            Internet Group Management Protocol Version 3 (IGMPv3) /
              Multicast Listener Discovery Version 2 (MLDv2) and
                    Multicast Routing Protocol Interaction

Status of This Memo

   This memo provides information for the Internet community. It does
   not specify an Internet standard of any kind. Distribution of this
   memo is unlimited.

Abstract

   The definitions of the Internet Group Management Protocol Version 3
   (IGMPv3) and Multicast Listener Discovery Version 2 (MLDv2) require
   new behavior within the multicast routing protocols. The additional
   source information contained in IGMPv3 and MLDv2 messages
   necessitates that multicast routing protocols manage and utilize the
   information. This document describes how multicast routing protocols
   will interact with these source-filtering group management protocols.

1. Introduction

   The definitions of IGMPv3 [IGMP3] and MLDv2 [MLDv2] require new
   behavior within the multicast routing protocols. The additional
   source information contained in IGMPv3 and MLDv2 messages
   necessitates that multicast routing protocols manage and utilize the
   information. This document will describe how multicast routing
   protocols will interpret information learned from these source-
   filtering group management protocols.

2. Multicast Forwarding State

   Existing multicast routing protocols utilize the group management
   database in determining if local members exist for a particular
   multicast group. With previous group management protocols, this
   database had one type of record indicating the group for which there
   was interest and the associated local interfaces.

In the case of IGMPv3 and MLDv2, these routing protocols may now
build multicast forwarding state based on the source filter
information available for each multicast group that has local
membership. This requires that the group management database have
four record types. Only one record may exist for a given interface
and a given multicast group.

    1. EXCLUDE <>
       The EXCLUDE <> record indicates interest in all sources
       destined to this group address for a set of local interfaces.
       It is equivalent to the single record type existing in previous
       versions of the group management protocols.

    2. INCLUDE <>
       The INCLUDE <> record indicates that there is no interest in
       any sources destined to this group address for a set of local
       interfaces.

    3. EXCLUDE <list>
       The EXCLUDE <list> record indicates that there is interest in
       all sources other than the specifically listed sources for a
       set of local interfaces.

    4. INCLUDE <list>
       The INCLUDE <list> record indicates that there is interest in
       only the specifically listed sources for a set of local
       interfaces.

The records in the group management database should be utilized when
generating forwarding state for a multicast group. If the source
address in the multicast packet exists in the database for the
specified multicast group and is in an INCLUDE list or is not listed
in an EXCLUDE list, the multicast routing protocol should add the
interface to the list of downstream interfaces; otherwise, it should
not be added based on local group membership.

3. DVMRP Interaction

The Distance Vector Multicast Routing Protocol (DVMRP) [DVMRP] does
not incorporate any knowledge of the multicast group's senders.
Therefore, DVMRP will act only on the multicast group address
contained in an IGMPv3 or MLDv2 report.

Future standardized versions of DVMRP may incorporate pruning and
grafting messages similar to PIM-DM (discussed in Section 5). The
rules defined in Section 5 can be applied in this situation.

4. MOSPF Interaction

   In Multicast Extensions to OSPF (MOSPF) [MOSPF], the consideration of
   source filter information in the group management database is limited
   to the building of forwarding state (discussed above). This is due
   to the flooding of group-membership-LSAs within MOSPF.

5. PIM-DM Interaction

   The PIM-DM protocol [PIMDM] interaction with a source-filtering group
   management protocol is important in two areas: multicast distribution
   tree pruning and multicast distribution tree grafting. The following
   sections will describe the behavior needed in PIM-DM to interoperate
   with IGMPv3 and MLDv2.

5.1. PIM-DM Prunes

   PIM-DM prune messages are initiated when a PIM-DM router determines
   that there are no entities interested in the data flowing on the
   (S,G) forwarding state. If the multicast router is running IGMPv3 or
   MLDv2, this is determined by the source S being in EXCLUDE state in
   the source filter for the destination G, or all interest in G being
   terminated for an existing (S,G) forwarding entry.

5.2. PIM-DM Grafts

   PIM-DM graft messages are sent in order to override an existing PIM-
   DM prune. In the case of IGMPv3 or MLDv2, this occurs when prune
   state exists for (S,G) and a state change occurs in which the source
   filter state for S changes to INCLUDE for the specified G.

6. PIM-SM Interaction

   A PIM-SM interaction takes place when a PM-SM [PIMSM] router receives
   an IGMP or MLD message regarding a group address that is in the Any
   Source Multicast (ASM) range. This range is defined as the entire
   multicast address space excluding the global SSM range [SSM] and any
   locally defined Source Specific space.

6.1. PIM-SM Joins (ASM Behavior)

   PIM-SM join messages are initiated when a PIM-SM router determines
   that there are entities interested in a specific group or a specific
   source sending to the group. If this is due to an IGMPv3 or MLDv2
   report with a zero-length EXCLUDE list, then the join is sent as a
   (*,G) join towards the RP.

   If the join is triggered by an IGMPv3 or MLDv2 state change that
   affects source information, the PIM-SM join is sent as a (S,G) join
   towards the specific source. This behavior optimizes the join
   process, as well as facilitates the adoption of the SSM model. The
   generation of this (S,G) join can cause failures in architectures
   where leaf routers do not have global reachability, and thus, can be
   overridden by local policy. If this is the case, then all triggered
   joins are sent towards the RP as (*,G) joins. The router sending the
   (*,G) join is responsible for filtering the data as per the IGMPv3
   database before forwarding.

6.2. PIM-SM Prunes (ASM Behavior)

   PIM-SM prune messages are initiated when a PIM-SM router determines
   that there are no entities interested in a specific group, or a
   specific source sending to the group. If this is triggered by either
   receiving a report with an EXCLUDE or if a specific Source/Group
   times out, then an (S,G) prune is sent towards the upstream router.
   If all of the IGMPv3 or MLDv2 derived requests for a group time out,
   then (S,G) and (*,G) prunes are sent upstream as needed to stop all
   flow of traffic for that group.

7. PIM-SSM Interaction

   A PIM-SSM interaction takes place when a PIM-SM router receives an
   IGMPv3 or MLDv2 message regarding a group address that is in the
   Source Specific Multicast range. This behavior is not defined in
   this document, but rather in [PIMSM].

8. Security Considerations

   This document does not introduce any additional security issues above
   and beyond those already discussed in [PIMDM], [PIMSM], [IGMP3], and
   [MLDv2].

9. Acknowledgements

   The authors would like to thank Murali Brahmadesam, Leonard Giuliano,
   and Hal Sandick for their feedback and suggestions.

10. Normative References

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Authors' Addresses

   Brian Haberman
   The Johns Hopkins University Applied Physics Laboratory
   11100 Johns Hopkins Road
   Laurel, MD 20723-6099
   US

   Phone: +1 443 778 1319
   EMail: brian@innovationslab.net

   Jim Martin
   Woven Systems
   2455 Augustine Drive, Suite 211
   Santa Clara, CA 95054
   US

   Phone: +1 408 654-8143
   EMail: jim@wovensystems.com

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