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  STAMP Session-Reflector
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.

**Figure 1: STAMP Session-Sender Test Packet for links**
For end-to-end SR Policy, STAMP Session-Sender test packets are transmitted with:

1. MPLS label stack of SR-MPLS Policy
2. SRv6 SRH [RFC 8754] with Segment List of SRv6 Policy
   - Using upper-layer processing (for UDP header) defined in SRv6 network programming
3. User-configured destination UDP port is used for STAMP test packets (or port 862)
4. IPv4 TTL/IPv6 Hop-limit is set to 255
5. 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

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

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**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.

<table>
<thead>
<tr>
<th>IP Header</th>
</tr>
</thead>
<tbody>
<tr>
<td>. Source IP Address = Session-Reflector IPv4 or IPv6 Address</td>
</tr>
<tr>
<td>. Destination IP Address =</td>
</tr>
<tr>
<td>. Source IP Address from Received Test Packet</td>
</tr>
<tr>
<td>. Protocol = UDP</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UDP Header</th>
</tr>
</thead>
<tbody>
<tr>
<td>. Source Port = As chosen by Session-Reflector</td>
</tr>
<tr>
<td>. Destination Port = Source Port from Received Test Packet</td>
</tr>
</tbody>
</table>

| 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

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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)

![Figure: Destination Node Address TLV Format]
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
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