UDP Path for In-band Performance Measurement for Segment Routing Networks

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Agenda

- Requirements and Scope
- Probe Query Message
- Probe Response Message
- Return Path, Sequence Number and Block Number TLVs
- ECMP Support
- Next Steps
Requirements and Scope

Requirements:
- Delay and Loss Performance Measurement (PM) for SR links and end-to-end P2P and P2M P 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
- One-way and two-way measurements
- Handle ECMP for SR Policies

Scope:
- Use RFC 6374 defined **probe message formats**
- Use RFC 7876 (IP/UDP return path) defined probe response messages
- Define IP/UDP path for PM probe query messages
Probe Query Messages

- IP/UDP path is defined for PM probe query messages for delay and loss measurements for SR links and end-to-end P2P and P2MP SR Policies.
- For **end-to-end** performance measurement, the probe query messages are sent in-band with MPLS label stack SR-MPLS Policies and SRv6 SRH with SID list for SRv6 Policies.
- Payload contains [RFC6374] defined message for DM or LM.
- UDP port IANA-TBA1 is used for identifying DM probe packets.
- UDP port IANA-TBD2 is used for identifying LM probe packets.
Probe Response Messages

- Probe response messages can be sent in-band (two-way measurement) or out-of-band (one-way measurement) for SR links and SR Policies.
- Use the information from the UDP Return Object (URO) TLV [RFC7876] from the received Probe query message payload, otherwise use the IP/UDP information (Source IP Address and Source UDP port) from the received Probe query message header.

### IP Header
- Source IP Address = Responder IPv4 or IPv6 Address
- Destination IP Address = URO.Address
- Protocol = UDP
- Router Alert Option Not Set

### UDP Header
- Source Port = As chosen by Responder
- Destination Port = URO.UDP-Destination-Port

### Message as specified in RFC 6374 Section 3.2 for DM, or
- Message as specified in RFC 6374 Section 3.1 for LM
Return Path TLV

• For two-way end-to-end performance measurement of SR Policies, the responder node needs to send the probe response messages in-band on a specific reverse SR path.
• Querier node can request the responder node to send the probe response messages back on a given reverse path (e.g. co-routed path) by adding a Return Path Segment List (RPSL) TLV in the probe query messages.

TBA3: SR-MPLS RPSL
TBA4: SRv6 RPSL
TBA5: SR-MPLS BSID
TBA6: SRv6 BSID

<table>
<thead>
<tr>
<th>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</th>
</tr>
</thead>
</table>
| RPSL Type | Length | Reserved
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>Segment List(0)</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>Segment List(n)</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
</tr>
</tbody>
</table>

Figure 7: Return Path Segment List TLV
Sequence Number TLV

- Define Sequence Number TLV for Probe Query and Response messages.
- Useful when some probe query messages are lost or they arrive out of order.

![Figure 10: Sequence Number TLV](image-url)
Block Number TLV

- Define Block Number TLV for Probe Query and Response messages.
- [RFC8321] requires to identify the Block Number (color) of the traffic counters carried by the probe query and response messages.

```
0                   1                   2                   3
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 TBA8 | Length   | Reserved |
+----------+----------+----------+
|          |          |          |
|          |          |          |
| Block Number |
+----------+----------+
```

Figure 11: Block Number TLV
ECMP Support

• 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
    • Different Destination/Source Addresses or Source UDP ports in IP/UDP header.
  – For SR-MPLS
    • Entropy label.
  – For SRv6
    • Flow Label in SRH.
Next Steps

• Welcome your comments and suggestions
• Implementations of building blocks already exist (e.g. RFC6374, IP/UDP paths for probes as in RFC 7876)
• Request for WG adoption
Thank you.