PIM Multi-Topology ID (MT-ID) Join-Attribute

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Abstract

   This document introduces a new type of PIM Join Attribute that
   extends PIM signaling to identify a topology that should be used when
   constructing a particular multicast distribution tree.

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1. **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].

2. Introduction

Some unicast protocols, such as OSPF and IS-IS, allow a single
network to be viewed as multiple topologies [RFC4915, RFC5120]. This
enables PIM to construct multicast distribution trees using separate
network paths even when the roots of the trees are the same.

This capability can be used to improve the resilience of multicast
applications. For instance, a multicast stream can be duplicated and
transported using different network layer addresses simultaneously.
Assuming that two source trees, (S1, G1) and (S1, G2), are used for
the stream. By using MT capable unicast routing protocols and
procedures described in this document, it is possible to construct
two source trees for (S1, G1) and (S1, G2) in such a way that they do
not share any transit network segment. As a result, a single network
failure will not cause any loss to the stream.

This draft introduces a new type of PIM Join Attribute used to encode
the identity of the topology PIM uses for RPF. It is based on
[RFC5384], and specifies additional procedures and rules to process
the attribute and resolve conflict.

3. Functional Overview

3.1. PIM RPF Topology

PIM RPF topology is a collection of routes used by PIM to perform RPF
operation when building shared or source trees. In the rest of the
document, PIM RPF topology may be simply referred to as "topology"
when there is no ambiguity.

In a multi-topology environment, multiple RPF topologies can be
created in the same network. A particular source may be reachable in
only one of the topologies, or in several of them via different
paths.

To select the RPF topology for a particular multicast distribution
tree, one or more of the following can be done.

  1. configure a policy that maps a group range to a topology. When
     RPF information needs to be resolved for the RP or the sources
     for a group within the range, the RPF lookup takes place in the
     specified topology. This can be used for PIM-SM/SSM/Bidir.

   2. configure a policy that maps a source prefix range to a
      topology. This can be used for PIM-SM and PIM-SSM.

   3. use the topology identified by the Join Attribute encoding in
      the received PIM packets.

   The details of the first two methods are implementation specific and
   are not discussed in this document. The specification to support the
   third method is included in this document.

3.2. PIM MT-ID

   For each PIM RPF topology created, a unique numerical ID is assigned.
   This ID is called PIM MT-ID. PIM MT-ID has the following property,

   - this value is not required to be the same as the MT-ID used by
     the unicast routing protocols that contribute routes to the
     topology. Although in practice, when only one unicast routing
     protocol (such as OSPF or IS-IS) is used, PIM MT-ID is typically
     assigned the same value as the IGP topology identifier.

   - this value must be unique and consistent within the network
     domain for the same topology

   - 0 is reserved as the default, and MUST NOT be included in the
     join attribute encoding.

   - how to assign a PIM MT-ID to a topology is decided by the network
     administrator and is outside the scope of this document

3.3. Applicability

   The PIM MT-ID join attribute described in this draft applies to PIM
   Join/Assert packets used by PIM SM/SSM/Bidir. It is not used in any
   other PIM packets, such as Prune, Register, Register-Stop, Graft,
   Graft-ack, DF Election, Candidate-RP, and Bootstrap. As such, it can
   only be used to build shared or source trees for PIM SM/SSM and PIM-
   bidir downstream.

   When this attribute is used in combination with RPF vectors defined
   in [ID.ietf-pim-rpf-vector] [ID.ietf-l3vpn-2547bis-mcast], they are
   processed against the topology identified by the PIM MT-ID attribute.

4. **Protocol Specification of PIM MT-ID**

4.1. **Sending PIM MT-ID Join Attribute**

   When a PIM router originates a PIM Join/Assert packet, it may choose
   to encode PIM MT-ID of the topology in which RPF lookup takes place
   for the corresponding (*,G) or (S,G) entry. The chosen PIM MT-ID MUST
   be the one decided by local topology selection configuration if it
   exists, or the one received from downstream routers after conflict
   resolution procedures are applied.

   The following are the exceptions,

     - a router MUST NOT attach the attribute if PIM MT-ID is 0. The
       value of 0 is ignored on reception.

     - a router SHOULD NOT do so if the upstream router, or one of the
       routers on the LAN does not include "PIM Join Attribute" option
       in its Hello packets.

     - a router SHOULD NOT encode PIM MT-ID for pruned sources. If
       encoded, the value is ignored.

4.2. **Receiving PIM MT-ID Join Attribute**

   When a PIM router receives a PIM MT-ID join attribute in a
   Join/Assert packet, it MUST perform the following,

     - validate the attribute encoding. The detail is described in the
       next section.

     - if the join attribute is valid, use the rules described in the
       section "Conflict Resolution" to determine a PIM MT-ID to use.

     - use the topology identified by the selected PIM MT-ID to perform
       RPF lookup for the (*,G)/(S,G) entry unless a different topology
       is specified by a local configuration. The local configuration
       always takes precedence.

4.3. Validating PIM MT-ID Join Attribute

An encoded PIM MT-ID join attribute is valid if all of the following
conditions are satisfied,

   - there is at most 1 PIM MT-ID attribute encoded.

   - the length field must be 2 and the value must not be 0.

If an encoded PIM MT-ID join attribute is deemed invalid, it is
ignored and not forwarded further. The packet is processed as if the
attribute were not present.

It is important to note that, if the sender is not a PIM neighbor
that has included "PIM Join Attribute" option in its Hello packets,
or if the "F" bit in the encoding is reset, the encoding may still be
considered valid by an implementation and is allowed to be forwarded.

4.4. Conflict Resolution

Depending on whether a PIM router is an upstream or a downstream
router, the action it takes to resolve conflicting PIM MT-ID
attributes differs. The detail is described below.

4.4.1. Upstream Routers

If an upstream router has a local configuration that specifies a
different topology than that from an incoming Join/Assert packet,
including the case PIM MT-ID is not encoded in the incoming packet,
it is not considered a conflict.

A conflict occurs when a router doesn't have local topology selection
policy and it has received different PIM MT-ID from Join packets sent
by its downstream routers or Assert packets from another forwarding
router on the LAN.

   - if an upstream router receives different PIM MT-ID attributes
     from PIM Join packets, it MUST follow the rules specified in
     [RFC5384] to select one. The PIM MT-ID chosen will be the one
     encoded for its upstream neighbor.

   - if an upstream router receives a different PIM MT-ID attribute in
     an ASSERT packet, it MUST use the tie-breaker rules as specified
     in [RFC4601] to determine an ASSERT winner. PIM MT-ID is not
     considered in deciding a winner from Assert process.

4.4.2. Downstream Routers

   A conflict is detected by a downstream router when it sees a
   different PIM MT-ID attribute from other routers on the LAN,
   regardless of whether the router has local topology selection policy
   or not.

     - if a downstream router sees different PIM MT-ID attributes from
       PIM Join packets, it MUST follow the specification of [RFC4601]
       as if the attribute did not exist. For example, the router
       suppresses its own Join packet if a Join for the same (S,G) is
       seen.

       The router MUST NOT use the rules specified in [RFC5384] to
       select a PIM MT-ID from Join packets sent by other downstream
       routers.

     - if a downstream router sees its preferred upstream router loses
       in the ASSERT process, and the ASSERT winner uses a different PIM
       MT-ID, the downstream router SHOULD still choose the ASSERT
       winner as the RPF neighbour but it MUST NOT encode PIM MT-ID when
       sending Join packets to it.

5. PIM MT-ID Join 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|E| Attr Type | Length        | Value                         |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

     - F bit: 1 Transitive Attribute.

     - E bit: As specified by [RFC5384]

     - Attr Type: 3.

     - Length: 2.

     - Value: PIM MT-ID, 1 to 65535.

6. IANA Considerations

   A new PIM Join Attribute type needs to be assigned. 3 is proposed for
   now.

7. Security Considerations

   As a type of PIM Join Attribute, the security considerations
   described in [RFC5384] apply here. Specifically, malicious alteration
   of PIM MT-ID may cause the resiliency goals to be violated.

8. Acknowledgments

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10. Normative References

[RFC2119] S. Bradner, "Key words for use in RFCs to Indicate
Requirement Levels", 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] A. Boers, I. Wijnands, E. Rosen, "The Protocol Independent
Multicast (PIM) Join Attribute Format", RFC 5384, November 2008

11. Informative References

[RFC4915] P. Psenak, S. Mirtorabi, A. Roy, L. Nguyen, P. Pillay-
Esnault, "Multi-Topology (MT) Routing in OSPF", RFC 4915, June 2007.

[RFC5120] T. Przygienda, N. Shen, N. Sheth, "M-ISIS: Multi Topology
(MT) Routing in Intermediate System to Intermediate Systems (IS-
ISs)", RFC 5120, February 2008.

[ID.ietf-pim-rpf-vector] I. Wijnands, A. Boers, E. Rosen, "The RPF
Vector TLV", draft-ietf-pim-rpf-vector.

[ID.ietf-l3vpn-2547bis-mcast] E. Rosen,R Aggarwal, "Multicast in
MPLS/BGP IP VPNs", draft-ietf-l3vpn-2547bis-mcast