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Explicit RPF Vector
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Abstract

This document describes a use of the Reverse Path Forwarding (RPF) Vector TLV as defined in [RPC 5496] to build multicast trees via an explicitly configured path sent in the PIM join.

Status of this Memo

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1. Introduction

In some applications it might be useful to have a way to specify the explicit path along which the PIM join is propagated.

This document defines a new TLV in the PIM Join Attribute message [RFC5384] for specifying the explicit path.

The procedures in [RFC5496] define how a RPF vector can be used to influence the path selection in the absence of a route to the Source. However, the same procedures can be used to override a route to the Source when it exists. It is possible to include multiple RPF vectors in the stack where each router along the path will perform a unicast route lookup on the first vector in the attribute list. Once the router owning the address of the RPF vector is reached, following the procedures in [RFC5496], the RPF vector will be removed from the attribute list. This will result in a 'loosely' routed path based on the unicast reachability of the RPF vector(s). We call this loosely because we still depend on unicast routing reachability to the RPF Vector.

In some scenarios we don't want to rely on the unicast reachability to the RPF vector address and we want to build a path strictly based on the RPF vectors. In that case the RPF vector(s) represent a list of directly connected PIM neighbors along the path. For these vectors we MUST NOT do a unicast route lookup. We call these 'explicit' RPF vector addresses. If a router receiving an explicit RPF vector does not have a PIM neighbor matching the explicit RPF vector address it MUST NOT fall back to loosely routing the JOIN. Since the behavior of the explicit RPF vector differs from the loose RPF vector as defined [RFC5496], we're defining a new attribute called the explicit RPF Vector.

2. Specification of Requirements

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL" "NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

3. Solution Requirements

Some broadcast video transport networks use a multicast PIM live-live resiliency model for video delivery based on PIM SSM or PIM ASM. Live-Live implies using 2 active-active spatially diverse multicast trees to transport video flows from root to leaf multicast routers. The leaf multicast router receives 2 copies from the PIM multicast core and will replicate 1 copy towards the receivers [draft-mofrr-karan].

One of the main requirements of PIM live-live resiliency model is to ensure path-diversity of the active-active PIM trees in the core such that they do not intersect to avoid a single point of failure. IGP routed RPF paths of active-active PIM trees could be routed over the same transit router and create a single point of failure. It might be useful to have a way to specify the explicit path along which the PIM join is propagated.

How the explicit RPF vector stack is determined is outside the scope of this document. It may either be manually configured by the network operator or procedures may be implemented on the egress router to dynamically calculate the vector stack based on a link state database protocol, like OSPF or ISIS.

Due to the fact that the leaf router receives two copies of the multicast stream via two diverse paths, there is no need for PIM to repair the broken path immediately. It is up to the egress router to either wait for the broken path to be repaired or build a new explicit path using a new RPF vector stack. Which method is applied depends very much on how the vector stack was determined initially. Double failures are not considered and outside the scope of this document

4. Use of the PIM Explicit RPF Vector

Figure 1 provides an example multicast join path R4->R3->R6->R5->R2->R1, where the multicast JOIN is explicitly routed to the source hop-by-hop using the explicit RPF vector list.

```
[S]---(R1)--(R2)---(R3)--(R4)---[R]
       <---    |      |  ---
          |   |      |  |
          | (R5)---(R6) |
          - (S,G) Join -

               Figure 1
```

5. Explicit RPF Vector Attribute

This draft uses vector attribute 4 for specifying an explicit RPF vector.

6. Conflicting RPF Vectors

It is possible that a PIM router has multiple downstream neighbors. If for the same multicast route there is inconsistency between the Explicit RPF Vector stacks provided by the downstream PIM neighbor, the procedures as documented in RFC5384 section 3.3.3 apply.

7. Explicit RPF Vector Attribute TLV Format

```
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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|F|S| Type      | Length        |        Value
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-.......
```

F bit

The F bit MUST be set to 0. Otherwise there could be loops.

S bit

Bottom of Stack. If this bit is set then this is the last
TLV in the stack.

Type

The Vector Attribute type is 4.

Length

Length depending on Address Family of Encoded-Unicast address.

Value

Encoded-Unicast address. For IPv6, this should be a unique global
address and NOT link-local.

8. IANA Considerations

An new attribute type from the "PIM Join Attribute Types" registry needs to be assigned by IANA for the RPF Vector. The proposed value is 4.

9. Security Considerations

Security of the RPF Vector Attribute is only guaranteed by the security of the PIM packet, so the security considerations for PIM join packets as described in PIM-SM [RFC4601] apply here.

10. Acknowledgments

The authors would like to thank Vatsa Kumar for the comments on the draft.

11. Normative References

[RFC5496] Wijnands, IJ., Boers, A., Rosen, E., "The Reverse Path Forwarding (RPF) Vector TLV", RFC 5496, March 2009.

[RFC5384] Boers, A., Wijnands, IJ., Rosen, E., "The Protocol Independent Multicast (PIM) Join Attribute Format", RFC 5384, Nov 2008.

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.

[RFC4601] Fenner, B., Handley, M., Holbrook, H., and I. Kouvelas, "Protocol Independent Multicast - Sparse Mode (PIM-SM):

Protocol Specification (Revised)", RFC 4601, August 2006.

[RFC5384] Boers, A., Wijnands, I., and E. Rosen, "The Protocol Independent Multicast (PIM) Join Attribute Format", RFC 5384, November 2008.

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