

# Performance Measurement Using TWAMP Light for Segment Routing Networks

*draft-gandhi-spring-twamp-srpm-08*

*Rakesh Gandhi - Cisco Systems ([rgandhi@cisco.com](mailto:rgandhi@cisco.com)) - Presenter*

*Clarence Filsfils - Cisco Systems ([cfilsfil@cisco.com](mailto:cfilsfil@cisco.com))*

*Daniel Voyer - Bell Canada ([daniel.voyer@bell.ca](mailto:daniel.voyer@bell.ca))*

*Mach(Guoyi) Chen - Huawei ([mach.chen@huawei.com](mailto:mach.chen@huawei.com))*

*Bart Janssens - Colt ([Bart.Janssens@colt.net](mailto:Bart.Janssens@colt.net))*

# 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 Policies
  - ✓ Applicable to SR-MPLS/SRv6 data planes
- No need to bootstrap PM session (e.g. to negotiate UDP port) - spirit of SR
  - ✓ Stateless on egress node - spirit of SR
- Handle ECMP for SR Policies
- Support stand-alone direct-mode loss measurement

## Scope:

- RFC 5357 (TWAMP) defined probe messages - TWAMP Light
- User-configured IP/UDP path for probe messages

# History of the Draft

- Feb 2019
  - Draft was published - *draft-gandhi-spring-twamp-srpm-00*
- May 2019
  - Added STAMP TLV for Return Path
- Mar 2019
  - Presented version-00 at IETF 104 Prague in SPRING WG
- July 2019
  - Presented version-01 at IETF 105 Montreal in IPPM WG
    - Slide 9 Titled - Applicability of STAMP – STAMP is supported
- Aug 2019
  - Version-02 updates included a section on 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 version-04 at IETF 106 Singapore in SPRING WG
- Mar 2020
  - Moved STAMP support to *draft-gandhi--spring-stamp-srpm-00*
  - Scope 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 TWAMP Light
  - ✓ Updated Two-way mode procedure using the Control Code
2. Moved STAMP support to a new draft - *draft-gandhi-spring-stamp-srpm*
3. Informational draft - as TWAMP Light is informational, see Appendix I in RFC 5357 and Appendix A RFC 8545
4. Various editorial changes

## Open Items:

- None

# TWAMP Light 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 the 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**

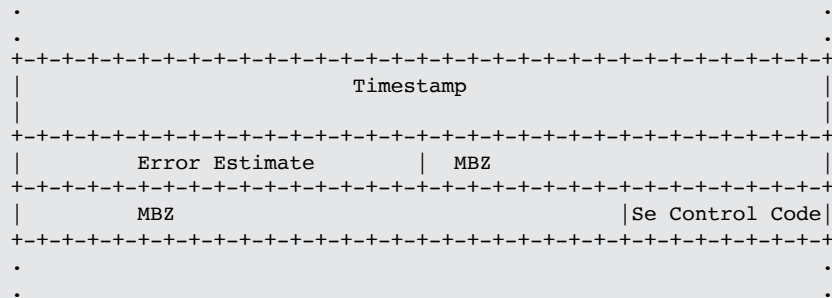


Figure: Control Code in TWAMP Light Query Message

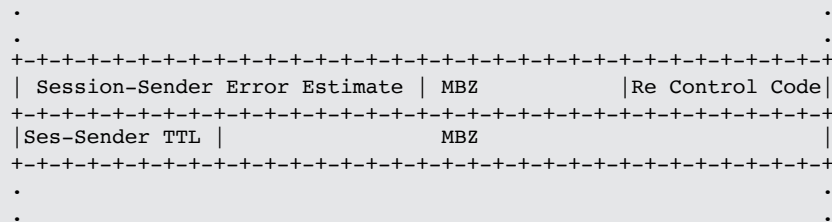


Figure: Control Code in TWAMP Light Response Message

# Performance Measurement Modes

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

# Next Steps

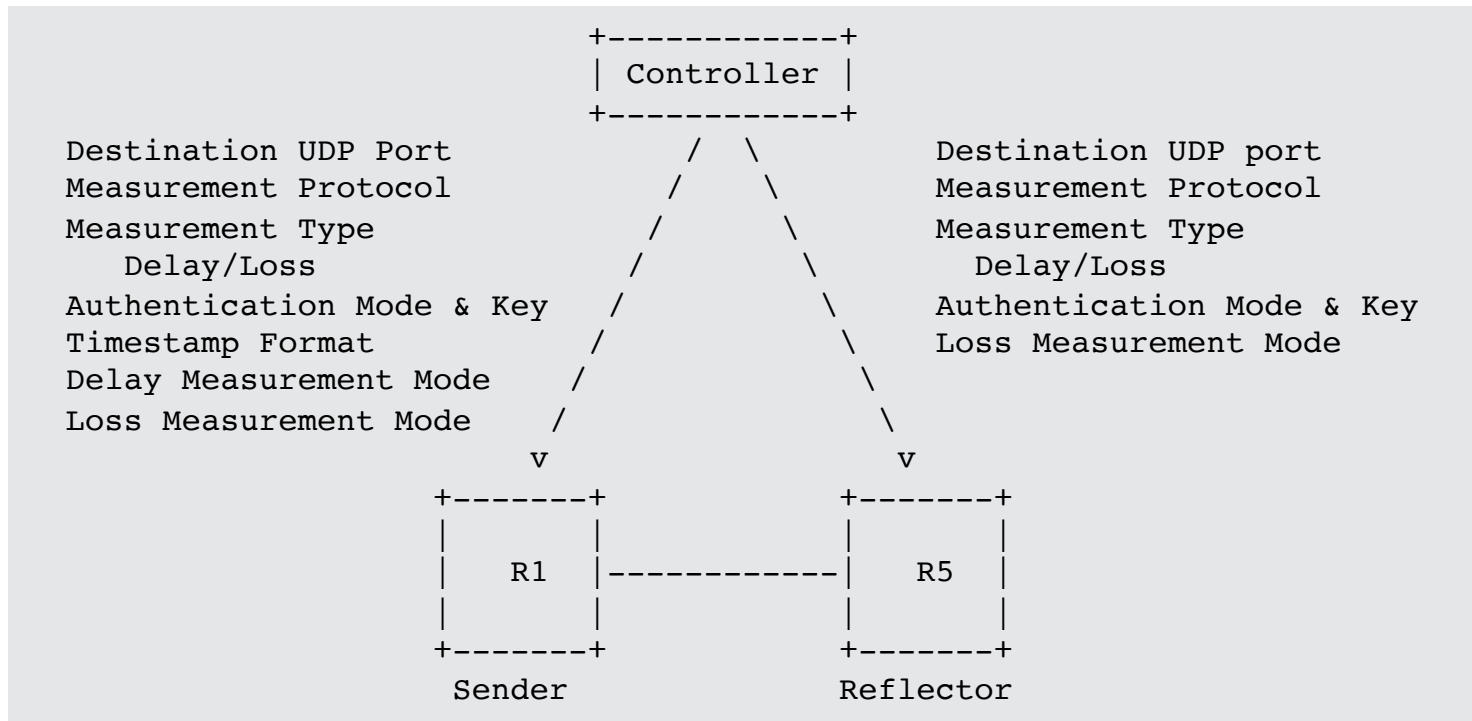
- Welcome your comments and suggestions
- Implementation exists
- In WG adoption (SPRING WG) queue
- Keep IPPM WG in the loop about the milestones



# Thank you

# Backup

# Example Provisioning Model



# Probe Query for Links

- User-configured destination UDP **port1** is used for DM probe messages in unauthenticated mode and **port2** is used for LM probe messages 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 4.2.1 of RFC 5357 |
. Payload = DM Message as specified in Section 4.1.2 of RFC 5357.
. Payload = LM Message as specified in this document .
. .
+-----+
```

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 messages are sent on the SR Policy path with:

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

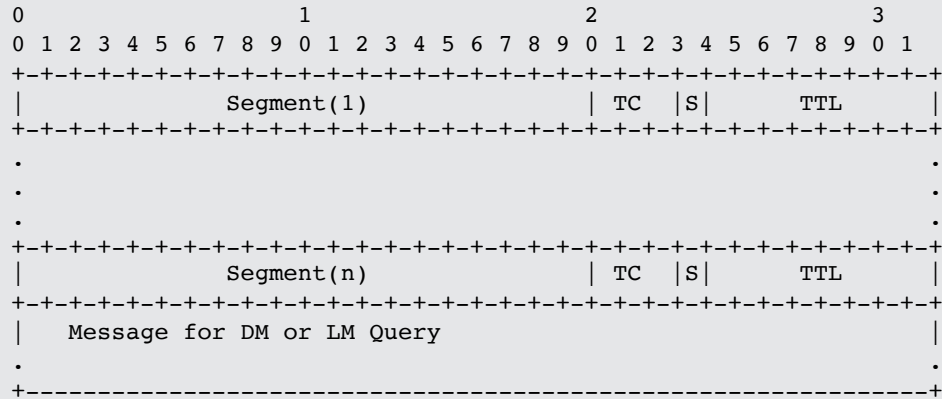


Figure: Probe Query Message for SR-MPLS Policy

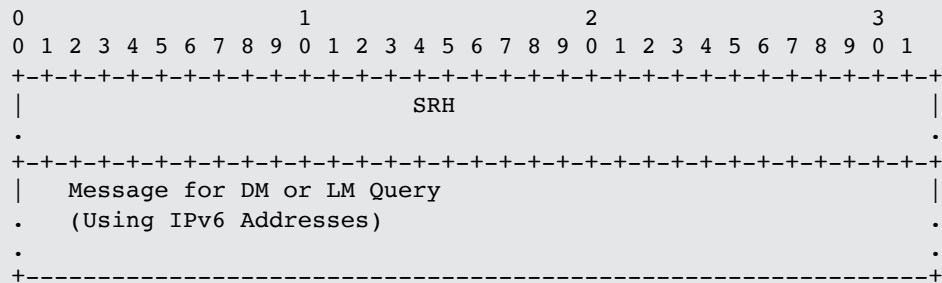


Figure: Probe Query Message for SRv6 Policy

# 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 .
. . .
+-----+
| DM Payload as specified in Section 4.2.1 of RFC 5357, or |
. LM Payload as specified in this document .
. . .
+-----+
```

Figure: Probe Response Message

# Stand-alone LM Message Format for TWAMP Light

- 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 TWAMP Light (which is for DM) procedure as different UDP destination port2 is used for LM.**

```

+-----+
| IP Header |
. Source IP Address = Sender IPv4 or IPv6 Address .
. Destination IP Address = Reflector IPv4 or IPv6 Address .
. Protocol = UDP .
. Router Alert Option Not Set .
.
+-----+
| UDP Header |
. Source Port = As chosen by Sender .
. Destination Port = User-configured Port2 for Loss Measurement. .
.
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                               Sequence Number |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                               Transmit Counter |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|X|B| Reserved | Block Number | MBZ |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                               Receive Counter |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                               Sender Sequence Number |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                               Sender Counter |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|X|B| Reserved | Sender Block Nu | MBZ |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| Sender TTL | Padding (3 Bytes) |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                               Padding |
.
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+

```

# ECMP Support for SR Policy

- SR Policy 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:
  - For IPv4
    - Destination addresses in IPv4 header (e.g. 127/8)
  - For IPv6
    - Destination addresses in IPv6 header (e.g. FFFF:7F00/104)
    - Flow label in IPv6 header



# Thank you