

Performance Measurement Using STAMP for Segment Routing Networks

draft-gandhi-spring-stamp-srpm-01

(previously draft-gandhi-spring-twamp-srpm-07)

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Agenda

- Requirements and Scope
- History of the Draft
- Updates Since IETF-106
- Summary
- Next Steps

Requirements and Scope

Requirements:

- Delay and Loss Performance Measurement (PM)
 - ✓ Links and End-to-end P2P/P2MP SR Paths
 - ✓ Applicable to SR-MPLS/SRv6 data planes
- Handle ECMP for SR Paths
- Support stand-alone direct-mode loss measurement

Scope:

- STAMP [RFC 8762]
- STAMP TLVs [draft-ietf-ippm-stamp-option-tlv]

History of the Draft

- Feb 2019
 - Draft was published - *draft-gandhi-spring-twamp-srpm-00*
- Mar 2019
 - Presented *draft-gandhi-spring-twamp-srpm-00* at IETF 104 Prague in SPRING WG
- May 2019
 - Added STAMP TLV for Return Path
- July 2019
 - Presented *draft-gandhi-spring-twamp-srpm-01* at IETF 105 Montreal in IPPM WG
 - Slide 9 Titled - Applicability of STAMP – STAMP is supported
- Aug 2019
 - *draft-gandhi-spring-twamp-srpm-02* included stand-alone LM messages
- Nov 2019
 - **SPRING Chairs announced in the meeting the agreement with IPPM chairs to progress the draft in SPRING WG**
 - Presented *draft-gandhi-spring-twamp-srpm-04* at IETF 106 Singapore in SPRING WG
- Mar 2020
 - Moved STAMP support to *draft-gandhi--spring-**stamp**-srpm-00*
 - Keep TWAMP Light support as informational in *draft-gandhi-spring-**twamp**-srpm-08*

Updates Since IETF-106 (Version-04)

Updates:

1. Defined Control Code for “In-band Response Requested” for STAMP
 - ✓ Updated Two-way mode procedure using the Control Code
2. Defined Destination Address in STAMP Node Address TLV to identify the intended Destination node
3. Added Return Address Sub-TLV in the STAMP Return Path TLV to send response to a specific node
4. Updated IANA registry action
5. Various editorial changes

Open Items:

- None

STAMP Control Code Field

For a Query: Sender Control Code

0x0: Out-of-band Response Requested.

This is also the default behavior.

0x1: In-band Response Requested.

Indicates that this query has been sent over a bidirectional path and the probe response is required over the same path in reverse direction. The bidirectional path does not have to be an SR path.

For a Response: Reflector Control Code

0x1: Error - Invalid Message.

Indicates that the operation failed because the received query message could not be processed.

0xN: Additional Error will be defined in future.

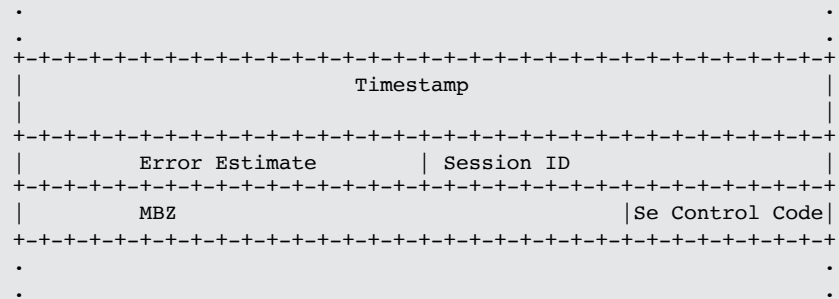


Figure: Sender Control Code in STAMP DM Message

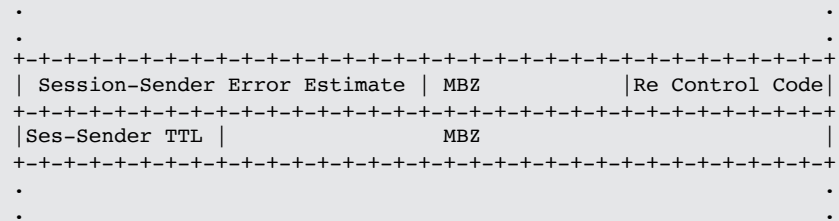


Figure: Reflector Control Code in STAMP DM Message

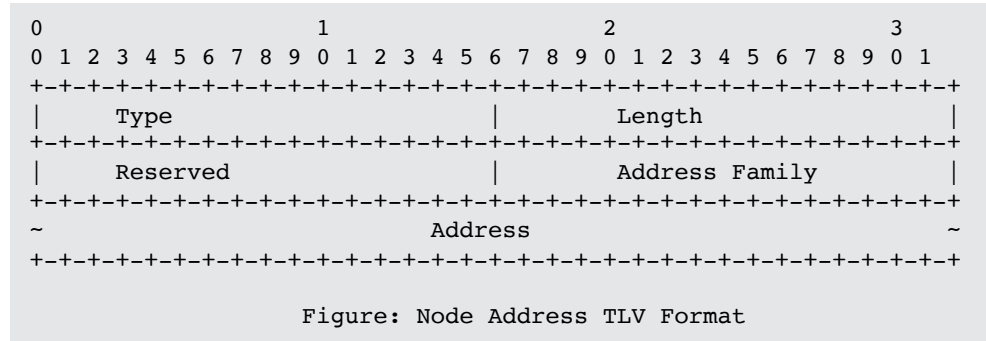
Performance Measurement Modes

- One-way Measurement Mode
 - Reply sent “out of band” on IP/UDP path by default
- Two-way Measurement Mode
 - Reply sent “in-band” on reverse SR path
 - Based on Control Code from the probe query message
 - Use Return Path TLV for STAMP from the probe query message
- Loopback Measurement Mode
 - Probe message carries the return path in the header of the packet

Destination Address in STAMP Node Address TLV

Destination Node Address (value TBA1):

- Indicates the address of the intended recipient node of the query message.
- The reflector node **MUST NOT** send response if it is not the intended destination node of the query.
- Useful when query is sent with 127/8 destination address.



Return Address in STAMP Return Path TLV

Return Path (value TBA2):

Sub-TLVs Types:

- Type (value 0): Return Address. Target node address of the response different than the Source Address in the query
- Type (value 1): SR-MPLS Label Stack of the Reverse SR Path
- Type (value 2): SR-MPLS Binding SID [draft-ietf-pce-binding-label-sid] of the Reverse SR Policy
- Type (value 3): SRv6 Segment List of the Reverse SR Path
- Type (value 4): SRv6 Binding SID [draft-ietf-pce-binding-label-sid] of the Reverse SR Policy

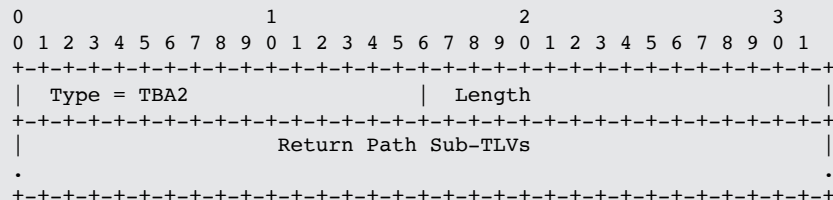


Figure: Return Path TLV

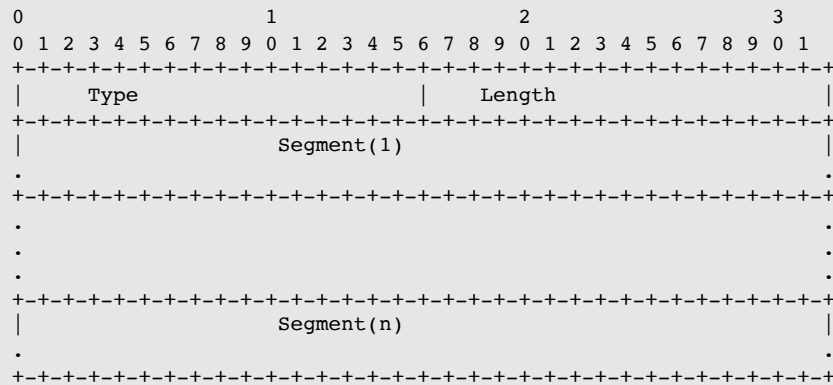
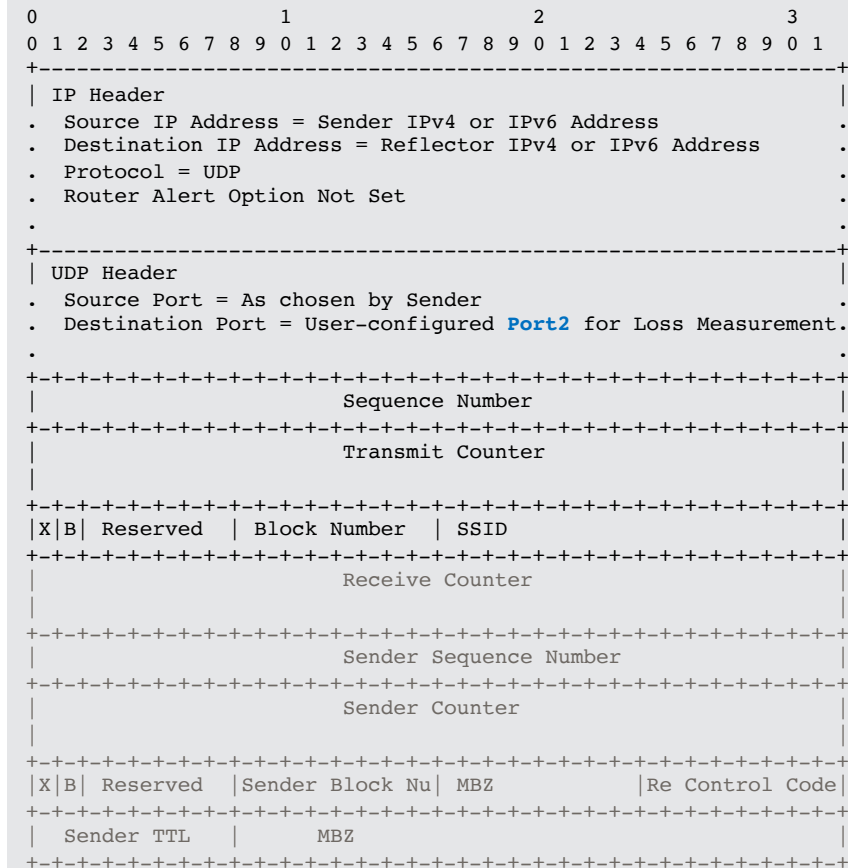


Figure: Segment List Sub-TLV in Return Path TLV

Stand-alone LM Message Format for STAMP

- Loss Measurement (LM) message defined
 - Hardware efficient counter-stamping
 - Well-known locations for transmit and receive traffic counters
 - Stand-alone LM message, not tied to DM
- LM message format is also defined for authenticated mode
- User-configured destination UDP **Port2** is used for identifying LM probe packets
- Does not modify existing STAMP (which is for DM) procedure as different UDP destination **Port2** is used for LM



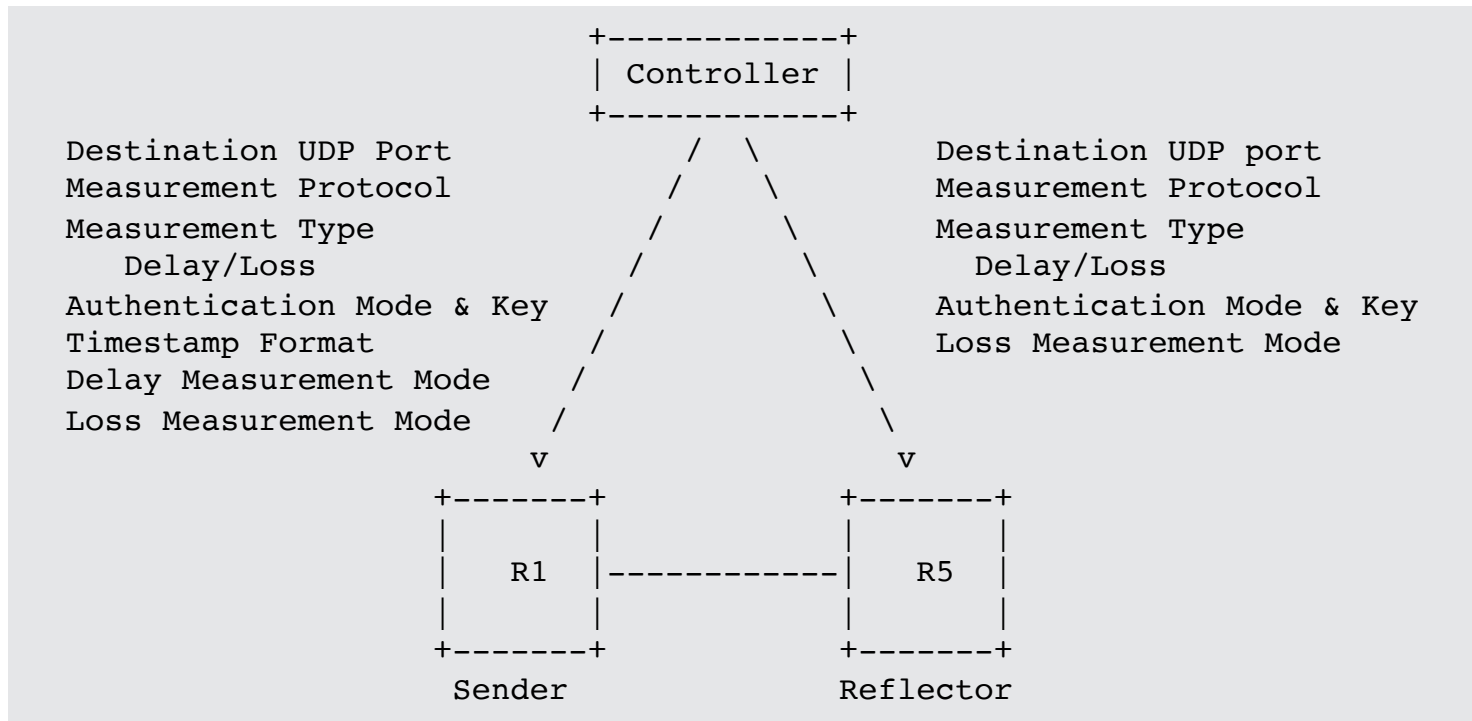
Next Steps

- Welcome your comments and suggestions
- Implementation exists
- In WG adoption (SPRING WG) queue
- Keep IPPM WG in the loop about the milestones

Thank you

Backup

Example Provisioning Model



Probe Query for Links

- User-configured destination UDP **port1** is used for DM probe messages and **port2** is used for LM probe messages, both in unauthenticated mode.

```
+-----+
| IP Header                                     |
. Source IP Address = Sender IPv4 or IPv6 Address .
. Destination IP Address = Reflector IPv4 or IPv6 Address .
. Protocol = UDP .
. .
+-----+
| UDP Header                                     |
. Source Port = As chosen by Sender .
. Destination Port = User-configured Port .
. .
+-----+
| Payload = DM Message as specified in Section 4.2 of RFC 8762 | |
. Payload = LM Message as specified in Figure 7 or 8 .
. .
+-----+
```

Figure: Probe Query Message

Probe Query for SR-MPLS and SRv6 Policy

For **end-to-end** performance delay/loss measurement of SR Policy, the probe query message is sent on the SR Policy with:

1. MPLS label stack for SR-MPLS Policies
2. SRv6 SRH [RFC 8754] with SID list for SRv6 Policies

```

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          |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| DM or LM Query Message including IP/UDP Header                    |
.
+-----+-----+-----+-----+-----+-----+-----+-----+-----+

```

Figure: Example Probe Query Message 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 = Sender IPv6 Address                               .
. Destination IP Address = Next Hop IPv6 Address                       .
.                                                                       .
+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| SRH as specified in RFC 8754                                           |
. <SID List>                                                            .
.                                                                       .
+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| IP Header (Optional)                                                  |
. Source IP Address = Sender IPv6 Address                               .
. Destination IP Address = Reflector IPv6 Address                       .
.                                                                       .
+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| UDP Header                                                            |
. Source Port = As chosen by Sender                                     .
. Destination Port = User-configured Port                             .
.                                                                       .
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| Payload = DM or LM Query Message                                      |
.
+-----+-----+-----+-----+-----+-----+-----+-----+-----+

```

Figure: Example Probe Query Message for SRv6 Policy

Probe Response Message

- The probe response message is sent using the IP/UDP information from the probe query message.

```
+-----+
| IP Header |
| . Source IP Address = Reflector IPv4 or IPv6 Address . |
| . Destination IP Address = Source IP Address from Query . |
| . Protocol = UDP . |
| . |
+-----+
| UDP Header |
| . Source Port = As chosen by Reflector . |
| . Destination Port = Source Port from Query . |
| . |
+-----+
| Payload = DM Response Message |
| . Payload = LM Response Message . |
| . |
+-----+
```

Figure: Probe Response Message

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 PM probe queries that can take advantage of the hashing function in forwarding plane.
- Existing forwarding mechanisms are applicable to PM probe messages. Examples are:
 - For IPv4
 - Sweeping destination address in IPv4 header (e.g. 127/8)
 - For IPv6
 - Sweeping flow label in IPv6 header

Backup

STAMP DM Message with Direct Measurement TLV (DM+LM Combined Probe Message)



Figure: Sender Message Format



Figure: Reflector Message Format

Thank you