Performance Measurement Using TWAMP Light for Segment Routing Networks

draft-gandhi-spring-twamp-srpm-04

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)

106th IETF @ Singapore
Agenda

• Requirements and Scope
• History of the Draft
• Updates Since IETF-104
• Summary
• Next Steps
Requirements and Scope

Requirements:

- Delay and Loss Performance Measurement (PM) for SR 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 direct-mode loss measurement

Scope:

- Use RFC 5357 (TWAMP) defined probe messages – TWAMP Light
- STAMP [draft-ietf-ippm-stamp] defined probe messages applicable
- **User-configured** IP/UDP path for probe messages
History of the Draft

• Feb 2019
  – Draft was first published
  – Uses the similar mechanism defined in draft-gandhi-spring-udp-pm for RFC 6374 (that was published Mar 2018)

• Mar 2019
  – Presented revision-00 at IETF 104 Prague in SPRING WG

• July 2019
  – Presented revision-01 at IETF 105 Montreal in IPPM WG
Updates Since IETF-104 (Revision-00)

Updates:

- Welcome Mach Chen and Bart Janssens as co-authors
- Added provisioning model
- Added STAMP [draft-ietf-ippm-stamp] message formats
- Added Loopback measurement mode
- Defined Return Path TLV for two-way measurement
- Additional message processing rules (TTL value, Router Alert option, UDP checksum validation)
- Elaborated on procedure for P2MP SR Policy
- Aligned message format for direct-mode loss measurement with delay measurement
  - Added flags for counter formats and loss measurement mode
- Various editorial changes

Open Items:
- None
### Provisioning Model

<table>
<thead>
<tr>
<th>Controller</th>
</tr>
</thead>
</table>

- **Measurement Protocol** | **Measurement Protocol**
- **Destination UDP Port** | **Destination UDP Port**
- **Measurement Type** | **Measurement Type**
- **Delay/Loss** | **Delay/Loss**
- **Authentication Mode & Key** | **Authentication Mode & Key**
- **Timestamp Format** | **Delay Measurement Mode**
- **Delay Measurement Mode** | **Padding/MBZ Bytes**
- **Padding/MBZ Bytes** | **Loss Measurement Mode**

<table>
<thead>
<tr>
<th>R1</th>
<th>R5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sender</td>
<td>Responder</td>
</tr>
</tbody>
</table>
Measurement Modes for SR Policy

• One-way Measurement Mode
  – Reply sent “out of band” IP/UDP path

• Two-way Measurement Mode
  – Reply sent using Return Path TLV from the probe query message

• Loopback Measurement Mode
  – Probe message carries the return path in the header of the packet
Return Path TLV for Two-way Measurement

1. Type (value 1): Respond back on Incoming Interface (Layer-3 and Layer-2) (Segment List is Empty)
2. Type (value 2): SR-MPLS Segment List (Label Stack) of the Reverse SR Path
4. Type (value 4): SRv6 Segment List of the Reverse SR Path
5. Type (value 5): SRv6 Binding SID [draft-ietf-pce-binding-label-sid] of the Reverse SR Policy

Case 1: Reply on the same bundle member as probe query
Case 2: Reply on the congruent return SR path of a bidirectional SR Policy
LM Message Format for TWAMP and STAMP

- Independent Loss Measurement (LM) message defined with fixed offsets for transmit and receive traffic counters
  - Hardware efficient counter-stamping
- LM message format aligned with DM message format
- LM Message format is also defined for authenticated mode
- User-configured destination UDP port2 is used for identifying LM probe packets
- Corresponding LM messages also defined for STAMP [draft-ietf-ippm-stamp]
Next Steps

- Welcome your comments and suggestions
- Has been implemented
- Has been deployed
- Ready for WG adoption (SPRING WG)
- Keep IPPM WG in the loop about the milestones
Thank you
Backup
 Probe Query Message

- User defined IP/UDP path for PM probe messages for delay and loss measurements for SR links and end-to-end P2P/P2MP SR Policies.
- Payload contains RFC 5357 (TWAMP) defined probe message for Delay Measurement (DM).
- User-configured destination UDP port is used for identifying DM probe packets in unauthenticated mode.

```
+-----------------------------------------------+   +-----------------------------------------------+
| IP Header                                      |   | UDP Header                                    |
|                                               |   |                                               |
|   .  Source IP Address = Querier IPv4 or IPv6 Address . |   |   .  Source Port = As chosen by Querier .     |
|   .  Protocol = UDP .                             |   |   .                                           |
|                                               |   |                                               |
|+-----------------------------------------------+   |+-----------------------------------------------+   |
| Payload = Message as specified in Section 4.2.1 of RFC 5357 |   | Payload = Message as specified in Section 4.1.2 of RFC 5357 . |
|                                               |   |                                               |
|+-----------------------------------------------+   |+-----------------------------------------------+   |

Figure 1: DM Probe Query Message for TWAMP Light
```
The probe response message is sent using the IP/UDP information from the probe query message.

```
+-----------------------------------------------+
| IP Header                                      |
| .  Source IP Address = Responder IPv4 or IPv6 Address |
| .  Destination IP Address = Source IP Address from Query |
| .  Protocol = UDP                               |
|                                              |
+-----------------------------------------------+
| UDP Header                                    |
| .  Source Port = As chosen by Responder       |
| .  Destination Port = Source Port from Query  |
|                                              |
+-----------------------------------------------+
| DM Payload as specified in Section 4.2.1 of RFC 5357, or |
| .  LM Payload as specified in Figure 7A or 7B in this document |
|                                              |
+-----------------------------------------------+
```

Figure 6: Probe Response Message
Probes for SR-MPLS or 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, Or,
2. SRv6 SRH [draft-ietf-6man-segment-routing-header] with SID list and END.OTP (for DM) or END.OP (for LM) for target SID for SRv6 Policies.

Figure 3: Probe Query Message for SR-MPLS Policy

Figure 4: Probe Query Message for SRv6 Policy
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 and IPv6
    - Destination addresses in IP header (e.g. 127/8 for IPv4 and FFFF:7F00/104 for IPv6)
    - Flow label in IPv6 header
STAMP DM Message with LM TLV (Destination UDP Port 3 for DM+LM)

```
<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 1 2 3 4 5 6 7 8 9 0 1</td>
<td>0 1 2 3 4 5 6 7 8 9 0 1</td>
<td></td>
</tr>
<tr>
<td>+--------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+--------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sequence Number</td>
<td></td>
<td>Sequence Number</td>
</tr>
<tr>
<td>+--------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Timestamp</td>
<td></td>
<td>Timestamp</td>
</tr>
<tr>
<td>+--------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Error Estimate</td>
<td></td>
<td>Error Estimate</td>
</tr>
<tr>
<td>+--------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MBZ (30 octets)</td>
<td></td>
<td>MBZ (30 octets)</td>
</tr>
<tr>
<td>+--------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Direct Measurement Type</td>
<td></td>
<td>Length</td>
</tr>
<tr>
<td>+--------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Session-Sender Tx counter (S_TxC)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Session-Reflector Rx counter (R_RxC)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Session-Reflector Tx counter (R_TxC)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Figure: Sender Message Format</td>
<td></td>
<td>Figure: Reflector Message Format</td>
<td></td>
</tr>
</tbody>
</table>
```

106th IETF @ Singapore
Thank you