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

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Rakesh Gandhi - Cisco Systems (rgandhi@cisco.com) - Presenter
Clarence Filsfils - Cisco Systems (cfilsfil@cisco.com)
Daniel Voyer - Bell Canada (daniel.voyer@bell.ca)
Stefano Salsano - Universita di Roma "Tor Vergata" (stefano.salsano@uniroma2.it)
Pier Luigi Ventre - CNIT (pierluigi.ventre@cnit.it)
Mach Chen - Huawei (mach.chen@huawei.com)

Sagar Soni - Cisco Systems (sagsoni@cisco.com)
Patrick Khordoc - Cisco Systems (pkhordoc@cisco.com)
Zafar Ali - Cisco Systems (zali@cisco.com)
Daniel Bernier - Bell Canada (daniel.bernier@bell.ca)
Dirk Steinberg - Steinberg Consulting (dws@dirksteinberg.de)

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Agenda

• Requirements and Scope
• Probe Query Message
• Probe Response Message
• Return Path Segment List, 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

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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.

```
+---------------------------------------------------------------+
| IP Header                                                     |
| Source IP Address = Querier IPv4 or IPv6 Address              |
| Destination IP Address = Responder IPv4 or IPv6 Address       |
| Protocol = UDP                                               |
| IP TTL = 1                                                   |
| Router Alert Option Not Set                                   |
+---------------------------------------------------------------+

+---------------------------------------------------------------+
| UDP Header                                                    |
| Source Port = As chosen by Querier                            |
| Destination Port = TBA1 by IANA for DM, TBA2 for LM           |
+---------------------------------------------------------------+

+---------------------------------------------------------------+
| Payload = Message as specified in RFC 6374 for DM and LM       |
+---------------------------------------------------------------+```
## 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.

<table>
<thead>
<tr>
<th>IP Header</th>
<th>IP Header</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source IP Address = Responder IPv4 or IPv6 Address</td>
<td>Source IP Address = Responder IPv4 or IPv6 Address</td>
</tr>
<tr>
<td>Destination IP Address = URO.Address</td>
<td>Destination IP Address = Source IP Address from Query</td>
</tr>
<tr>
<td>Protocol = UDP</td>
<td>Protocol = UDP</td>
</tr>
<tr>
<td>Router Alert Option Not Set</td>
<td>Router Alert Option Not Set</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UDP Header</th>
<th>UDP Header</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source Port = As chosen by Responder</td>
<td>Source Port = As chosen by Responder</td>
</tr>
<tr>
<td>Destination Port = URO.UDP-Destination-Port</td>
<td>Destination Port = Source Port from Query</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Message as specified in RFC 6374 Section 3.2 for DM, or</th>
<th>Message as specified in RFC 6374 Section 3.1 for LM</th>
</tr>
</thead>
</table>

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Return Path Segment List 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.

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

Figure 7: Return Path Segment List TLV

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

```
+---+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|   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)
• Request for WG adoption
Thank you.