

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

Goals:

- Avoid maintaining each test session on Session-Reflector
- Avoid control protocol for signaling dynamic parameters

Scope:

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

Updates Since Version-02

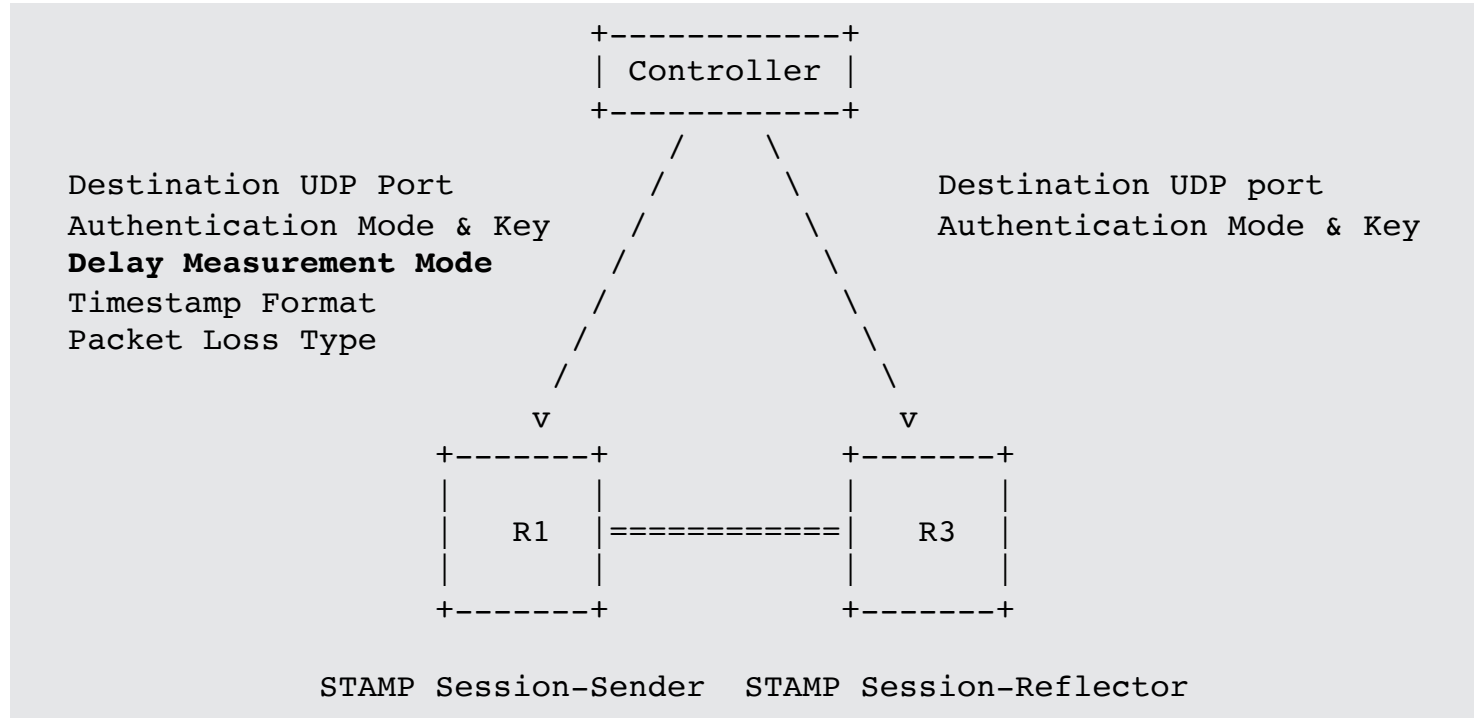
Updates:

- ✓ Draft status - Informational
- ✓ Updated terminology to align with STAMP
- ✓ Added (synthetic) packet loss section
- ✓ Removed stand-alone direct measurement messages
- ✓ Removed text for IPv6/UDP test packet with zero checksum
- ✓ Various editorial changes to address review comments

Open Items:

- None

Example STAMP Reference Model



STAMP Session-Sender Test Packet for Links

- For links, 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

```
+-----+
| IP Header |
. Source IP Address = Session-Sender IPv4 or IPv6 Address .
. Destination IP Address = Session-Reflector IPv4 or IPv6 Addr .
. Protocol = UDP .
. .
+-----+
| 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 1: STAMP Session-Sender Test Packet for links

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

- For end-to-end SR Policy, STAMP Session-Sender test packets are transmitted with:
 - MPLS label stack of SR-MPLS Policy
 - SRv6 SRH [RFC 8754] with Segment List of SRv6 Policy
 - Using upper-layer processing (for UDP header) 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 Destination Steering:
 - IPv4
 - Destination Address in 127/8 range
 - TTL is set to 1
 - IPv6
 - Destination Address set to ::1/128
 - Hop Limit is set to 1

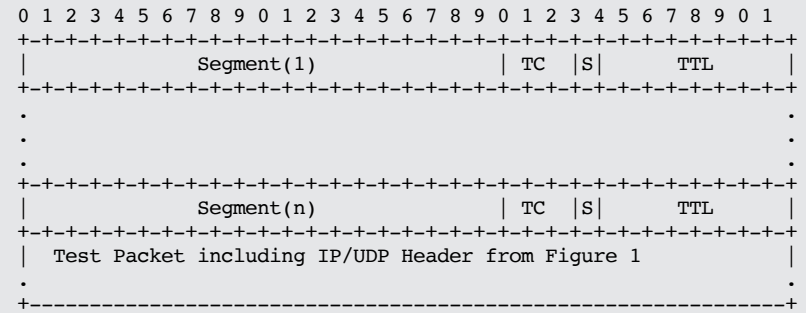


Figure 2: Example Session-Sender test packet for SR-MPLS Policy

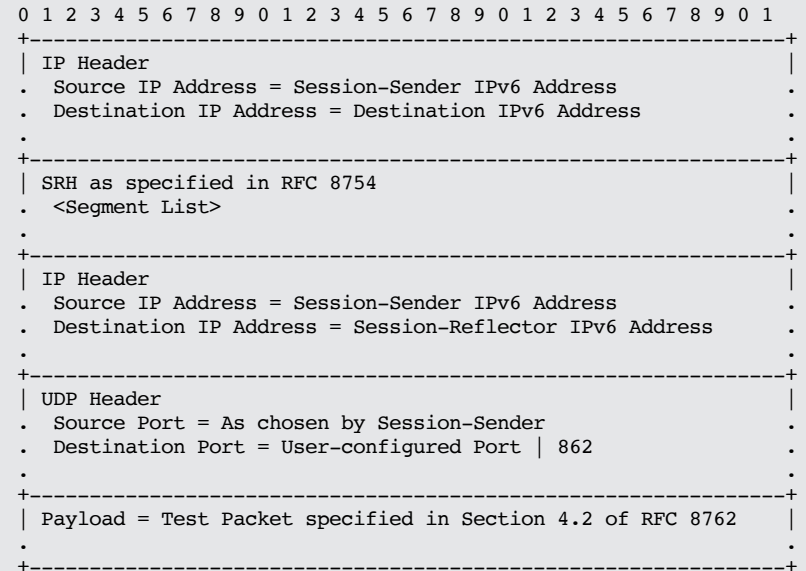


Figure 3: Example Session-Sender test packet for SRv6 Policy

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

- For end-to-end P2MP SR-MPLS Policy, STAMP Session-Sender test packets are transmitted with:
 - Tree-SID of the P2MP SR-MPLS Policy
 - IPv4 destination address selected from 127/8 range
 - IPv4 TTL is set to 1

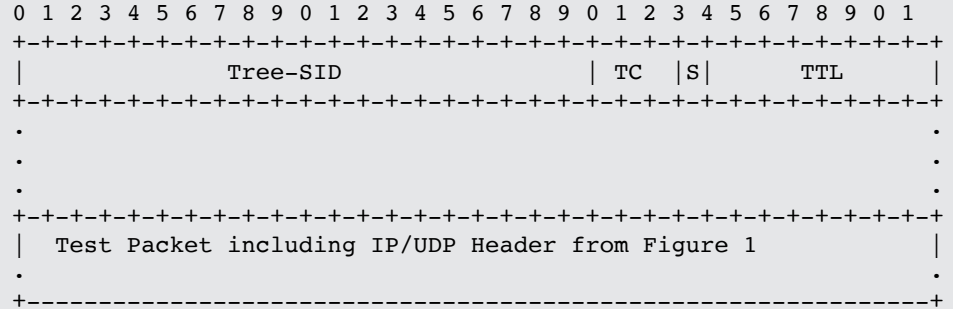


Figure 4: Example Session-Sender test packet for SR-MPLS Policy

STAMP Session-Reflector Test Packet

- STAMP Session-Reflector reply test packet is transmitted 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
 - Avoid per test session state on Session-Reflector
 - [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:
 - Packet loss (i.e., synthetic packet loss)
 - Direct measurement packet counters
 - Session status succeeded/failed (i.e., measurement is active)

Next Steps

- Welcome your comments and suggestions
- Requesting WG adoption

Thank you

Simple TWAMP (STAMP) Extensions for Segment Routing Networks

draft-gandhi-ippm-stamp-srpm-02

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Agenda

- Requirements and Scope
- Summary of Extensions
- Next Steps

Requirements, Goals and Scope

Requirements:

- In-band Performance Measurement for links and SR paths

Goals:

- Avoid maintaining each test session on Session-Reflector
- Avoid control protocol for signaling dynamic parameters

Scope:

- STAMP [RFC 8762]
- STAMP Extensions [RFC 8972]

Updates Since Version-00

Updates:

- ✓ Updated terminology to align with STAMP
- ✓ Moved direct measurement messages to *draft-gandhi-ippm-simple-direct-loss*
- ✓ Moved Control Code to Return Path TLV
- ✓ Various editorial changes to address review comments

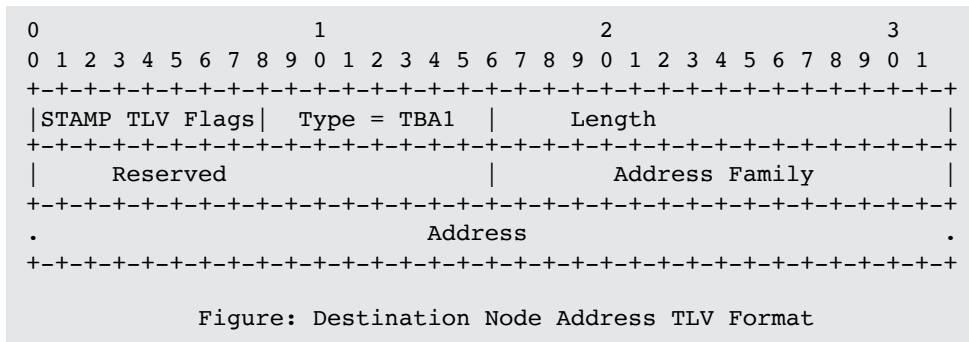
Open Items:

- None

STAMP Destination Node Address TLV

Destination Node Address TLV (value TBA1):

- Indicates the address of the intended destination of the Session-Sender test packet
- STAMP Session-Reflector that supports this TLV, **MUST NOT** send reply if it is not the intended destination of the Session-Sender test packet
- Useful when test packet is sent with 127/8 destination address (e.g. sweeping ECMP paths)



STAMP Return Path TLV

Return Path TLV (value TBA2) to carry Sub-TLV for return path:

Return Path Sub-TLVs Types:

- Type (value 1): Return Path Control Code. Reply test packet based on the control code flags
 - 0x0: No Reply Requested
 - 0x1: In-band Reply Requested
- Type (value 2): Return Address. Destination address for the reply; different than the Source Address in the Session-Sender test packet
- Type (value 3): SR-MPLS Label Stack of the Return SR Path
- Type (value 4): SR-MPLS Binding SID [draft-ietf-pce-binding-label-sid] of the Return SR Policy
- Type (value 5): SRv6 Segment List of the Return SR Path
- Type (value 6): SRv6 Binding SID [draft-ietf-pce-binding-label-sid] of the Return SR Policy

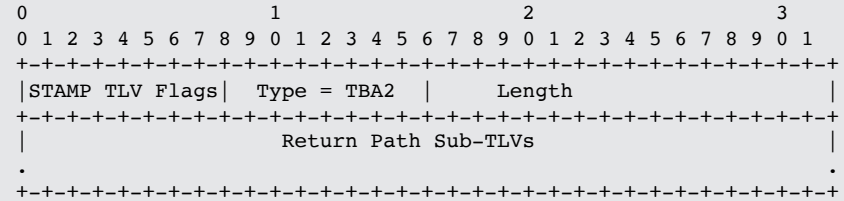


Figure: Return Path TLV

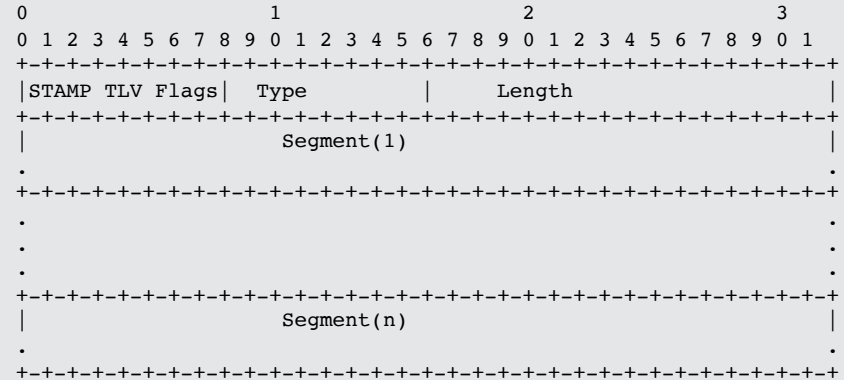


Figure: Segment List Sub-TLV in Return Path TLV

STAMP Return Path Control Code Sub-TLV - Usage

- Avoid maintaining each test session (session id, source-address) on Session-Reflector
- In-band Reply Requested:
 - For link delay measurement
 - STAMP Session-Reflector transmits test packet in-band on the same incoming link in the reverse direction
 - Link can be Virtual, LAG or LAG member
- No Reply Requested:
 - STAMP Session-Reflector does not transmit reply test packet to the STAMP Session-Sender and terminates the Session-Sender test packet

STAMP Return Address Sub-TLV - Usage

- Avoid maintaining each test session (session id, source-address) on Session-Reflector
- STAMP Session-Reflector reply test packet may be transmitted to a different node than the Session-Sender
- STAMP Session-Sender can specify in the test packet the receiving destination address for the STAMP Session-Reflector reply test packet

STAMP Return Path Segment List Sub-TLVs - Usage

- For an SR path, STAMP Session-Reflector reply test packet may need to be sent in-band on a specific return SR path
- Dynamically computed SR paths can change based on topology change, link/node failure, etc. in the network
- Avoid signaling and maintaining dynamic state on STAMP Session-Reflector for the return path for each STAMP test session (each session-id, source-address)
 - Can be order of 10K SR Policy (that can also have ECMPs)

Next Steps

- Welcome your comments and suggestions
- Requesting WG adoption

Thank you