

# Performance Measurement Using Simple TWAMP for Segment Routing Networks

*draft-gandhi-spring-stamp-srpm-05*

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# Agenda

- Requirements and Scope
- Summary of Procedure
- Next Steps

# Requirements, Goals and Scope

## Requirements:

- In-band Performance Delay and Loss Measurement
  - ✓ Links and end-to-end P2P/P2MP SR paths
    - ✓ Links include physical, virtual, LAG, LAG member links
  - ✓ Applicable to SR-MPLS/SRv6 data planes
- One-way, two-way, round-trip delay and packet loss metrics
- Handle ECMP for SR paths

## Goals:

- Avoid provisioning and maintaining test sessions on Session-Reflector - Stateless mode
- Avoid control protocol for signaling dynamic parameters
- High scale for number of test sessions and faster detection interval
  - Support hardware implementation

## Scope:

- STAMP [RFC 8762]
- STAMP Extensions [RFC 8972]
- [STAMP Extensions for SR \[draft-gandhi-ippm-stamp-srpm\]](#)

# Updates Since Version-02

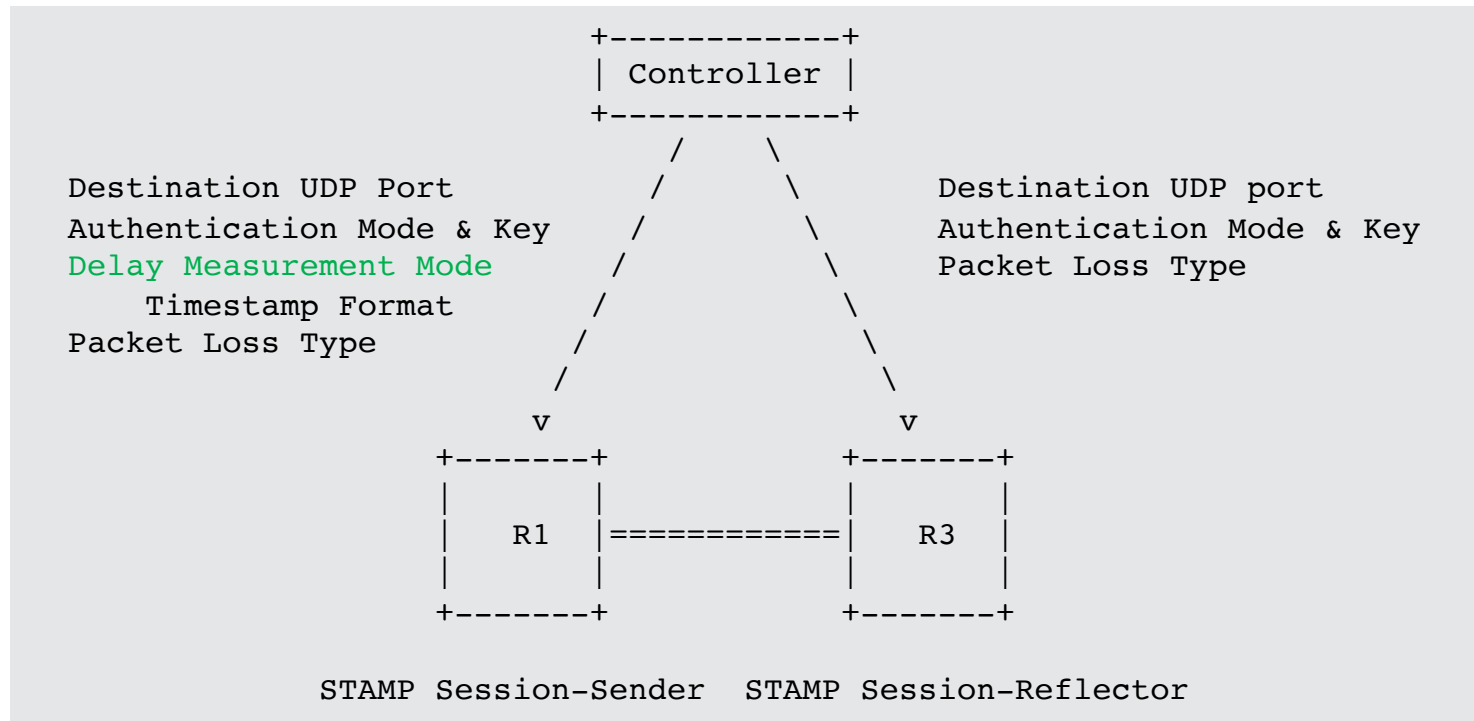
## Updates:

- ✓ STAMP Extensions for SR was moved to [draft-gandhi-ippm-stamp-srpm](#)
- ✓ Replaced TWAMP Light draft with STAMP draft
- ✓ Draft status - Informational
- ✓ Updated terminology to align with STAMP
- ✓ Added (test) packet loss section
- ✓ Removed STAMP direct measurement stand-alone messages
- ✓ Removed text for using IPv6/UDP test packets with zero checksum
- ✓ Various editorial changes to address review comments

## Open Items:

- None

# Example STAMP Reference Model



# Session-Sender Test Packet for Links

- For links, the STAMP Session-Sender test packets are transmitted over the links using local and remote link addresses
- User-configured destination UDP port is used for STAMP test packets (or port 862)
- IPv4 TTL /IPv6 Hop-limit is set to 1
- Applicable to physical, virtual, LAG, LAG member links

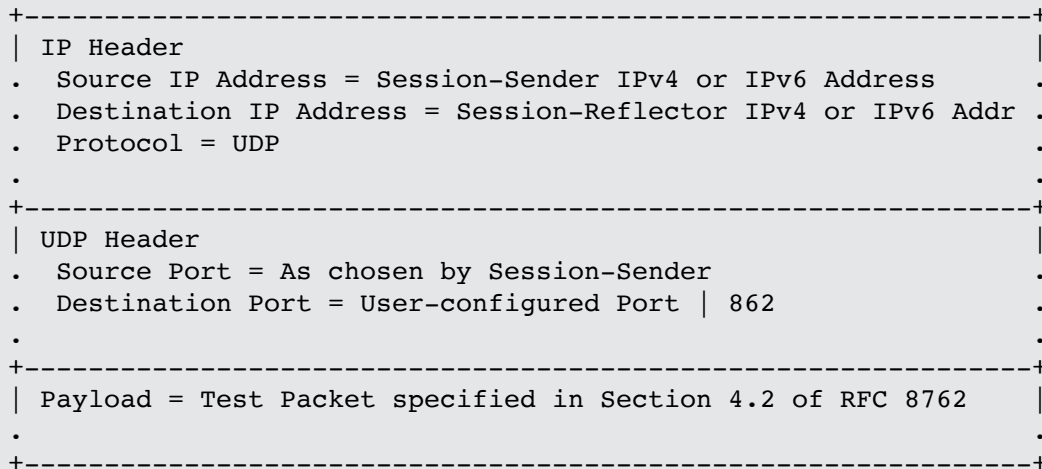


Figure 1: Session-Sender Test Packet for links

# STAMP Session-Sender Test Packet for SR-MPLS and SRv6 Policy

For end-to-end SR Policy, the STAMP Session-Sender test packets are transmitted on the SR Policy with:

1. MPLS label stack of SR-MPLS Policy
2. SRv6 SRH [RFC 8754] with Segment List of SRv6 Policy
  - Using upper-layer processing defined in SRv6 network programming
- User-configured destination UDP port is used for STAMP test packets (or port 862)
- IPv4 TTL/IPv6 Hop-limit is set to 255
- Color only SR-MPLS Policy:
  - Destination Address in 127/8 address
  - IPv4 TTL is set to 1

```

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
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                                     Segment(1)                 | TC | S |         TTL         |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
.
.
.
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                                     Segment(n)                 | TC | S |         TTL         |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| Test Packet including IP/UDP Header from Figure 1             |
.
+-----+

```

Figure 2: Example Session-Sender test packet for SR-MPLS Policy

```

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
+-----+---+
| IP Header |
. Source IP Address = Session-Sender IPv6 Address
. Destination IP Address = Destination IPv6 Address
.
+-----+---+
| SRH as specified in RFC 8754 |
. <Segment List>
.
+-----+---+
| IP Header |
. Source IP Address = Session-Sender IPv6 Address
. Destination IP Address = Session-Reflector IPv6 Address
.
+-----+---+
| UDP Header |
. Source Port = As chosen by Session-Sender
. Destination Port = User-configured Port | 862
.
+-----+---+
| Payload = Test Packet specified in Section 4.2 of RFC 8762 |
.
+-----+---+

```

Figure 3: Example Session-Sender test packet for SRv6 Policy

# STAMP Session-Sender Test Packet for P2MP SR-MPLS Policy

For end-to-end P2MP SR-MPLS Policy, the STAMP Session-Sender test packet is sent with:

- Tree-SID of the SR-MPLS Policy
- IPv4 destination address selected from 127/8 range
- IPv4 TTL is set to 1

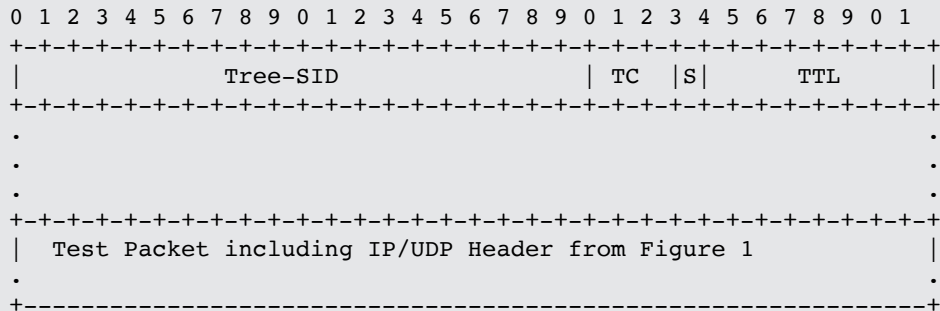


Figure 4: Example Session-Sender test packet for SR-MPLS Policy



# STAMP Session-Reflector Test Packet

- The STAMP reply test packet is sent using the IP/UDP information from the received test packet.

```
+-----+
| IP Header                                     |
| . Source IP Address = Session-Reflector IPv4 or IPv6 Address .
| . Destination IP Address =                      .
| .           Source IP Address from Received Test Packet      .
| . Protocol = UDP                                           .
| .                                                         .
+-----+
| UDP Header                                     |
| . Source Port = As chosen by Session-Reflector             .
| . Destination Port = Source Port from Received Test Packet .
| .                                                         .
+-----+
| Payload = Test Packet specified in Section 4.3 of RFC 8762 |
| .                                                         .
+-----+
```

Figure 5: STAMP Session-Reflector Test Packet

# Performance Measurement Modes

- Need to measure in-band one-way, two-way and round-trip delay metrics in SR networks
- One-way Delay Measurement Mode
  - Existing (default) behavior
- Two-way Delay Measurement Mode
  - STAMP Session-Reflector test packet sent “in-band” on reverse path
  - Link: Use Control Code Sub-TLV in the Return Path TLV from the received test packet.
  - E2E SR path: Use Segment List Sub-TLV in the Return Path TLV from the received test packet.
- Round-trip Delay Measurement Mode
  - STAMP Session-Sender test packet sent in loopback mode, carries the return path in the packet header

# ECMP Support for SR Path

- SR Path can have ECMP between the ingress and transit nodes, between transit nodes and between transit and egress nodes.
- Sending STAMP test packets that can take advantage of the hashing function in forwarding plane.
- Existing forwarding mechanisms are applicable to test packets. Examples are:
  - For IPv4
    - Sweeping destination address in IPv4 header (e.g. 127/8)
    - Identify intended actual destination node in “Destination Node Address TLV”
  - For IPv6
    - Sweeping flow label in IPv6 header

# Example PM Metrics

- Compute following example (one-way, two-way, round-trip) delay metrics:
  - Minimum delay
  - Maximum delay
  - Average delay
  - Delay variance
- Compute following example loss metrics:
  - Test packet loss (i.e., synthetic packet loss)
  - Data packet loss (i.e., direct measurement)
  - Session state succeeded/failed (i.e., measurement is active)

# Next Steps

- Welcome your comments and suggestions
- Requesting WG adoption

# Thank you