Enhanced Performance Delay and Liveness Monitoring in Segment Routing Networks

draft-gandhi-spring-sr-enhanced-plm-02

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Agenda

- Requirements and Scope
- Summary
- Next Steps
Requirements and Scope

Requirements:

- Performance Delay Monitoring & Liveness Monitoring in SR networks
  - End-to-end P2P/P2MP SR paths
  - Applicable to SR-MPLS/SRv6 data planes
- Running single protocol in SR networks
  - Simplify implementations and reduce development cost
  - Simplify deployment and reduce operational complexity
- No endpoint dependency
  - Stateless on endpoint (e.g. endpoint unaware of the protocol)
  - Higher scale and faster detection interval

Scope:

- RFC 5357 (TWAMP Light) defined probe messages
- RFC 8762 (STAMP) defined probe messages
History of the Draft

- March 2020
  - Draft was published

- April 2020
  - Presented version 00 in IETF MPLS WG Virtual Meeting
• Using PM probes (TWAMP Light/STAMP delay measurement messages) in Loopback Mode
• Probe messages sent using Segment List(s) of the SR Policy Candidate Path(s)
• Probe messages are not punted on the reflector node out of fast-path in forwarding
Using PM probes in loopback mode enabled with network programming function

- The network programming function optimizes the "operations of punt, add receive timestamp and inject the probe packet" on the reflector node
- As probe packets are forwarded in fast-path, faster liveness failure detection is possible

Reflector node adds the receive timestamp in the payload of the received probe message without punting the message

- Only adds the receive timestamp if the source address or destination address in the probe message matches the local node address
- Ensure loopback probe packets return from the intended reflector node
Failure Notification

• Delay metrics are notified when consecutive M number of probe messages have delay values exceed the configured thresholds

• Liveness failure (loss of heart beats) is notified when consecutive N number of return probe messages are not received at the sender
Probe Messages for Timestamp and Forward Function

- Leverage existing TWAMP implementations and deployments
- Sender adds Transmit Timestamp (t1)
- Reflector adds Receive Timestamp (t2) at fixed offset in payload locally provisioned (consistently in the network)
  - E.g. offset-byte 16 from the start of the payload
### SR-MPLS with Timestamp and Forward Function

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Example Probe Message with Timestamp Label for SR-MPLS

- Extended Special-purpose label (TBA1) is defined for Timestamp and Forward network programming
- Reverse Path can be IP or SR-MPLS
- Source and Destination Addresses are swapped to represent the Reverse direction path
SRv6 with Timestamp and Forward SID Function

- **Endpoint SID Function END.TSF** is defined for Timestamp and Forward network programming and is carried for the Reflector node SID.
- **Reverse path can be IP**
  - Reflect node removes SRH.
- **Reverse path can be SR**
  - Reverse direction SR path Segment-list carried in SRH.
  - Reflect node does not remove the SRH.
- **Source and Destination Addresses** are swapped to represent the Reverse direction path in the inner IPv6 header.

Example Probe Message with Endpoint Function for SRv6

1. **IP Header**
   - Source IP Address = Sender IPv6 Address
   - Destination IP Address = Destination IPv6 Address

2. **SRH as specified in RFC 8754**
   - <Segment List>
   - END.TSF with Reflector SID

3. **IP Header**
   - Source IP Address = **Reflector** IPv6 Address
   - Destination IP Address = **Sender** IPv6 Address

4. **UDP Header**
   - Source Port = As chosen by Sender
   - Destination Port = As chosen by Sender

5. **Payload**

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Example Probe Message with Endpoint Function for SRv6
ECMP Support for SR Paths

- SR Paths can have ECMP between the ingress and transit nodes, between transit nodes and between transit and egress nodes.
- PM probe messages can take advantage of the hashing function in forwarding plane.
- Existing forwarding mechanisms are applicable to PM probe messages. Examples are:
  - For IPv4
    - Sweeping destination address in IPv4 header (e.g. 127/8) if return path is also SR-MPLS
  - For IPv6
    - Sweeping flow label in IPv6 header
Figure 2: Example Provisioning Model
Next Steps

- Welcome your comments and suggestions
- Requesting SPRING WG adoption
Thank you
Backup
Loopback Mode with Timestamp and Forward for SR-MPLS Policy
Thank you