Simple TWAMP (STAMP) Extensions for Segment Routing Networks

draft-gandhi-ippm-stamp-srpm-01

Rakesh Gandhi - Cisco Systems (rgandhi@cisco.com) - Presenter
Clarence Filsfils - Cisco Systems (cfilsfil@cisco.com)
Daniel Voyer - Bell Canada (daniel.voyer@bell.ca)
Mach(Guoyi) Chen - Huawei (mach.chen@huawei.com)
Bart Janssens - Colt (Bart.Janssens@colt.net)

Agenda

- Requirements and Scope
- Summary of Extensions
- Next Steps

Requirements and Scope

Requirements:

- Support in-band Delay Measurement
- Support stand-alone Direct Measurement for Packet Loss
- 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 test packet
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 packet is for direct measurement
   e) Move Receive Counter and other Reply test packet fields to Section 4.1 from 3.2
      - Explain how the counters and sequence numbers are used to do loss measurement

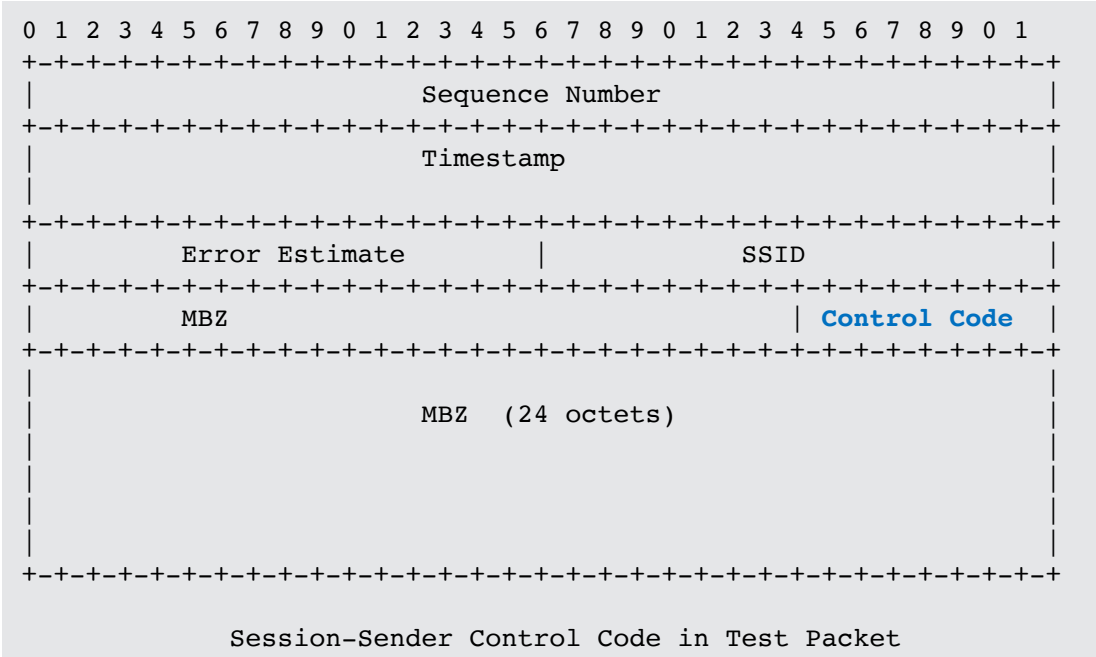
STAMP - Session-Sender Control Code Field

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.



Session-Sender Control Code in Test Packet

STAMP - Session-Sender Control Code Field

- Two-way measurement mode for links
  - 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 received 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

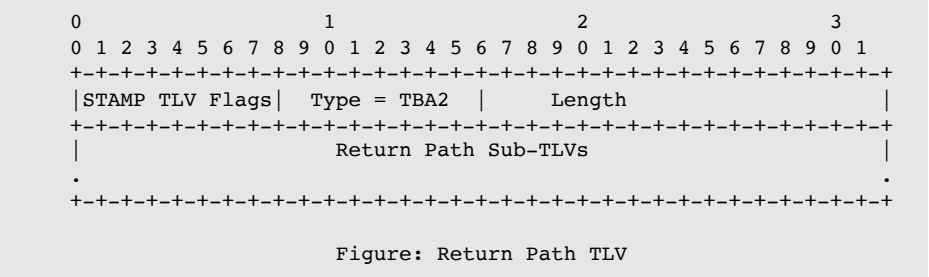


Figure: Return Path TLV

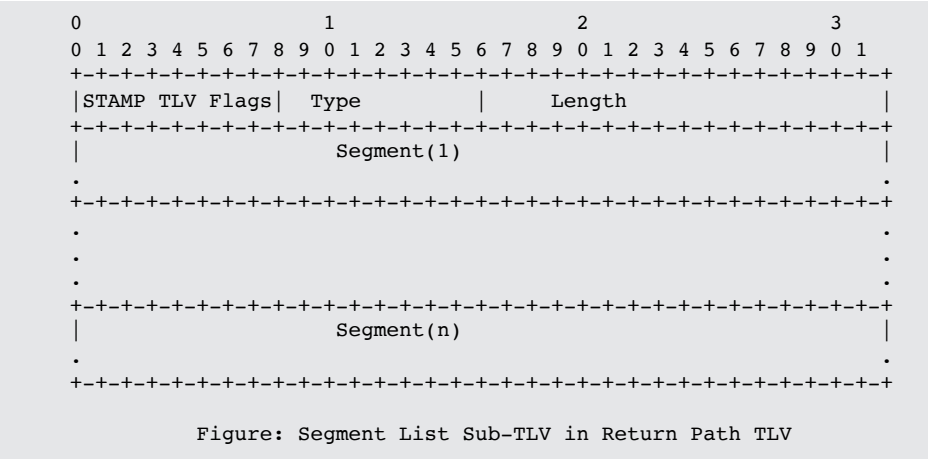


Figure: Segment List Sub-TLV in Return Path TLV

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.
- 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).

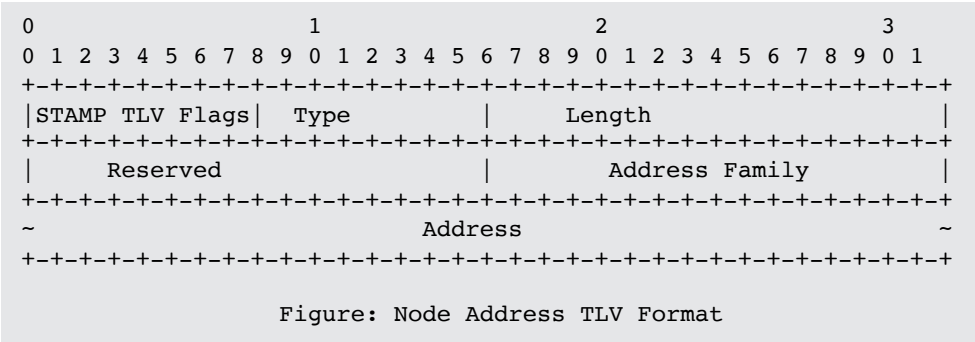


Figure: Node Address TLV Format

STAMP - Stand-alone Direct Measurement Test Packet

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

- X set to 1 for 64-Bit Counter, set to 0 for 32-Bit Counter
- B set to 1 for Byte Counter, set to 0 for Packet Counter
- T set to 1 for Sender-DSCP scoped Counter

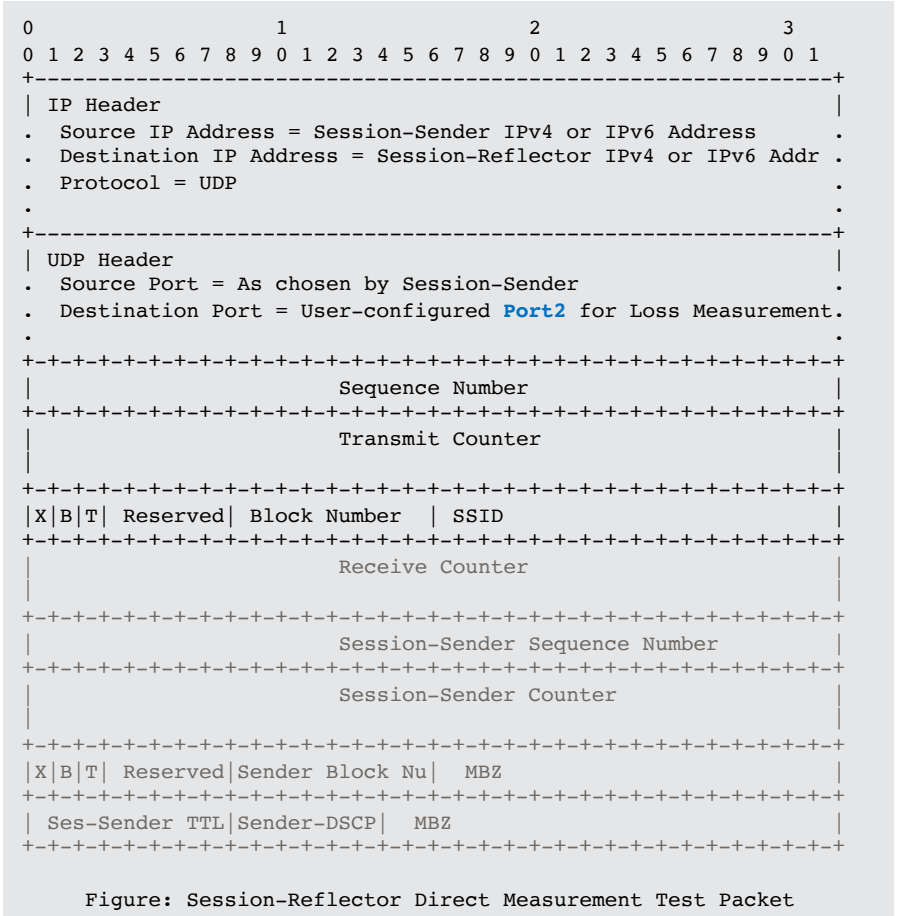
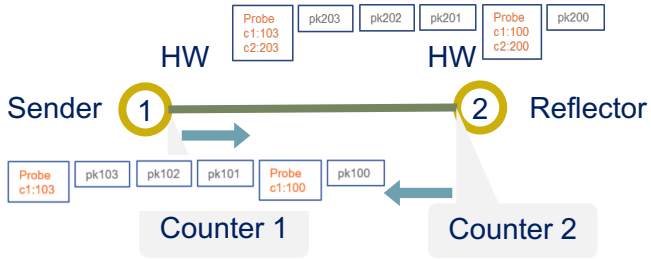


Figure: Session-Reflector Direct Measurement Test Packet

STAMP - Stand-alone Direct Measurement Test Packet

- Session-Sender:
  - Hardware needs to load the test packet in write-able memory which is limited
    - With direct measurement TLV, counter may not be at fixed location
    - With direct measurement TLV, counter also deeper into the test packet at location (Eth 18, IPv6 40, UDP 8, STAMP 44, TLV Type 4, Total = 114 Byte)
    - Also need to include other Encaps / headers in location
  - 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 (along with other TLVs), hence need to parse EVERY received test packet to check if direct measurement 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 + direct measurement packet format eliminate the complexity in Hardware
  - Counter at fixed location (Eth 18, IPv6 40, UDP 8, Seq 4, Total = 70 Byte), not deeper in the packet

Link Loss Direct 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
- Traffic 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                  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Direct Measurement TLV vs. Direct Measurement Test Packet

Direct Measurement TLV	Direct Measurement Test Packet
1. Suitable for collecting data packet counters from control plane (distributed forwarding plane)	1. Suitable for collecting data packet counters from hardware – inline counter-stamping
2. Direct Measurement TLV supports **32-bit packet** counters	2. Direct Measurement Test Packet supports **32-bit packet and byte** counters
3. Does not support per-traffic class direct measurement (DSCP TLV processing not specified for Counters)	3. Direct Measurement Test Packet supports **64-bit packet and byte** counters
4. Various STAMP TLV processing required	4. Direct Measurement Test Packet identifies the block number of the counters - used for alternate marking method (RFC 8321)
	5. Per traffic-class counter collection (per traffic-class loss measurement) (e.g. drop best effort traffic)
	6. No STAMP TLV processing
	7. Two-way direct meadurement for links with reply packet with transmit counter at the same location – important property for hardware counter-stamping
	8. Matching the functionality supported by RFC6374

Next Steps

- Welcome your comments and suggestions
- Requesting WG adoption

Thank you

STAMP Test Packet with Direct Measurement TLV

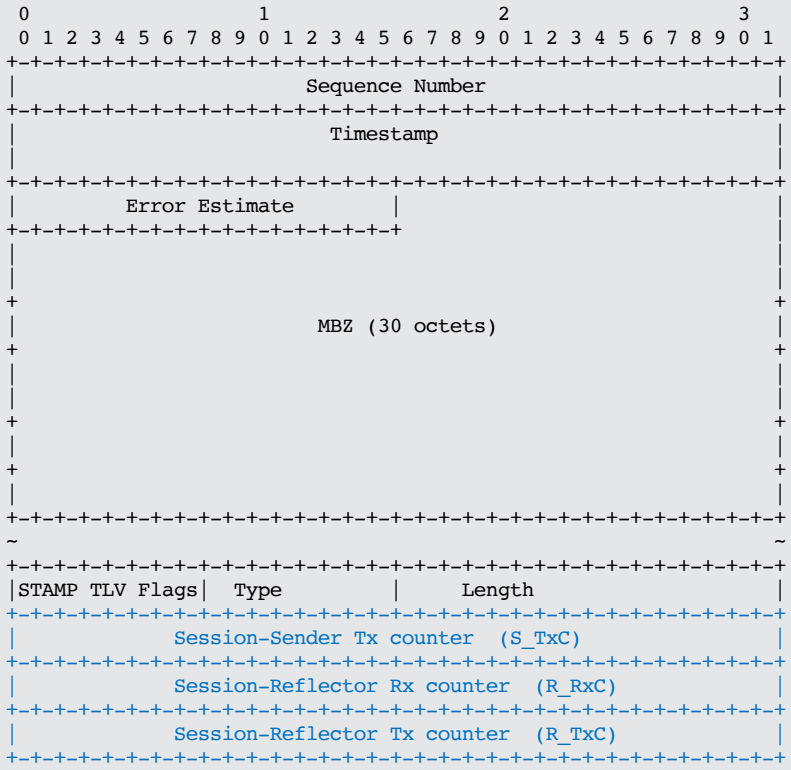


Figure: Session-Sender Test Packet Format

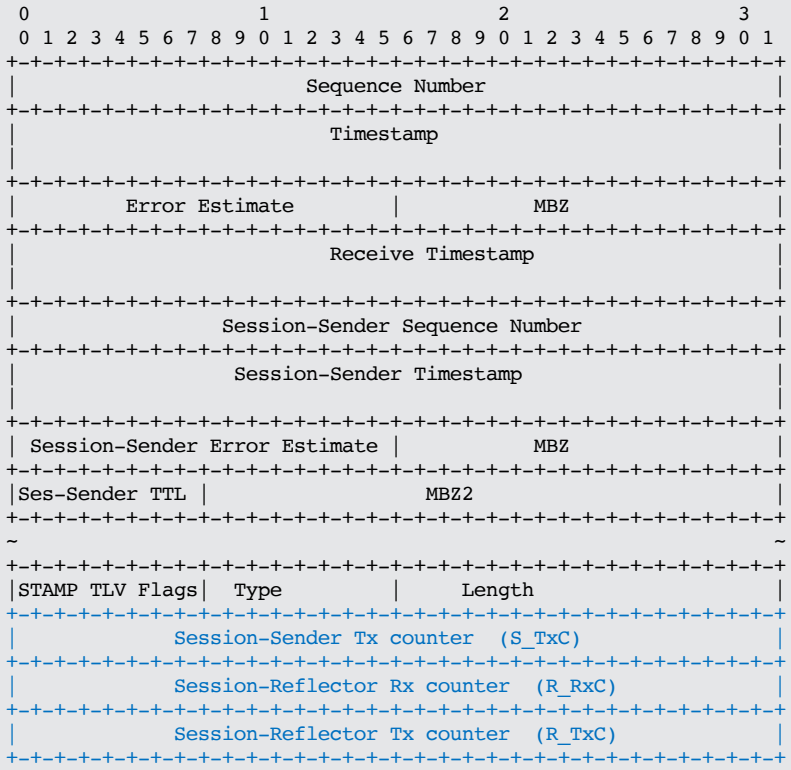


Figure: Session-Reflector Test Packet Format