

Simple TWAMP (STAMP) Extensions for Segment Routing Networks

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Agenda

- Requirements and Scope
- Summary of Extensions
- Next Steps

Requirements and Scope

Requirements:

- Support in-band Delay Measurement
- Support stand-alone direct-mode Loss Measurement
- Support links and SR paths

Goals:

- Eliminate per session provisioning on Session-Reflector
- No control-channel signaling for sessions
- Support hardware implementation - very high scale for number of sessions and faster detection interval

Scope:

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

Review Comments

1. Draft status:
 - a) Draft defines extensions for RFC 8762 - STAMP
 - Updates RFC 8762 due to new field (control code) in the message
2. Extensions specific to SR?
3. Editorial
 - a) Define Abbreviations (BSID, SRH, HMAC-SHA)
 - b) Use Test packet, Session-Sender, Session-Reflector terms
 - c) Show entire test packet with session-sender control code field
 - d) Indicate new packet loss message is for direct-mode loss
 - e) Move Receive Counter and other Reply message fields to Section 4.1 from 3.2
 - Explain how the counters and sequence numbers are used to do loss measurement

STAMP - Session-Sender Control Code Field

Session-Sender Control Code

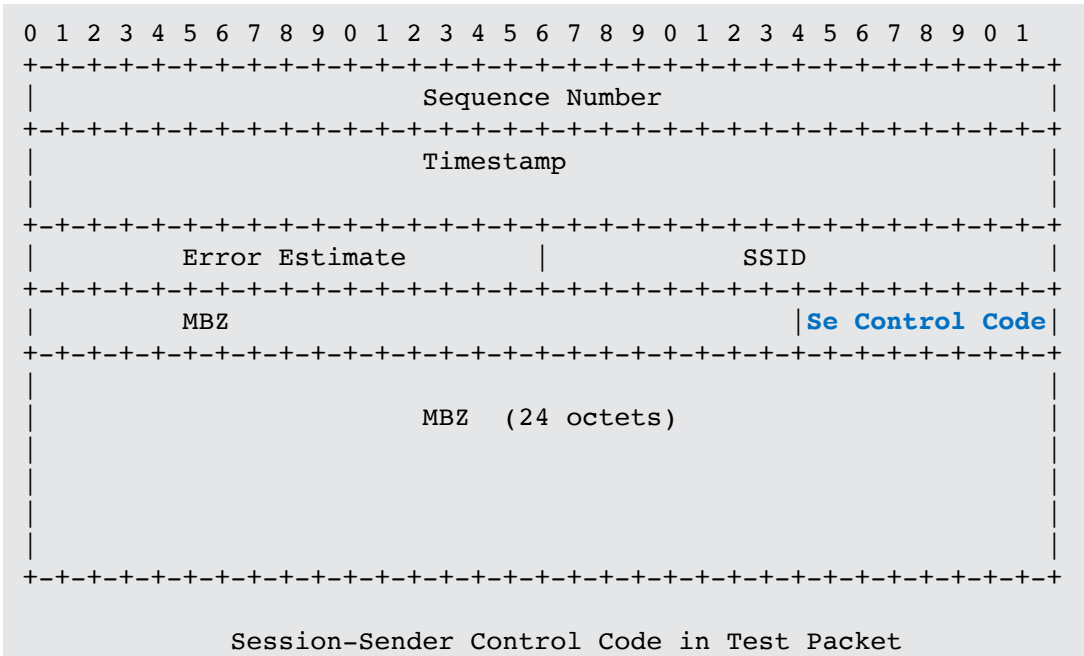
0x0: Out-of-band Reply Requested.

This is the existing behavior.

0x1: In-band Reply Requested.

Indicates that this test packet has been sent over a bidirectional path and the reply is required over the same path in the reverse direction.

0x2: No Reply Requested.



STAMP - Session-Sender Control Code Field

- Two-way measurement mode
 - Reflector needs to send reply on the same link (**in-band**) (symmetric delay on forward and reverse link)
- No way of knowing if one-way or two-way mode from the STAMP test packet
- Not scalable to configure for each (session id, source-address) on session-reflector (can have an order of 1K links)
 - Cannot always send reply on the same incoming interface as the STAMP test packet
reply may need to be IP routed

STAMP - Return Path TLV

Return Path TLV (value TBA2):

Sub-TLVs Types:

- Type (value 1): Return Address. Target node address for the reply; different than the Source Address in the test packet
- Type (value 2): SR-MPLS Label Stack of the Reverse SR Path
- Type (value 3): SR-MPLS Binding SID [draft-ietf-pce-binding-label-sid] of the Reverse SR Policy
- Type (value 4): SRv6 Segment List of the Reverse SR Path
- Type (value 5): SRv6 Binding SID [draft-ietf-pce-binding-label-sid] of the Reverse SR Policy



Figure: Return Path TLV

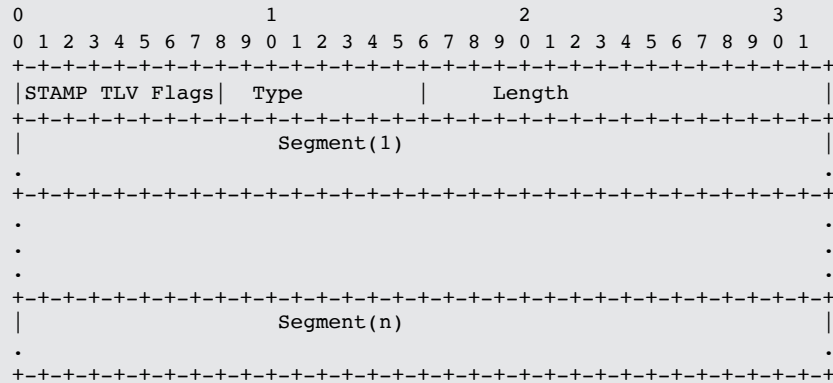


Figure: Segment List Sub-TLV in Return Path TLV

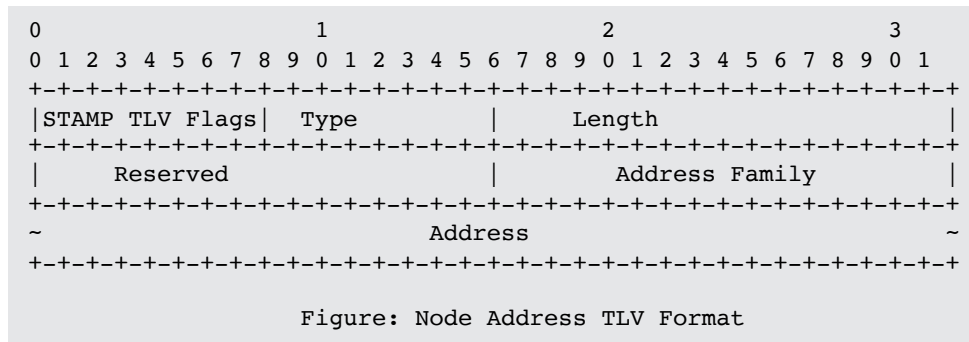
STAMP - Return Path TLV

- For Bidir SR Policy, reply test packet needs to be sent (**in-band**) on the reverse SR Policy
- Bidir SR Path (forward and reverse) dynamically computed using CSPF by the head-end node
 - Path can change often based on topology change, link/node failure in the network, etc.
- No signaling in SR, possible to use PCE
- Need per session state on session-reflector node to store reverse paths (each session-id, source-address) – order of 10Ks SR Policy (that can have active and standby candidate-paths and each can have multiple segment-lists)
- In SR, state is in the packet

STAMP - Destination Node Address TLV

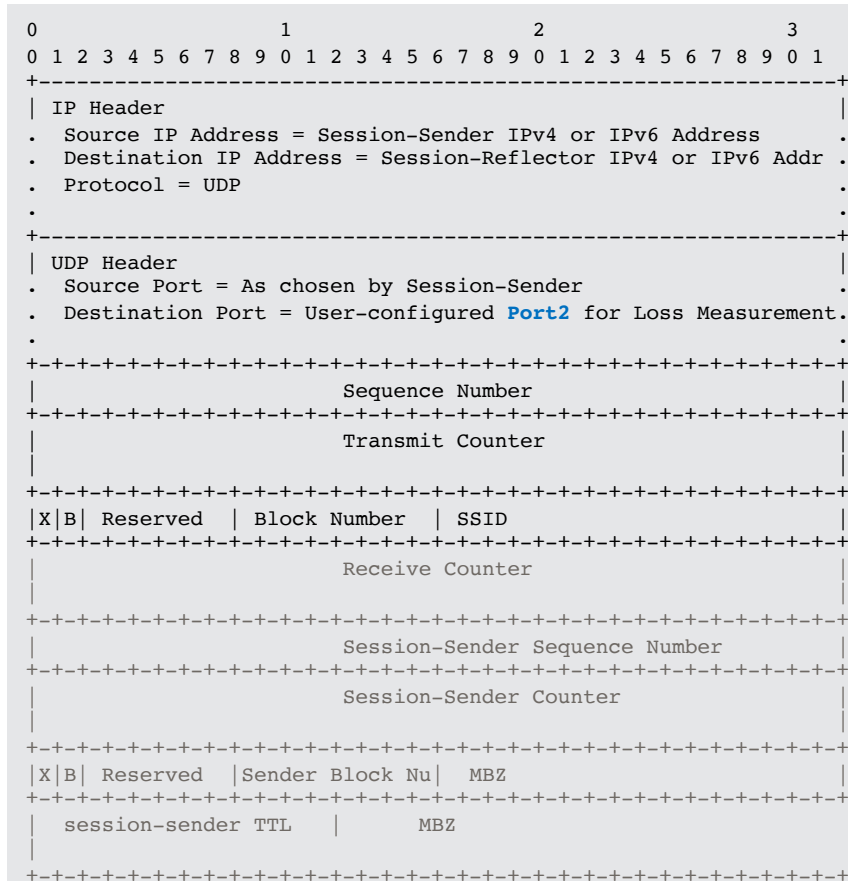
Destination Node Address TLV (value TBA1):

- Indicates the address of the intended recipient node of the test packet message.
- The Session-Reflector node **MUST NOT** send reply if it is not the intended destination node of the test packet.
- Useful when test packet is sent with 127/8 destination address (e.g. sweeping ECMP paths).



STAMP - Stand-alone Direct-mode LM Test Packet Format

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

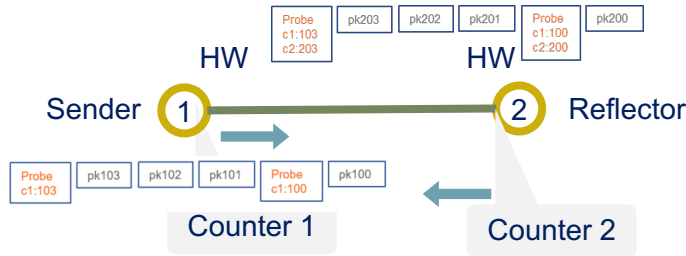


STAMP - Stand-alone Direct-mode LM Test Packet Format

- Session-Sender:
 - Hardware needs to load the test packet in write-able memory which is limited
 - With LM TLV, counter may not be at fixed location
 - With LM TLV, counter also deeper into the test packet at offset (Eth 18, IPv6 40, UDP 8, STAMP 44, TLV Type 4, Total = 114 Byte)
 - Also need to include other Encaps / headers in offset
 - Hardware also not capable to write both TS and Counter in the same test packet
 - Hardware also not capable to recompute UDP checksum
- Session-Reflector:
 - Some test packets received from one session-sender with base test packet and some with LM TLV, hence need to parse EVERY received test packet to check if direct-mode loss TLV is present before punting the packet
 - Hardware needs to punt with receive TS or receive Counter
 - Hardware also not capable to punt with both TS and Counter for the same test packet
- Separate UDP port + LM message format eliminate the complexity in Hardware
 - Counter at fixed location - offset (no TLV, Eth 18, IPv6 40, UDP 8, Seq 4, Total = 70 Byte)

Link Direct-mode Loss Measurement

– Inline Counter-stamping in Hardware



- Advertise extended TE metrics – link loss percentage
 - RFC 8570 (IS-IS)
 - RFC 7471 (OSPF)
 - RFC 8571 (BGP-LS)

- One Way Packet Loss %

$$= 100 * ((C1(t) - C1(t-1)) - (C2(t) - C2(t-1)) / (C1(t) - C1(t-1)))$$

$$= 100 * ((103 - 100) - (203 - 200) / (103 - 100))$$

$$= 0$$
- Hardware Counters – counter-stamping in hardware

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--------------|---|---|---|---|---|---|---|---|---|-----------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--|--|--|--|--|--|--|--|--|--|
| 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 | | | | | | | | | | |
| + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | | | | | | | | | | |
| Type | | | | | | | | | | Length | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | | | | | | | | | | |
| A RESERVED | | | | | | | | | | Link Loss | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | | | | | | | | | | |

Next Steps

- Welcome your comments and suggestions
- Requesting WG adoption

Thank you