

STAMP Extensions for Reflecting STAMP Packet Extension Headers

draft-ietf-ippm-stamp-ext-hdr-00

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Agenda

- Requirements, Goals, and Scope
- Summary of Procedure
 - IPv6 Data plane
 - MPLS Data plane
- Review Comments
- STAMP Extensions in other WGs
- Next Steps

Requirements, Goals, and Scope

Requirements:

- STAMP Extensions to Reflect extension headers:
 - ✓ Hop-by-hop and edge-to-edge measurements
 - ✓ Two-way and one-way measurements

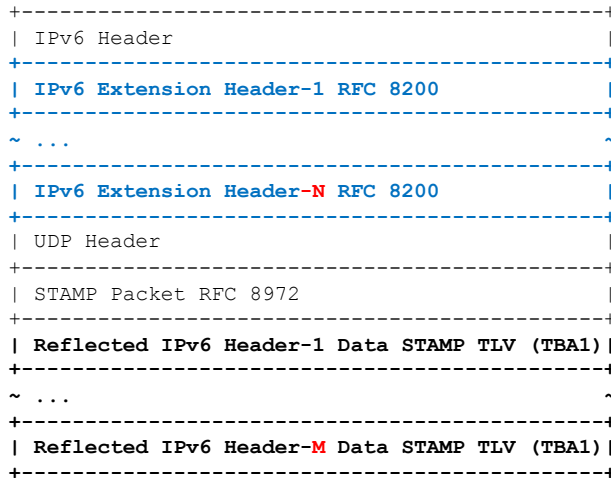
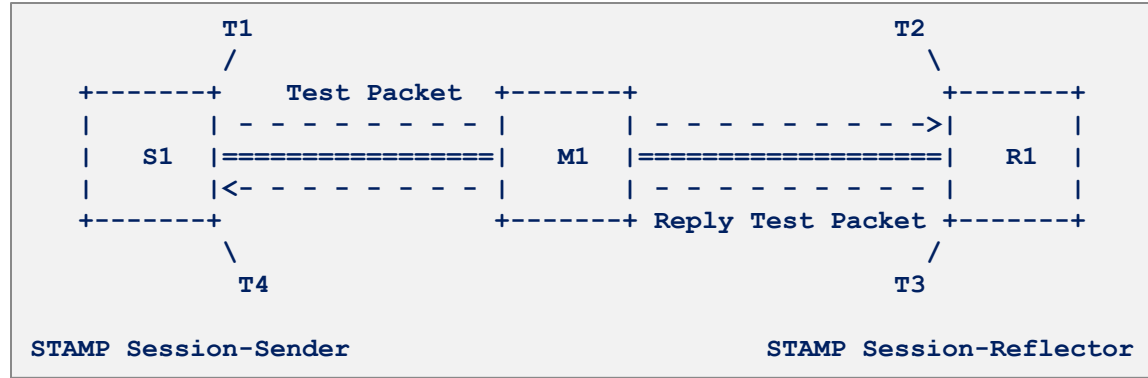
Goals:

- Leverage existing implementation of extension headers on **midpoint nodes**
 - Note: midpoints nodes are agnostics to STAMP protocol
- Avoid IPv6 and MPLS protocol extensions

Scope:

- STAMP [RFC8762] and STAMP Extensions [RFC8972]
- IPv6 Data plane: IPv6 Extension Headers [RFC8200]
- MPLS Data plane: MPLS Network Action Sub-Stack [draft-ietf-mpls-mna-hdr]

STAMP TLV Extension for IPv6 Data plane



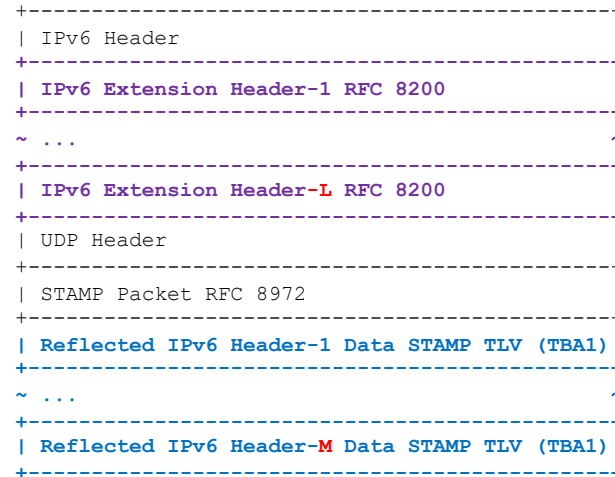
Session-Sender Test Packet

1. Transmit



Pre-allocated
Empty TLVs
in the same
order

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Session-Reflector Test Packet

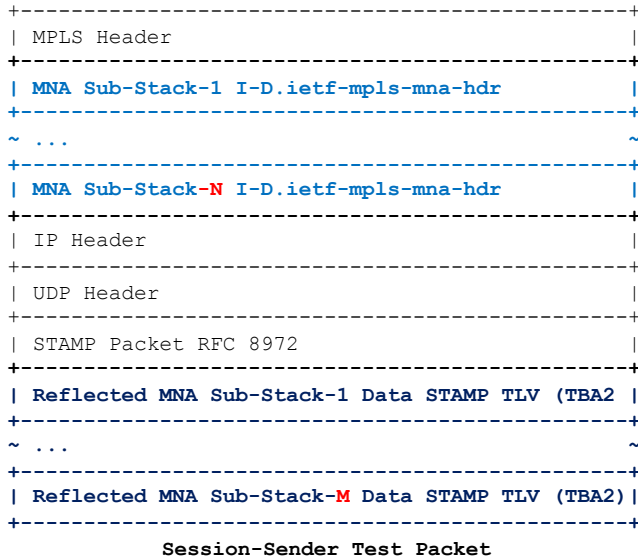
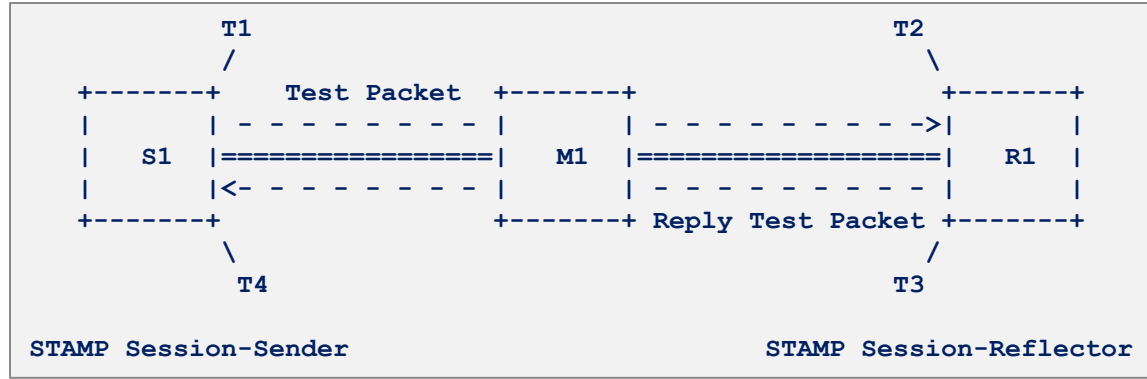
4. Reflect



3. New Ext headers
(two-way
measurement)

2. Copy
Extension
headers in
STAMP
TLVs

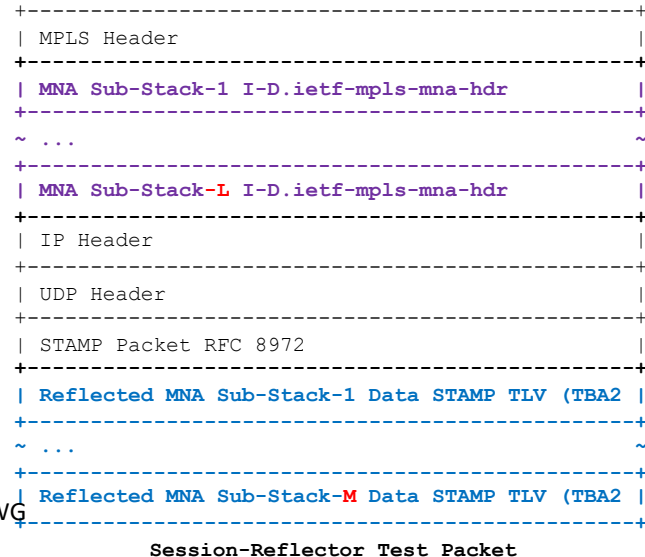
STAMP TLV Extension for MPLS Data plane



1. Transmit



4. Reflect



3. New MNA headers (two-way measurement)

2. Copy Sub-Stack in STAMP TLVs as Data



Reflect Specific Extension Header(s) in STAMP TLV

(Not in the draft)

1. Session-Sender test packets carry Extension header 1 (length 24), header 2 (length 40) and header 3 (length 40) (EH may carry multiple options)
2. Session-Sender adds Reflected STAMP TLV 1 (length 24) and STAMP TLV 2 (length 40).
 - **Ambiguity:** Session-Reflector reflect header 2 or header 3 (both has the same length)?

Solution

1. Session-Sender optionally fills the header field of the IPv6 extension header in the Empty Reflected IPv6 header STAMP TLV
 - a. First 4 bytes: Header Ext Len, Option Type, Opt Data Len (without Next-Header field). If field is non-zero, only reflect if matches.
 - b. For IPv6 header: first 4 bytes would be zeros. Reflected without checking for matching the fields. Zero value means wild-card for match.
2. Session-Sender fills the header field of the MNA Sub-Stack in the Empty Reflected MPLS Sub-Stack STAMP TLV
 - a. First 8 bytes: First LSE (Format A) with MNA label/TC/TTL and second LSE (Format B) with Opcode/U/Scope/NASL/NAL (exclude AD in Format B due to potential mutability). If field is non-zero, reflect if matches.
3. Session-Reflector matches the (IPv6/MNA) header fields in the received STAMP TLV to find the Extension Header to reflect

```
+-----+
| IPv6 Header |
+-----+
| IPv6 Extension Header-1 (Length 24) |
+-----+
| IPv6 Extension Header-2 (Length 40) |
+-----+
| IPv6 Extension Header-3 (Length 40) |
+-----+
| UDP Header |
+-----+
| STAMP Packet RFC 8972 |
+-----+
| Reflected IPv6 Header-1 Data STAMP TLV (TBA1) |
+-----+
| Reflected IPv6 Header-3 Data STAMP TLV (TBA1) |
+-----+
```

Session-Sender Test Packet

```
+-----+
| IPv6 Header |
+-----+
| UDP Header |
+-----+
| STAMP Packet RFC 8972 |
+-----+
| Reflected IPv6 Header-1 Data STAMP TLV (TBA1) |
+-----+
| Reflected IPv6 Header-3 Data STAMP TLV (TBA1) |
+-----+
```

Session-Reflector Test Packet

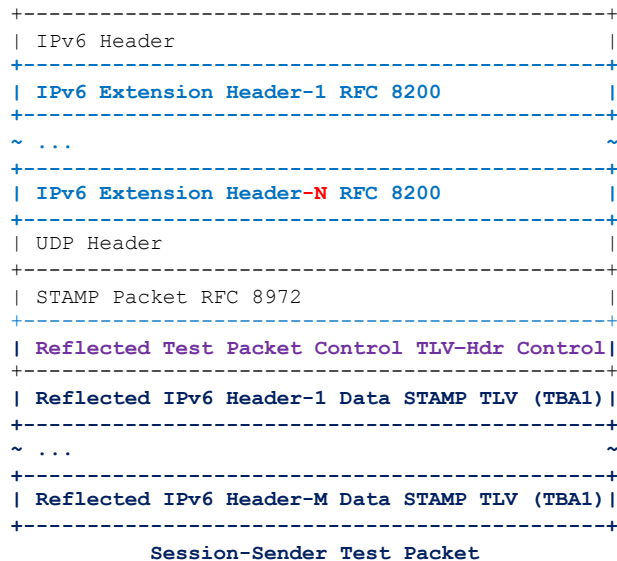
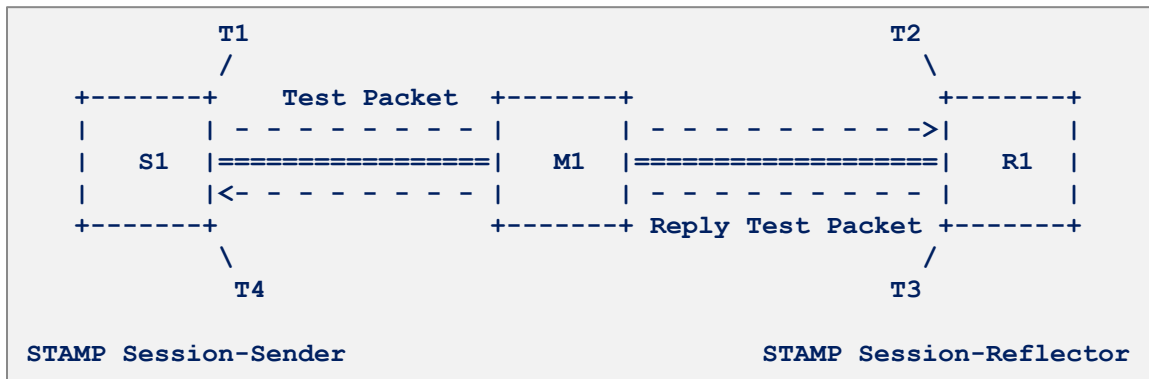
STAMP Extension for One-Way Measurement with Reply (Inserting EHs in Reply STAMP Packet Header)

1. **Default Behavior is two-way** measurement for STAMP when Reflected STAMP TLV is received
2. One-way measurement: Session-Sender to Session-Reflector direction
3. New Sub-TLV “**Extension Header Control**” (Type TBA3) is defined for STAMP TLV “Reflected Test Packet Control TLV” [draft-ietf-ippm-asymmetrical-pkts]
 - a) When Session-Sender Test Packet is received with “Extension Header Control” Sub-TLV, Session-Reflector **will not insert** (IPv6/MNA) Extension Headers in the Return Session-Reflector Test Packet Header
 - b) Session-Reflector will copy the (IPv6/MNA) Extension Headers from the Session-Sender Test packet into the Session-Reflector Test packet Reflected Header STAMP TLVs (Type TBA1 and TBA2)

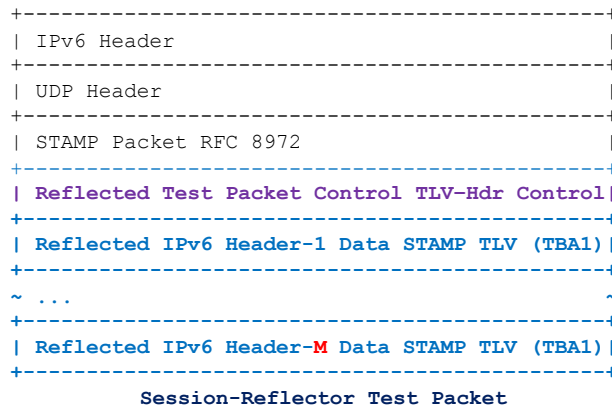
Notes:

1. **Insert all or none relevant** extension headers from the received packet in reply packet **header**
2. Do not insert received routing headers (e.g., IPv6/SRH) in reply packet header

STAMP Extension for IPv6 Data plane (One-Way with Reply)



1. Transmit

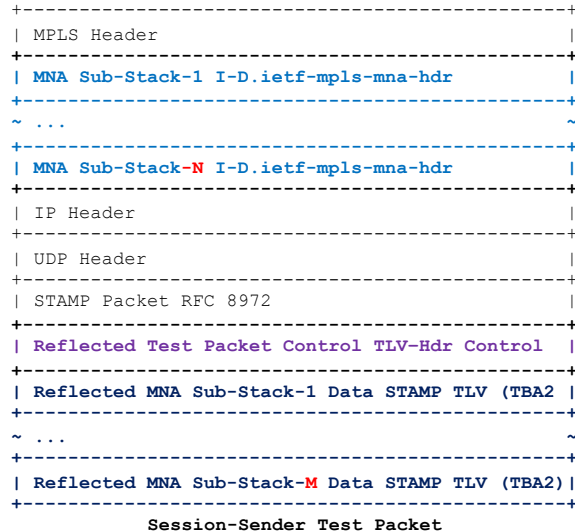
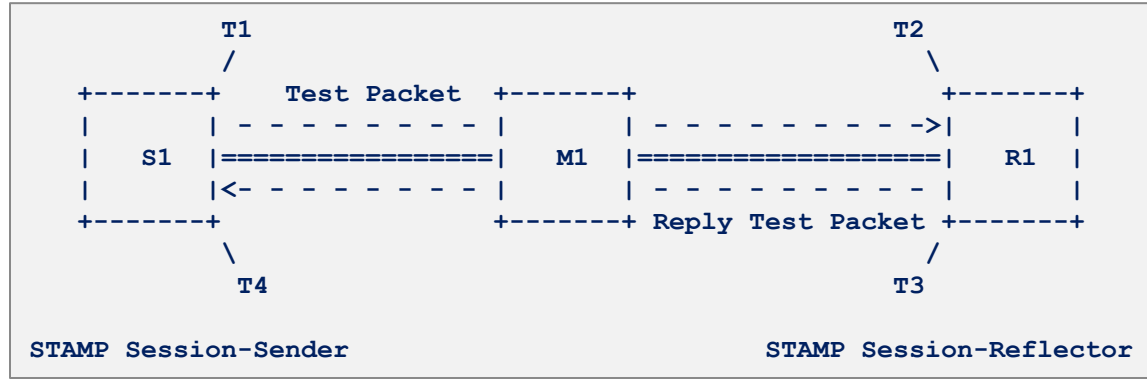


2. Copy Extension headers in STAMP TLVs

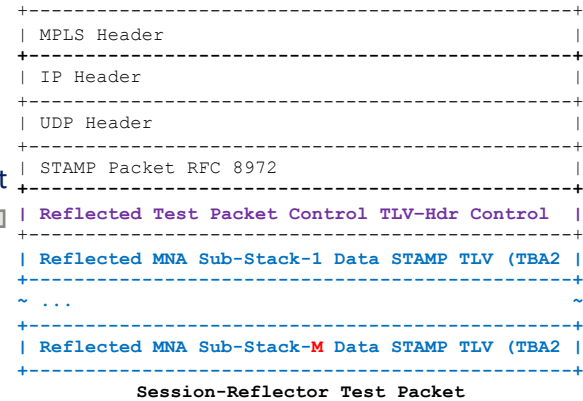
4. Reflect



STAMP Extension for MPLS Data plane (One-Way with Reply)



1. Transmit



4. Reflect



2. Copy Sub-Stack in STAMP TLVs as Data

Pre-allocated Empty TLVs in the same order

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Example IPv6 Extension Headers Carried in STAMP

1. In-Situ OAM (IOAM) and Direct Export (DEX) Option-Types [RFC9486]
 - ✓ Example Use Case for HBH and E2E measurement
2. Routing Header: Segment Routing Header [RFC8754] (Not in the draft)
3. Performance and Diagnostic Metrics (PDM) [RFC8250]
4. Maximum Path MTU [RFC9268]
5. Alternate Marking Method (AMM) [RFC9343]
6. any new IPv6 extension headers to be defined in future

Example Use Case 1: IOAM E2E and HBH Measurement

1. IOAM is used for recording and collecting operational and telemetry data for hop-by-hop and edge-to-edge measurements and for direct exporting
2. IOAM Option-Types in [RFC9197] and Direct Export in [RFC9326]
3. IPv6 extension headers carry IOAM Option-Types defined in [RFC9486]
 - a. Pre-allocated Trace Option-Type
 - b. Proof of Transit Option-Type
 - c. E2E Option-Type
 - d. Direct Export (DEX) Option-Type**
 - e. Not supported: Incremental Trace Option-Type
4. STAMP test packets carry IPv6 extension headers for IOAM
- 5. Sender, midpoint, and Reflector process the IOAM Option-Types as implemented today (agnostic to STAMP protocol)**
6. Leverage existing implementation of IOAM on midpoint nodes without additional requirements

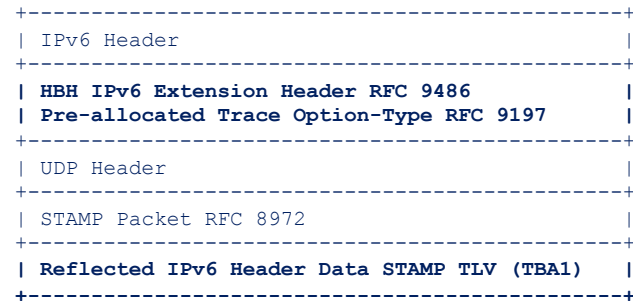


Figure 1: IOAM HBH Recording in two-way measurement with Reflected IPv6 Header STAMP TLV

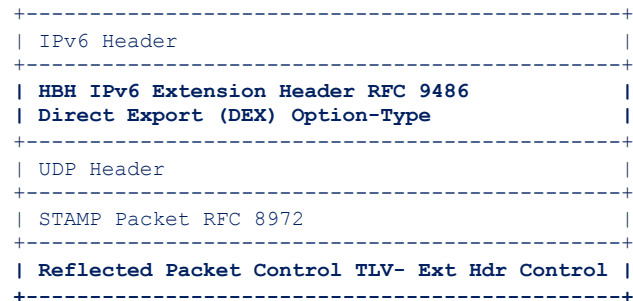
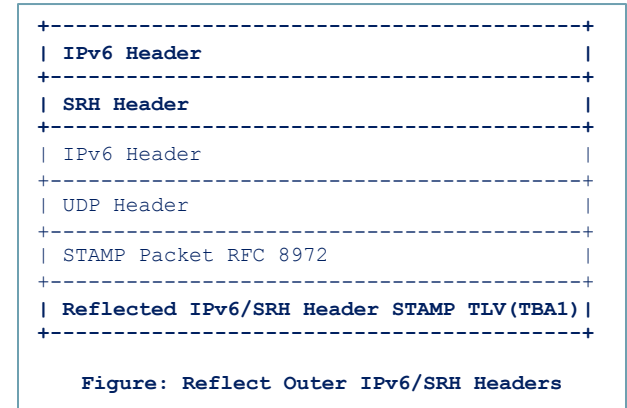


Figure 2: Direct Export in one-way measurement with No Reflected IPv6 Header STAMP TV

Example Use Case 2: Reflect IPv6 Header Encapsulation (Not in the draft, comments from Tal and Xiao Min)

1. Background: STAMP IPv6 header fields reflected are:
 - ✓ Class of Service TLV [RFC8972]: TC (DSCP) in STAMP TLV [RFC8972]
 - ✓ Location Sub TLV [RFC8972]: SA/DA/SPort/DPort
 - ✓ STAMP payload [RFC8762]: Session-Sender HL (TTL)
2. Problem: Today IPv6 Flow Label and Next Header fields are not reflected
 - ❖ Use case is ECMP paths using different FL values
 - Solution: Reflector can use the received flow-label in Session-Reflector test packet header (default behavior)
 - Solution: Reflect Outer IPv6/SRv6 Encapsulation
 - Also, return MPLS encapsulation (including Entropy Label)



Example Use Case 3: Comment from Giuseppe

1. Regarding Section 5 of draft-gandhi-ippm-stamp-ioam, I agree that it needs to be further explained. Indeed, there are **some cases where the Reflected STAMP TLV does not help so much.**
2. For example, for AltMark, it is used IPFIX/YANG Push to report AltMark telemetry information from each intermediate node. These considerations are included in Section 4 of draft-wang-ippm-stamp-hbh-extensions.
 - Use Case example where no extension header reflected in STAMP TLV and no insertion of extension header in reply STAMP packet header

Specific Use Cases: Comment from Zhenqiang Li

(Not in the draft)

1. Give at least one specific use case in the doc

Examples:

- Leverage sequence number, timestamp from STAMP packets
 1. Direct Export uses sequence number and timestamp from STAMP packet
 2. Per-hop delay measurement using timestamps from STAMP and IOAM HBH option
- Add in Appendix?

IANA Requests for New STAMP TLV Types

Value	Description	Reference
TBA1	Reflected IPv6 Option Data	This document
TBA2	Reflected MNA Sub-Stack Data	This document

STAMP TLV Types

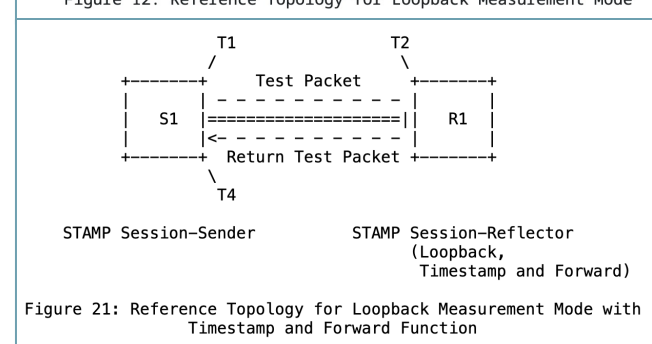
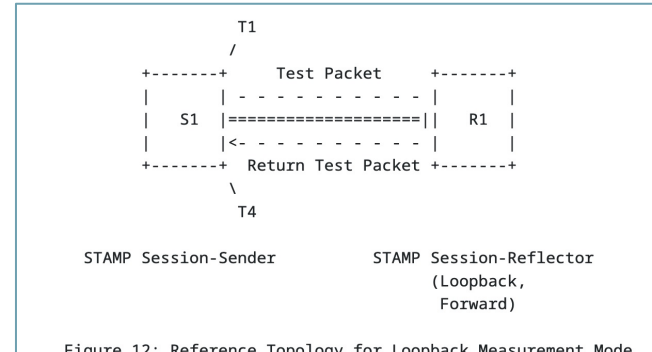
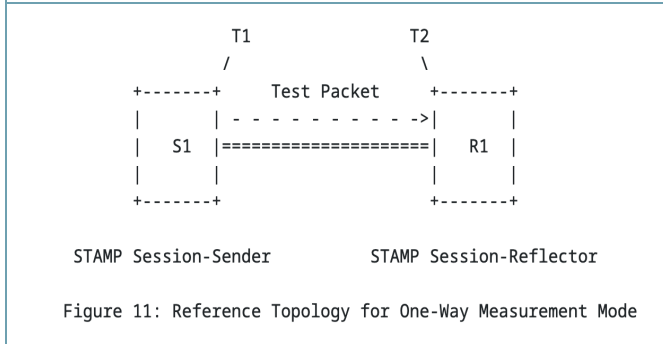
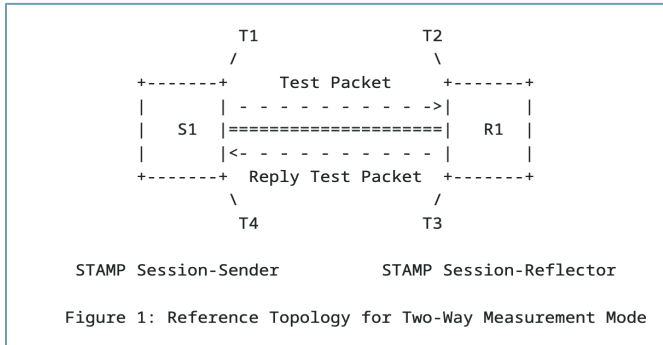
Value	Description	Reference
TBA3	Extension Header Control	This document

Sub-TLV Type for Reflected Test Packet Control TLV

STAMP Extensions in SPRING WG

Performance Measurement Using STAMP for Segment Routing Networks

- <https://datatracker.ietf.org/doc/draft-ietf-spring-stamp-srpm/>
- Defines various measurement modes for SR:
 - Two-way, One-way (with no reply), Loopback, and Loopback with timestamp



STAMP Extensions in MPLS WG

Encapsulation of STAMP for PseudoWires in MPLS Networks

- <https://datatracker.ietf.org/doc/draft-gandhi-mpls-stamp-pw/>
- STAMP with Generic Association Channel (GACH)



Welcome your comments and suggestions

Next Steps

- Update the draft with the review comments
- Welcome further comments and suggestions

Thank you!