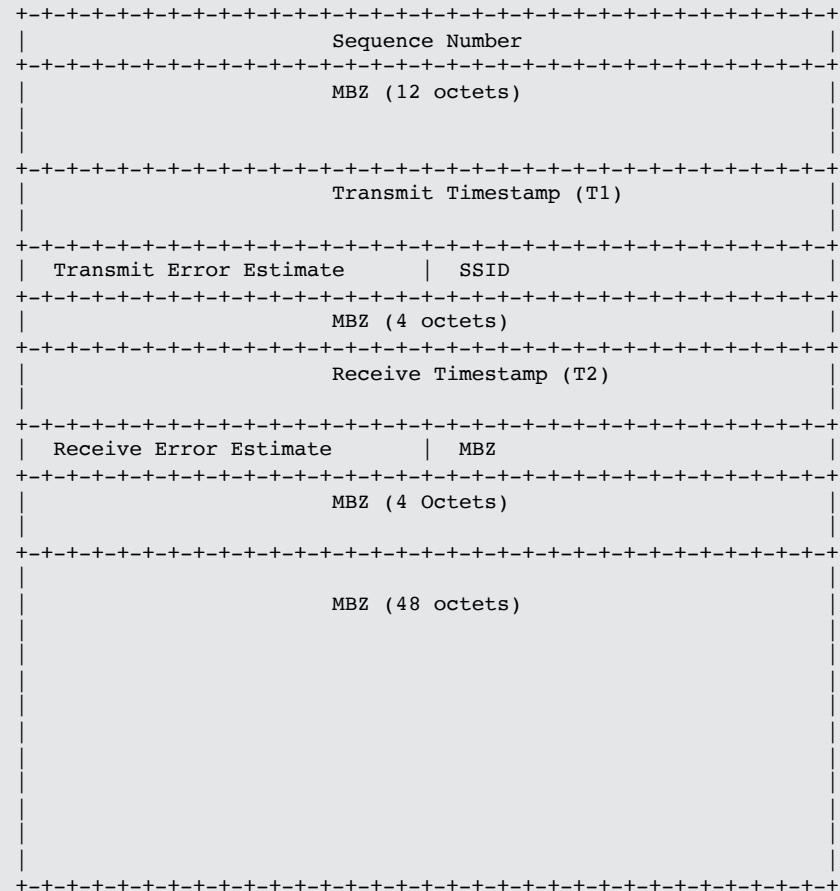
# PLM Test Packet Formats

- Leverage existing STAMP implementations in hardware for timestamp field locations
- Session-Sender adds Transmit Timestamp (T1)
- Session-Reflector adds Receive Timestamp (T2) at offset-byte location in payload, for example,
  - offset-byte 16 from the start of the payload in unauthenticated mode, or
  - offset-byte 32 from the start of the payload in authenticated mode, or
  - locally provisioned location (consistently in the network)



## PLM Test Packet Format in Unauthentication Mode

☐ F Or



## PLM Test Packet Format in Authentication Mode

# 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 2 3 4 5 6 7 8 9 0 1
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
|          Label(1)          | TC | S |          TTL          |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
.
.
.
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
|          Label(n)          | TC | S |          TTL          |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
|          Extension Label (15)          | TC | S |          TTL          |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
|      Timestamp Label (TBA1 or TBA2)      | TC | S |          TTL          |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
| IP Header |
. Source IP Address = Session-Reflector IPv4 or IPv6 Address .
. Destination IP Address = Session-Sender IPv4 or IPv6 Address .
.
+-----+
| UDP Header |
. Source Port = As chosen by Session-Sender .
. Destination Port = As chosen by Session-Sender .
.
+-----+
| PLM Test Packet |
.
+-----+
```

Example PLM Test Packet 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

```
+-----+
| IP Header                                     |
. Source IP Address = Session-Sender IPv6 Address .
. Destination IP Address = Destination IPv6 Address .
. . . . .
+-----+
| SRH as specified in RFC 8754                 |
. <Segment List>                               .
. End.TSF (TBA3 or TBA4) with Session-Reflector SID .
. . . . .
+-----+
| IP Header                                     |
. Source IP Address = Session-Reflector IPv6 Address .
. Destination IP Address = Session-Sender IPv6 Address .
. . . . .
+-----+
| UDP Header                                   |
. Source Port = As chosen by Session-Sender .
. Destination Port = As chosen by Session-Sender .
. . . . .
+-----+
| PLM Test Packet                             |
. . . . .
+-----+
```

Example PLM Test Packet with Timestamp Endpoint Function for SRv6

- Timestamp Endpoint Function End.TSF (TBA3) is defined for Timestamp and Forward and is carried with the Session-Reflector node SID
- Reverse path can be IP
  - Session-Reflector removes SRH
- Reverse path can be SR
  - Reverse direction SR path Segment-list carried in SRH
  - Session-Reflector does not remove the SRH
- Source and Destination Addresses are swapped that represent the Reverse direction path in the inner IPv6 header

# Performance Metric Notifications

- Liveness success (success of heart beats) initially is notified as soon as one or more PLM return test packets are received at the Session-Sender
- Liveness failure (loss of heart beats) is notified when consecutive N number of PLM return test packets are not received at the Session-Sender
- Synthetic packet loss is notified when X number of PLM return test packets not received at the Session-Sender out of last Y PLM test packets transmitted (with configured XofY threshold)
- Delay metrics are notified as an example, when consecutive M number of PLM test packets have delay values exceed the configured thresholds (absolute/percentage)

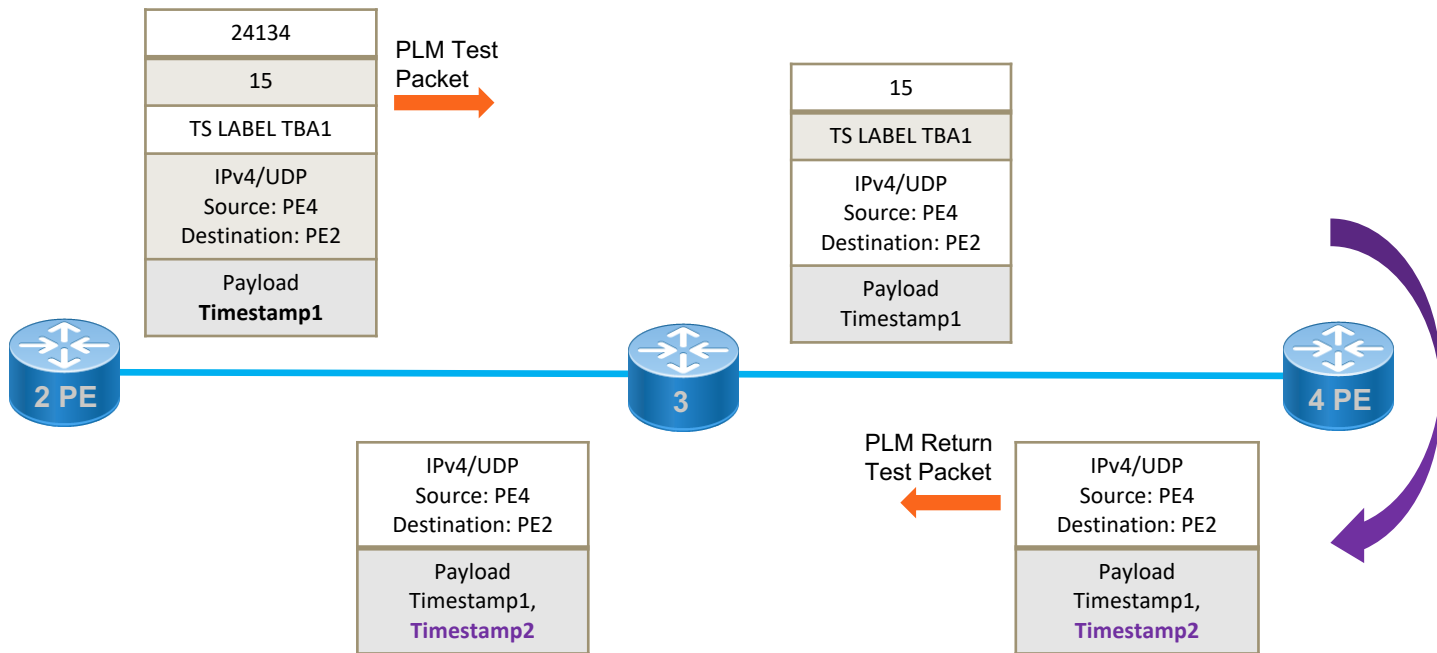
# Next Steps

- Welcome your comments and suggestions
- Requesting SPRING WG adoption

# Thank you

# Backup

# Loopback Mode with Timestamp and Forward for SR-MPLS Policy





# Thank you