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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

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10. Normative References

- [IGMP3] Cain, B., Deering, S., Kouvelas, I., Fenner, B., and A. Thyagarajan, "Internet Group Management Protocol, Version 3", RFC 3376, October 2002.
- [MLDv2] Vida, R., Ed., and L. Costa, Ed., "Multicast Listener Discovery Version 2 (MLDv2) for IPv6", RFC 3810, June 2004.
- [DVMRP] Waitzman, D., Partridge, C., and S. Deering, "Distance Vector Multicast Routing Protocol", RFC 1075, November 1988.
- [MOSPF] Moy, J., "Multicast Extensions to OSPF", RFC 1584, March 1994.
- [PIMDM] Adams, A., Nicholas, J., and W. Siadak, "Protocol Independent Multicast - Dense Mode (PIM-DM): Protocol Specification (Revised)", RFC 3973, January 2005.
- [PIMSM] Fenner, B., Handley, M., Holbrook, H., and I. Kouvelas, "Protocol Independent Multicast - Sparse Mode (PIM-SM): Protocol Specification (Revised)", RFC 4601, August 2006.
- [SSM] Holbrook, H. and B. Cain, "Source-Specific Multicast for IP", RFC 4607, August 2006.

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