IGMP and MLD protocols are extensible, but no extensions have been defined so far. This document provides a well-defined way of extending IGMP and MLD, including a new extension type to distinguish between different extensions. This document also defines an extension for use with IGMP and MLD over BIER, that allows for identifying the sender. This will in turn enable MLD (resp. IGMP) to be used in the BIER multicast flow overlay.
1. Introduction

In this document, we describe a generic method to extend IGMPv3 [RFC3376] and MLDv2 [RFC3810] messages to accommodate information other than what is contained in the current message formats. This is done by introducing an extension-type field in the message formats to indicate the application for which the extension is done. This will be followed by the actual value of the extension.

Bit Index Explicit Replication (BIER [RFC8279]) defines a new architecture for optimal forwarding of multicast packets through a multicast domain without requiring a protocol for explicitly building multicast distribution trees while obviating the need for intermediate nodes to maintain any per-flow state. Forwarding in the BIER network is accomplished by having ingress routers construct a bit mask indicating the set of egress routers in the BIER domain interested in receiving the packet.

New technologies (such as BIER) can use MLD (resp. IGMP) as an overlay protocol, in order to collect the ingress and egress nodes for multicast flows in a multicast domain (such as a BIER domain) [I-D.ietf-bier-mld]. That draft makes use of an extension to IGMP/MLD, defined in this document, to have additional info identifying the BIER sender of the message. This allows the IGMP/MLD overlay to know exactly who is interested in receiving flows. It can potentially also be used for other purposes such as logging to

...
2. Conventions used in this document

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [RFC2119] when, and only when, they appear in all capitals, as shown here.

3. Proposed MLD/IGMP Extension

The proposed MLD (resp. IGMP) extension for BIER will contain the same information as the PTA tunnel identifier in [RFC8556] and is shown in Figure 1. Note that, as defined in the MLD (resp. IGMP), existing implementations are supposed to ignore this additional data.

```
0                   1                   2                   3
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|Extension Type | Sub-domain ID |         BFR-ID                |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                   BFR-Prefix                                  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                   BFR-Prefix                                  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                   BFR-Prefix                                  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 1: MLD/IGMP Extension Data for BIER

- Extension Type: The first octet will introduce an IGMP/MLD extension type for BIER. This would mean that if we need to extend MLD (resp. IGMP) messages for other purposes, the type can tell us what the extension represents. What follows is the information needed for BIER overlay. For BIER the value here will be as assigned by IANA.

- Sub-domain-id: The second field is a single octet, containing a BIER sub-domain-id (see [[RFC8279]]). This indicates the BIER sub-domain of the router originating the message.
- BFR-id: The next field is a two-octet field containing the BFR-id, in the specified sub-domain, of the router originating the message.

- BFR-prefix: The last field is the BFR-prefix (see [[RFC8279]]) of the router that is originating the message. The BFR-prefix will either be a /32 IPv4 address or a /128 IPv6 address.

### 3.1. Multicast Listener Query Extension

The MLD query format with the proposed extension is shown below:

```
                  0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-----------------------------------------------+
| Type = 130 |      Code     |           Checksum            |
+-----------------------------------------------+
| Maximum Response Code |           Reserved            |
+-----------------------------------------------+
|                                                               |
*                                                               *
|                                                               *
|                                                               *
|                                                               *
|                                                               *
|                                                               *
|                                                               *
|                                                               *
|                                                               *
|                                                               *
*                       Multicast Address                       *
|                                                               *
|                                                               *
|                                                               *
+-----------------------------------------------+
| Resv  |S| QRV |     QQIC      |     Number of Sources (N)     |
+-----------------------------------------------+
|                                                               *
|                                                               *
|                                                               *
|                                                                Source Address [1] *
|                                                               *
|                                                               *
|                                                                ++
|                                                               *
|                                                               *
|                                                               *
|                                                                Source Address [2] *
|                                                               *
|                                                               *
|                                                                .
|                                                                .
```

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3.2. Version 2 Multicast Listener Report Extension

The MLD report format with the proposed extension is shown below.
3.3. IGMP Membership Query Extension

The IGMP query format with the proposed extension is shown below.
3.4. IGMP Version 3 Membership Report Extension

The IGMP report format with the proposed extension is shown below.
4. Security Considerations

This document extends MLD (resp. IGMP) message formats for a BIER overlay. As such, there is no impact on security or changes to the considerations in [RFC3810] and [RFC3376].

5. IANA Considerations

This document requests that IANA assign a new registry entry for the MLD (resp. IGMP) extension-types.
6. References

6.1. Normative References


6.2. Informative References


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