Source Segment for SRv6 based Multicast VPN

draft-xl-bess-source-segment-00

PIM Working group, IETF116
In Unicast
- the (P2P) LSP Label is downstream-assigned. (LDP, RSVP-TE).
- the VPN Label is also downstream-assigned. (RFC4364).

In Multicast
- the (P2MP) LSP Label is downstream-assigned (mLDP, RSVP-TE P2MP)
- the VPN Label for multicast is upstream-assigned. (RFC5331, RFC6513, RFC8556, etc), because...
  - multicast has multiple egress routers,
  - If the VPN Label is downstream-assigned, there will be multiple VPN labels from different egress nodes, which can't be used for the ingress node.

PE0 is the ingress node and PE 1, 2, 3 are the egress nodes.
- If the MVPN Label is assigned by egress nodes separately, PE0 doesn’t know which of these “downstream-assigned” should be used (VPN Labels 101/102/103).
- So PE0 requests a Label locally allocated---- which could be called “Upstream-assigned” VPN Label.
Challenge & Problem: SRv6 Unicast & Multicast

In Unicast

- **SRv6-VPN-SID** is ”downstream-assigned” and usually carried in SRH as the last SID. (RFC8986, RFC9252).

In Multicast

- The ”downstream-assigned” **SRv6-VPN-SID** can’t be used directly in multicast because the similar reason discussed in the previous slides:
  - Multicast has multiple egress routers,
  - DA in IPv6 header will be used to indicate replication behavior and the next replication nodes which changes along the path
  - So ”downstream-assigned" SRv6-VPN-SID doesn’t work in SRv6 multicast.

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![Diagram](https://via.placeholder.com/150)

- The DA of the IPv6 header could be a SID which indicates replication behavior and change along the path: PE0->P1, P1->P2, P2->PE1/PE2/PE3.
- **Question:** how to define an “Upstream-assigned SRv6-VPN-SID” for SRv6 Multicast which won’t change after replication?
Proposal in this draft: Upstream-assigned SRv6-VPN-SID in Source Address

- In this draft, the “Source Address (SA)” field of IPv6 header is used to carry the “Upstream-assigned SRv6-VPN-SID”, which won’t change along the path.
- The “Upstream-assigned SRv6-VPN-SID” is named “Source-Segment” and have 4 variants:
  - Src.DT4: Source Segment for Decapsulation and IPv4 multicast Table lookup
  - Src.DT6: Source Segment for Decapsulation and IPv6 multicast Table lookup
  - Src.DT46: Source Segment for Decapsulation and IP(v4 or v6) multicast Table lookup
  - Src.DT2: Source Segment for Decapsulation and Layer-2 multicast Table lookup
Related Work and Next Step

There are also other solutions under discussion:

- `<draft-ietf-spring-sr-replication-segment>` implies to carry SRv6-VPN-SID in SRH
- `<this document>` defines SRv6-VPN-SID in IPv6 source address

We think both solutions are valid and necessary to be discussed in IETF.

Looking forward to your comments.
SRv6 Multicast: Approaches and Impacts to SRv6 Architecture

draft-xie-spring-srv6-multicast

PIM Working group, IETF116
2 Approaches for SRv6 Multicast: Stateful Approach (SRv6-P2MP), Stateless Approach (MSR6-BE)

- **SRv6 P2MP**: Replicate a packet and send each copy of the packet to a downstream replication node according to the “Replication State”* that associated with the End.Replicate SID (stateful).

- **MSR6 BE**: Replicate a packet and send each copy of the packet to a downstream replication node according to the End.RGB (replication through global bitstring) and the BitString/BIER-info in packet (stateless).

These two approaches are both based on SRv6 Architecture

<table>
<thead>
<tr>
<th></th>
<th>SRv6 Multicast ---- SRv6 P2MP</th>
<th>SRv6-Multicast ---- MSR6 BE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SID</strong></td>
<td>Defines an SRv6 SID &quot;End.Replicate&quot;: Replicate-through-state</td>
<td>Defines an SRv6 SID &quot;End.RGB&quot;: Replicate-through-Global-BitString</td>
</tr>
<tr>
<td><strong>Behavior</strong></td>
<td>Replicate a packet and send each copy of the packet to a downstream SRv6 node according to the &quot;State&quot; that associated with the End.Replicate SID</td>
<td>Replicate a packet and send each copy of the packet to a downstream SRv6 node according to the End.RGB and the BitString/BIER-info in packet</td>
</tr>
<tr>
<td><strong>Forwarding</strong></td>
<td>Need a new forwarding procedure to be implemented based on SRv6 (FIB Entry) and SRH (context).</td>
<td>Need a new forwarding procedure to be implemented based on SRv6 (FIB Entry) and DOH (BitString/BIER-info).</td>
</tr>
<tr>
<td><strong>DA Changes along the path</strong></td>
<td>the destination address is updated through the path, which is the End.Replicate SID of the downstream SRv6 node (change en route)</td>
<td>the destination address is updated through the path, which is the End.RGB SID of the downstream SRv6 node (change en route)</td>
</tr>
<tr>
<td><strong>MVPN</strong></td>
<td>SRv6 VPN SID in SRH</td>
<td>SRv6 VPN SID in IPv6 Source Address</td>
</tr>
<tr>
<td><strong>Encapsulation</strong></td>
<td>Multicast packet encapsulated in { IPv6 + Extension Header (optional) }</td>
<td>Multicast packet encapsulated in { IPv6 + Extension Header (optional) }</td>
</tr>
<tr>
<td></td>
<td>Optional SRH to carry VPN SID.</td>
<td>Optional DOH to carry BitString/BIER-info.</td>
</tr>
</tbody>
</table>
Thoughts and Comments

- SRv6 Multicast solution is necessary, especially in an SRv6 deployed unicast network
  - There are 2 approaches for SRv6 multicast: SRv6 P2MP and MSR6 BE;
  - Both provide new types of MVPN “PMSI tunnel” adapted for SRv6 network;
  - Both provide multicast service for IPv4, IPv6 PIM traffic through MVPN;

- SRv6 P2MP has just finished WG last call and it may be good timing for MSR6 BE discussion
Thanks