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
- Stateless on session-reflector
- Support 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 not 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 Response 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

In a Query: Session-Sender Control Code

0x0: Out-of-band Response Requested. This is the existing 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.

0x2: No Response Requested.

With this, the Session-Reflector node does not require any additional state for PM

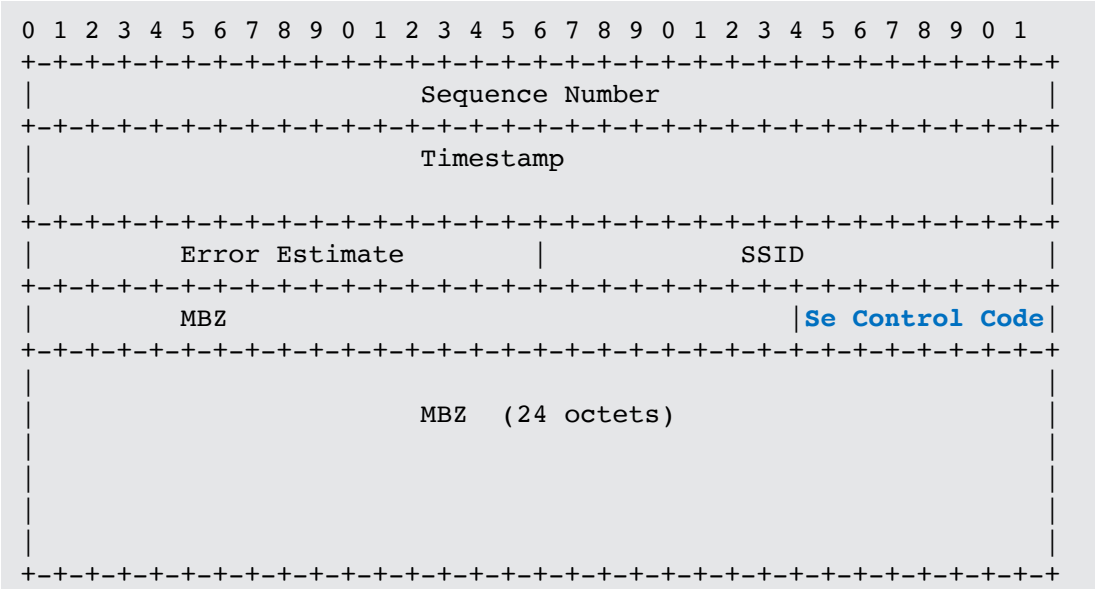


Figure: Session-Sender Control Code in STAMP DM Message

STAMP - Session-Sender Control Code Field

- Two-way measurement mode that does not require clock synchronization
- Reflector needs to send response back on the same link (symmetric delay on forward and reverse link) for two-way mode
- No way of knowing if one-way or two-way mode from the STAMP test packets
- Not scalable to configure for each (session id, source-address) on reflector (can have an order of 1K links)
  - Reflector node may have PTP clock sync but may be not all sender nodes
  - Cannot always send response back on the same incoming interface as the STAMP test packet may be received for an SR Policy

STAMP - Return Path TLV

Return Path TLV (value TBA2):

Sub-TLVs Types:

- Type (value 1): Return Address. Target node address of the response; different than the Source Address in the query
- 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

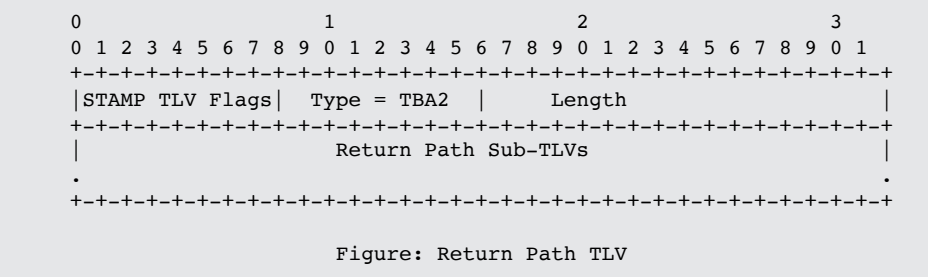


Figure: Return Path TLV

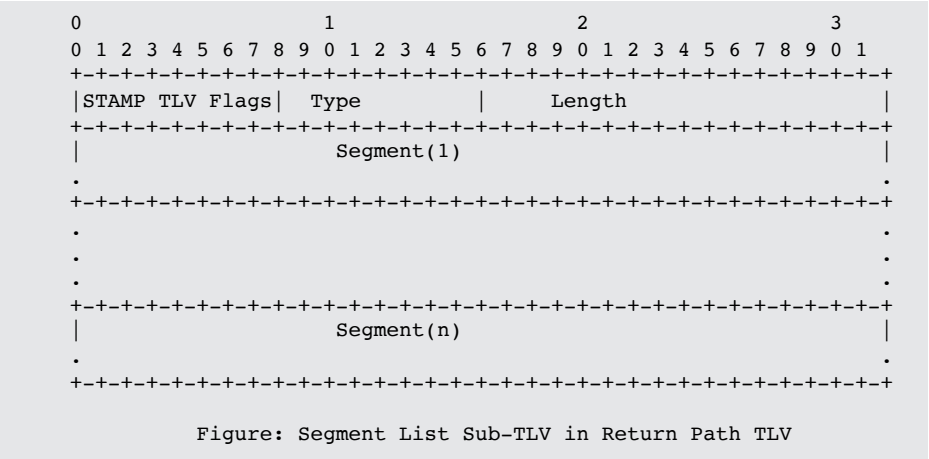


Figure: Segment List Sub-TLV in Return Path TLV

STAMP - Return Path TLV

- For Bidir SR Policy, reply packet to be sent 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 - no control plane, possible to use PCE
- Need per session state on 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 query message.
- The Session-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 (e.g. sweeping ECMP paths).

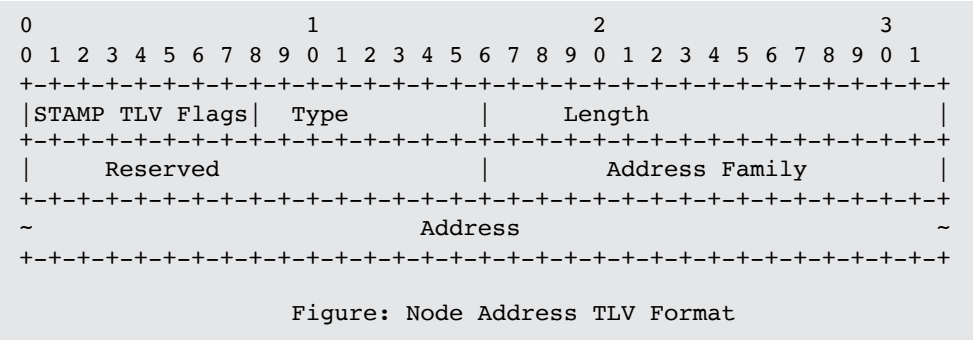


Figure: Node Address TLV Format

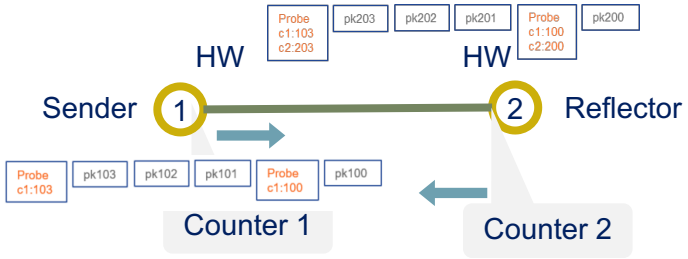
STAMP - Stand-alone Direct-mode LM Message Format

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

STAMP - Stand-alone Direct-mode LM Message Format

- Sender:
  - Counter at fixed location - offset value (no TLV, Eth 18, IPv6 40, UDP 8, Seq 4, Total = 70 Byte)
  - With LM TLV – may not be at fixed location, also deeper into the packet at offset (Eth 18, IPv6 40, UDP 8, STAMP 44, TLV Type 4, Total = 114 Byte)
  - May need to include other Encaps / headers in offset
  - H/W also not capable to write both TS and Counter in the same packet
    - H/W also not capable to recompute UDP checksum
- Reflector:
  - Some test packets received from one sender with base test packet and some with LM TLV, hence need to parse the received packet to check if it is for delay or direct-mode loss before punting the packet
  - H/W need to punt with receive TS or receive Counter
  - H/W also not capable to do both for the same packet
- Separate UDP port + message format eliminate the complexity in hardware

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