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1 Configuring MLD

1.1 Introduction

The Multicast Listener Discovery (MLD) protocol manages IPv6 multicast members.

MLD defines how to establish and maintain membership between multicast devices and member hosts in an IPv6 network, to decide a forwarding path of multicast streams. Figure 1-1 shows the topology of MLD in an IPv6 multicast network.

Figure 1-1   Topology of MLD in a Multicast Network

PIM (IPv6) network

O Interface with the MLD function enabled

There are two versions of MLD: MLDv1 is based on version 2 of the Internet Group Management Protocol (IGMP) and MLDv2 is based on version 3 of IGMP. A later MLD version is backward-compatible with an earlier MLD version. MLDv1 completes IPv6 member management based on the query and report mechanism. MLDv2 supports member hosts to decide whether to receive packets from a specified multicast source on the basis of MLDv1.

- MLD of both versions supports the Any-Source Multicast (ASM) model.
- MLDv2 can be directly applied to the Source-Specific Multicast (SSM) model.
- MLDv1 can be applied to the SSM model only when MLD SSM mapping is configured.

1.1.2 Working Principles of MLDv1

The querier election mechanism, general group query and report mechanism, join mechanism, and leave mechanism are defined in MLDv1.

1.   **Types of MLDv1 Packets**

MLDv1 supports the following four types of packets:

● General group query packet: A querier sends general group query packets to all multicast devices and hosts in the same network segment to understand groups with members.

● Group-specific query packet: A querier sends query packets to specified multicast groups in the same network segment to understand whether these groups contain members.

● Report packet: A host sends report packets to the querier to respond to the query packets or join a group.

● Leave packet: A host sends leave packets to the querier when the host leaves a group, notifying the querier that it leaves the specified group.

2.   **Working Mechanisms of MLDv1**

● Querier election

If multiple multicast devices exist in a network segment, only one multicast device needs to send query packets as a querier. This avoids redundancy. When the querier in the network segment fails, other devices in the same network segment need to take the role and process MLD protocol packets. During querier election, interface addresses of the devices are compared. The device with a smallest IP address is elected as the querier, as shown in Figure 1-2.

a   Device A and Device B consider themselves as the querier and send query packets to the local network segment.

b   They compare the source IPv6 address in the received packets with the address of their interfaces. The address of Device A is smaller. Therefore, Device A acts as the querier to periodically send query packets.

c   Device B fails in the election and starts a query keepalive timer. When the timer expires, Device B considers that the querier fails and starts to send query packets to initiate a new round of querier election.

Figure 1-2   Querier Election Diagram

Device A query packet

Device B query packet

Device A acting as the
querier and sending
query packets

- General group query and report

  The MLD querier periodically sends general group query packets to all hosts and multicast devices in the local network segment, and understands and maintains group membership based on the report packets replied by the member hosts. Figure 1-3 shows the general group query and report procedure.

  a   The MLD querier Device A periodically sends general group query packets to the destination address FF02::1.

  a   Upon receiving the general group query packets, Host A and Host B in the multicast group G start respective timers Timer-G-A and Timer-G-B.

  b   The host whose timer expires first sends report packets destined for the multicast group G.

       If the timer Timer-G-A of Host A expires first, Host A sends report packets to the multicast group G. Upon receiving the report packets, Host B stops its timer and sends report packets in the network segment.

  c   Upon receiving the report packets destined for the multicast group G from Host A, the MLD querier knows that there is member in the multicast group G. The multicast routing protocol generates an (*, G) entry. Upon receiving multicast data destined for the multicast group G, the MLD querier forwards the multicast data in the network segment.

Figure 1-3   General Group Query and Report Diagram

Host A   Device A MLD   Host B
(G)   querier

Time line

General group query
packet
Group G report
packet

General group query
packet
Group G report
packet

Group G multicast
data

Group G multicast
data
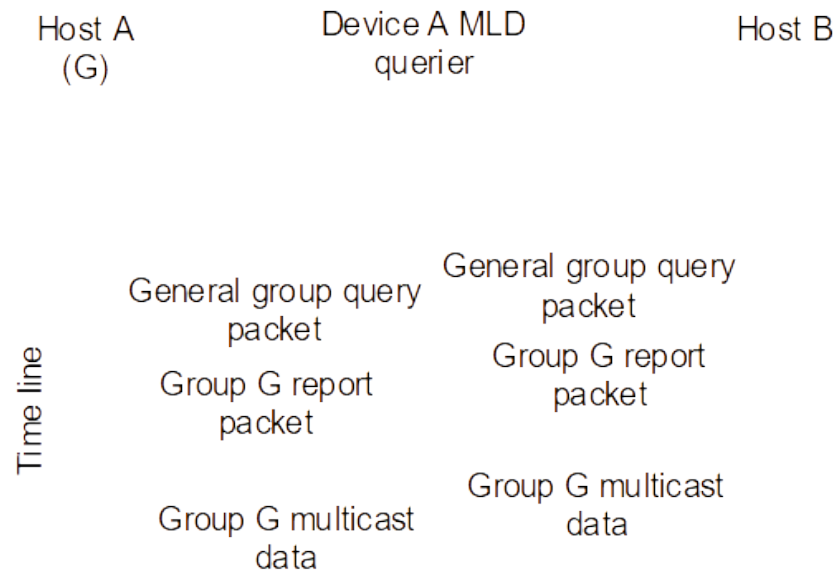
● Member join

When a host tries to join a multicast group, it takes some time for the host to join the group if the host waits for a general group query packet from the querier and replies a report packet. If the host can proactively send a report packet to the MLD querier, the querier can immediately generate a multicast forwarding entry upon receiving the packet. If multicast devices in the group receive multicast data, the new host can quickly get multicast service. Figure 1-4 shows the new member join procedure.

a   Before receiving a general group query packet from Device A, Host A proactively sends a report packet destined for the multicast group G, to notify that Host A joins the multicast group G.

a   Upon receiving the report packet, the MLD querier Device A knows that there is a member in the multicast group G in the current network segment. The multicast routing protocol generates an (*, G) entry. Upon receiving multicast data destined for the multicast group G, the MLD querier forwards the multicast data in the network segment.
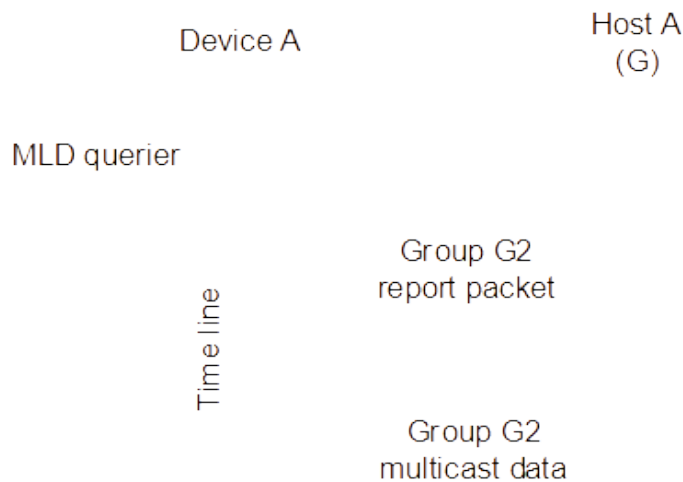
Figure 1-4   Member Join Diagram

Device A   Host A
                                              (G)

MLD querier

                          Group G2
                        report packet

Time line

                          Group G2
                        multicast data

- Member leave

  Upon receiving a leave packet from a member to plan to leave the multicast group G, the MLD querier sends a group-specific query packet to understand whether there is any other member existing in the group in the network segment. If not, the MLD querier deletes the corresponding membership to reduce redundant multicast traffic in the network and save bandwidth. Figure 1-5 shows the member leave procedure.

  a   Host A sends a leave packet destined for all multicast devices in the local network segment to leave the multicast group G.

  a   Upon receiving the leave packet, the MLD querier Device A sends a group-specific query packet destined for the multicast group G.

  b   If there is any other member (for example, Host B) in the multicast group G, Host B sends a report packet for the multicast group G upon receiving the query packet. The MLD querier continues to maintain the membership of the multicast group G upon receiving the report packet. The (*, G) entry remains existent. Upon receiving multicast data destined for the multicast group G, the MLD querier forwards the multicast data in the network segment.

  c   If there is no other member in the multicast group G, the querier receives no report packet for the multicast group G. After the timer expires, the (*, G) entry is deleted. Upon receiving multicast data destined for the multicast group G, the MLD querier does not forward the multicast data in the network segment.
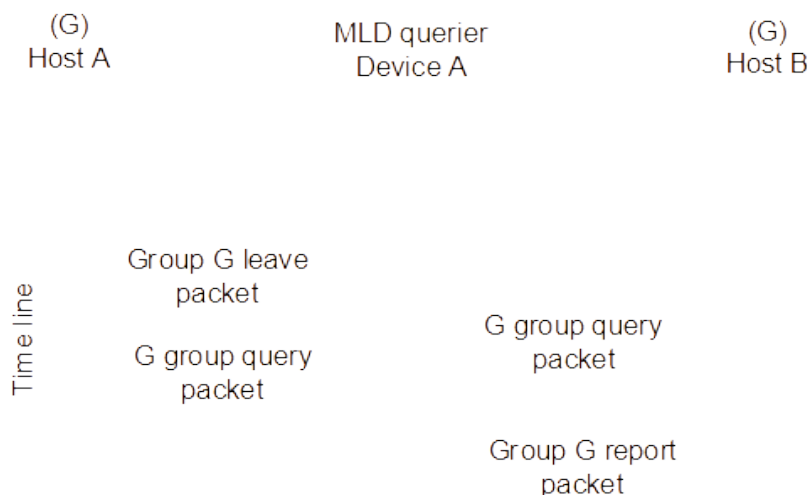
Figure 1-5 Member Leave Diagram

(G)
Host A

MLD querier
Device A

(G)
Host B

Time line

Group G leave
packet

G group query
packet

G group query
packet

Group G report
packet

1.1.3 Working Principles of MLDv2

1. Changes of MLDv2 from MLDv1

- In MLDv2, when you add a host to a group, you can specify the host to receive multicast data from specified sources. In MLDv1, you cannot specify sources for a host.

- In MLDv1, an MLDv1 packet can carry information of only one multicast group. In MLDv2, an MLDv2 packet can carry information of multiple multicast groups. This relieves the interaction problem of a great number of packets between hosts and the querier.

2. Types of MLDV2 Packets

- Query packets include general group query packet, group-specific query packet, and source-specific query packet (check whether members in a group receive multicast data from the specific source).

- Member report packets include multicast group and multicast source information. A source can be filtered in INCLUDE or EXCLUDE mode. (G, INCLUDE, (S1, S2...)) means to receive multicast data sent only from specified sources S1, S2, ... to the group G. (G, EXCLUDE, (S1, S2...)) means to reject multicast data sent from specified sources S1, S2, ... to the group G.

3. Working Mechanisms of MLDv2

Compared with MLDv1, MLDv2 supports you to select sources for a host to receive multicast data when you add the host.

- Specify sources to receive multicast data: You can specify sources for the host to receive multicast data when you add the host to a multicast group.

- Query a specified source: Upon receiving a report packet to modify the correspondence between multicast sources and groups from members, the MLD querier sends a specified source query packet. If you expect a member to receive multicast data from a specified source, configure a report packet. The MLD querier updates the source list of this group based on the report.

1.1.4 MLD SSM Mapping

In the source-specific multicast (SSM) model, a host must run MLDv2 if you want to specify source addresses for the host. If a host supports only MLDv1, a multicast source cannot be specified for the host. To enable a host that supports only MLDv1 to use the SSM service, you can enable the MLD SSM mapping function on the multicast device.

Based on the MLD SSM mapping mechanism, static SSM address mapping rules can be configured on the multicast device to convert the (*, G) information in MLDv1 report packets to (S, G) information so that the SSM service can be used by the host that supports only MLDv1.

In the SSM network shown in Figure 1-1, the MLD multicast device runs MLDv2, Host A supports only MLDv1, and Host B supports MLDv2. The MLD SSM mapping function can be enabled on the MLD querier to provide SSM service for Host A.

In this network, when the device receives an MLDv1 report packet from Host A, the device checks the address of the IPv6 multicast group G in the packet.

- If the multicast group G is not in the IPv6 SSM group address range, the ASM service is provided.

- If the multicast group G is in the IPv6 SSM group address range, whether the ASM service can be provided depends on the following situation:

  o If no MLD SSM mapping rule is configured on the device for the multicast group G, the SSM service cannot be provided and the packet is discarded.

  o If an MLD SSM mapping rule is configured on the device for the multicast group G, the (*, G) information in the MLDv1 report packet is mapped to (G, INCLUDE, (S1, S2)) and the SSM multicast service is provided.

Figure 1-1   Topology of MLD SSM Mapping

SSM (IPv6)
network

Device MLD
querier

1.1.5 MLD Proxy

In some user scenarios, if you do not want devices connected to hosts to run complete multicast routing protocols, you can enable the MLD proxy function.

On the user side, the MLD proxy acts as a querier and periodically queries user information. On the route side, the MLD proxy acts a host and sends user information to a network when necessary. In this way, L2 multicast

flooding is suppressed, user information is more effectively obtained and controlled, and the protocol packets and network load are reduced to some extent.

Two types of MLD proxy interfaces are defined to facilitate understanding:

● MLD proxy service interface: This interface is responsible for behaviors of hosts. It receives query packets from uplink devices, replies report packets based on current group membership, and sends report or leave packets when the membership changes.

● MLD MRoute proxy interface: This interface is responsible for behaviors of the querier. It sends query packets, collects host information, and maintains membership.

Figure 1-1　Topology of MLD Proxy

PIM (IPv6) network

1.1.6　Protocols and Standards

● RFC2710: Multicast Listener Discovery (MLDv1) for IPv6
● RFC3810: Multicast Listener Discovery Version 2 (MLDv2) for IPv6

1.2　Restrictions and Guidelines

● In an IPv6 network, all L3 devices must run the IPv6 PIM protocol before multicast forwarding entries can be established normally.

● Device interfaces must run MLDv2 before hosts supporting either MLD version can use the SSM service.

● A member host can be a PC or a set top box (STB), and it can normally receive multicast data by the multicast client software.

1.3　Configuration Task Summary

MLD configuration includes the following tasks:

(1) [Configuring Basic Functions of MLD](#)

(2) (Optional) [Configuring an MLD Version](#)

(3) [Enabling Security Control for MLD Multicast](#). All the configuration tasks below are optional. Select the configuration tasks as required.

- ○ [Enabling Access Control for Multicast Groups](#)

- ○ [Configuring the Maximum Number of Group Members](#)

(4) [Configuring MLD Querier Parameters](#). All the configuration tasks below are optional. Select the configuration tasks as required.

- ○ [Configuring the Last Member Query Interval](#)

- ○ [Configuring the Last Member Query Times](#)

- ○ [Configuring the General Group Query Interval](#)

- ○ [Configuring the Maximum Response Time of Query Packets](#)

- ○ [Configuring the Other Querier Keepalive Time](#)

- ○ [Configuring the Robustness Variable of the MLD Querier](#)

(5) (Optional) [Configuring Static MLD Groups](#)

(6) (Optional) [Configuring a Device Interface as a Simulated Host to Join a Group](#)

(7) (Optional) [Enabling the MLD Proxy Function](#)

(8) (Optional) [Enabling the SSM Mapping Function](#)

1.4 Prerequisites

An IPv6 unicast routing protocol is configured to ensure that device nodes are reachable through IPv6 unicast routes.

1.5 Configuring Basic Functions of MLD

1.5.1 Overview

The multicast routing function is enabled on the local network and group information on the local network is collected so that member hosts can join multicast groups to receive multicast data packets.

1.5.2 Restrictions and Guidelines

- The IPv6 multicast routing function should be enabled on each multicast device on the local network unless otherwise specified.

- The PIM-SMv6 function should be enabled on an L3 interface directly connected to the local network unless otherwise specified.

1.5.3 Prerequisites

All PIM interfaces should be reachable through IPv6 unicast routes.

1.5.4 Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Enable the IPv6 multicast routing function.

ipv6 multicast-routing

The IPv6 multicast routing function is disabled by default.

(4) Enter the interface configuration mode.

interface *interface-type interface-number*

PIM interfaces must be L3 interfaces, including routing, L3AP, SVI, and loopback interfaces.

(5) Enable the PIM-SMv6 function.

ipv6 pim sparse-mode

The PIM-SMv6 function on an interface is disabled by default.

1.6 Configuring an MLD Version

1.6.1 Overview

At present, there are two versions of MLD. Multicast devices running MLDv2 can identify MLDv1 packets. Multicast devices running MLDv1 cannot identify MLDv2 packets.

1.6.2 Restrictions and Guidelines

- After an MLD version is configured, MLD automatically restarts.

- The MLD version on a multicast device must be later than or equal to the MLD version on a host.

- It is recommended that an MLD version be configured on all multicast device interfaces directly connected to the local network unless otherwise specified.

1.6.3 Prerequisites

Configuring Basic Functions of MLD.

1.6.4 Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Enter the interface configuration mode.

interface *interface-type interface-number*

(4) Configure an MLD version.

ipv6 mld version { **1** | **2** }

MLDv2 is running on an interface by default.

1.7 Enabling Security Control for MLD Multicast

1.7.1 Overview

● To prevent a host from joining an IPv6 multicast group, you can enable the function of filtering the MLD group on the interface directly connected to a network segment.

● To prevent a great number of hosts from joining an IPv6 multicast group and affecting interface performance of devices, you can configure the maximum number of members on the interface directly connected to a network segment.

● To prevent a great number of hosts from joining an IPv6 multicast group and affecting the overall performance of devices, you can configure the maximum number of members on the devices.

1.7.2 Configuration Tasks

All the configuration tasks below are optional. Select the configuration tasks as required.

● Enabling Access Control for Multicast Groups

● Configuring the Maximum Number of Group Members

1.7.3 Prerequisites

Configuring Basic Functions of MLD.

1.7.4 Enabling Access Control for Multicast Groups

1. **Overview**

After enabling access control for multicast groups on an interface, you can control hosts from joining groups in the directly connected network segment. ACLs are used to limit the group address range. Report packets denied by the ACLs are discarded.

When MLDv2 is enabled, this command supports extended ACLs to precisely filter source record information in MLDv2 packets. If the received MLD report packets follow the format of (S1, S2, S3, ..., Sn, G), the corresponding ACL must be configured for filtering. S1, S2, S3, ..., Sn correspond to source addresses in ACL entries, and G corresponds to the destination address in the ACL entries.

2. **Restrictions and Guidelines**

It is recommended that access control be enabled on all multicast device interfaces directly connected to the local network unless otherwise specified.

3. **Prerequisites**

Before a multicast group address range is configured, ensure that the corresponding ACL is created and a multicast group range is specified. For details about ACL configuration, see *Configuring ACL*.

4. **Procedure**

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Enter the interface configuration mode.

interface *interface-type interface-number*

PIM interfaces must be L3 interfaces, including routing, L3AP, SVI, and loopback interfaces.

(4) Enable access control for multicast groups.

ipv6 mld access-group *acl-name*

An interface allows hosts to join any group by default.

1.7.5 Configuring the Maximum Number of Group Members

1. Overview

To prevent a great number of hosts from joining an IPv6 multicast group, you can limit the number of members.

- In the global configuration mode, the number of members in an MLD group on a device is limited.

- In the interface configuration mode, the number of members in an MLD group on an interface is limited.

If the number of group members exceeds the interface limit or global limit, subsequent report packets are ignored.

If an exceptional list is configured, report packets in a specified range can be normally processed, and the records about these group members are not counted.

Interface and global limits can be configured separately. If the global limit is smaller than the interface limit, the global limit prevails.

2. Restrictions and Guidelines

It is recommended that the maximum number of group members be configured on all multicast device interfaces directly connected to the local network unless otherwise specified.

It is recommended that the maximum number of group members be configured on multicast devices directly connected to the local network unless otherwise specified.

3. Prerequisites

- Before an exceptional list is configured, ensure that the corresponding ACL is created and an exceptional multicast group range is specified. For details about ACL configuration, see *Configuring ACL*.

4. Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Configure the maximum number of MLD group members. Select one of the following to configure.

   ○ Configure the maximum number of MLD group members on a device.

   ipv6 mld limit *limit* [**except** *acl-name*]

   ○ Configure the maximum number of MLD group members on an interface.

interface *interface-type interface-number*

ipv6 mld limit *limit* [**except** *acl-name*]

By default, the maximum number of MLD group members on a device is **64000**, and that on an interface is **4000**.

1.8 Configuring MLD Querier Parameters

1.8.1 Overview

MLD maintains IPv6 membership by query packets and report packets. If multiple multicast devices exist in a network segment, only one multicast device needs to send query packets as a querier. IP addresses of multicast devices are compared. The device with the smallest address is elected as the querier. The querier periodically sends query packets to obtain local member information and ensure that a group has at least one host. If no host is available in a group, the group is deleted by the device.

The MLD querier work can be adjusted using multiple parameters. When the default parameter values are used, the querier can normally work. Network optimization can be implemented by adjusting querier parameter values to avoid excessive protocol packets and network congestion. Also, membership can be updated and maintained in time.

1.8.2 Restrictions and Guidelines

- It is recommended that querier parameters be configured on all multicast device interfaces directly connected to the local network unless otherwise specified.

- In actual network deployment, to accurately, timely, and stably maintain group membership and avoid non-queriers from initiating a new round of election, ensure that the following durations are arranged in ascending order: Maximum response time of general group query packet < Sending interval of general group query packet < Other querier keepalive time.

1.8.3 Prerequisites

Configuring Basic Functions of MLD.

1.8.4 Configuration Tasks

All the configuration tasks below are optional. Select the configuration tasks as required.

- Configuring the Last Member Query Interval
- Configuring the Last Member Query Times
- Configuring the General Group Query Interval
- Configuring the Maximum Response Time of Query Packets
- Configuring the Robustness Variable of the MLD Querier
- Configuring the Other Querier Keepalive Time

1.8.5 Configuring the Last Member Query Interval

1. Overview

Before a host leaves a multicast group, the host sends a leave packet. Upon receiving the leave packet, the querier continuously sends group-specific/source-specific query packets and waits for responses from hosts. This parameter specifies the query packet sending interval.

2. Restrictions and Guidelines

- It is recommended that this parameter be configured on all multicast device interfaces directly connected to the local network unless otherwise specified.

- The unit of the last member query interval is 0.1 seconds. If the parameter value is 10, the actual sending interval is 1 second.

3. Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Enter the interface configuration mode.

interface *interface-type interface-number*

(4) Configure the last member query interval.

ipv6 mld last-member-query-interval *interval*

The group-specific query packet sending interval is **1** second by default.

1.8.6 Configuring the Last Member Query Times

1. Overview

Before a host leaves a multicast group, the host sends a leave packet. Upon receiving the leave packet, the querier continuously sends specific group/source query packets and waits for responses from the host. This parameter specifies the query packet sending times.

2. Restrictions and Guidelines

It is recommended that this parameter be configured on all multicast device interfaces directly connected to the local network unless otherwise specified.

3. Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Enter the interface configuration mode.

interface *interface-type interface-number*

(4) Configure the last member query times.

ipv6 mld last-member-query-count *count*

The group-specific query packet sending times is **2** by default.

1.8.7 Configuring the General Group Query Interval

1. Overview

The MLD querier periodically sends query packets to all hosts and multicast devices on the shared network. This parameter specifies the interval for sending query packets.

2. Restrictions and Guidelines

It is recommended that this parameter be configured on all multicast device interfaces directly connected to the local network unless otherwise specified.

3. Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Enter the interface configuration mode.

interface *interface-type interface-number*

(4) Configure the general group query interval.

ipv6 mld query-interval *interval*

The default interval for sending general group query packets is **125** seconds.

1.8.8 Configuring the Maximum Response Time of Query Packets

1. Overview

After the MLD querier sends query packets, member hosts reply upon receiving the query packets before the maximum response time expires. If no response is received after timeout, it is considered that no member exists in the group of the directly connected network segment and the group information is deleted.

2. Restrictions and Guidelines

It is recommended that this parameter be configured on all multicast device interfaces directly connected to the local network unless otherwise specified.

3. Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Enter the interface configuration mode.

interface *interface-type interface-number*

(4) Configure the maximum response time of query packets.

ipv6 mld query-max-response-time *max-response-time*

The maximum response time of query packets is **10** seconds by default.

1.8.9 Configuring the Other Querier Keepalive Time

1.   Overview

When a non-querier does not receive a query packet in the same network segment within a specified period, the non-querier considers there is only querier (itself) in the directly connected network segment and initiates a new round of querier election. This parameter specifies the timeout time for the non-queriers to wait for query packets.

2.   Restrictions and Guidelines

It is recommended that this parameter be configured on all interfaces where MLD is enabled on the local network unless otherwise specified.

3.   Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Enter the interface configuration mode.

interface *interface-type interface-number*

(4) Configure the other querier keepalive time.

ipv6 mld querier-timeout *timeout*

The keepalive time of other querier is **255** seconds by default.

1.8.10 Configuring the Robustness Variable of the MLD Querier

1.   Overview

When the query packets sent by the querier are lost due to network instability, the query packets are retransmitted. The retransmission times are referred to as the robustness variable of the MLD querier.

In the event of packet loss, query packet retransmission occurs in either of the following situations:

● When the querier is started, it sends general group query packets.

● Upon receiving leave packets, the querier sends group-specific/source-specific query packets to check whether there are members existing in the specific multicast group.

2.   Restrictions and Guidelines

It is recommended that this parameter be configured on all interfaces where MLD is enabled on the local network unless otherwise specified.

3.   Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Enter the interface configuration mode.

interface *interface-type interface-number*

(4) Configure the robustness variable of the MLD querier.

ipv6 mld robustness-variable *robustness*

The robustness variable of the MLD querier is **2** by default.

1.9   Configuring Static MLD Groups

1.9.1 Overview

In some application scenarios, a static multicast group may need to be configured on the interfaces connected to group members in the following cases:

1. The group members are stable and multicast data needs to be quickly and stably forwarded to member interfaces.

2. The group members cannot send report packets but need to receive certain multicast data. After the static multicast group is configured, the multicast devices consider that group members exist on these interfaces and forward multicast data to these interfaces.

1.9.2 Restrictions and Guidelines

A static multicast group must be manually configured on an interface connected to group members.

1.9.3 Prerequisites

Configuring Basic Functions of MLD.

1.9.4 Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Enter the interface configuration mode.

interface *interface-type interface-number*

(4) Configure a static MLD group.

ipv6 mld static-group *ipv6-group-address*

No interface is added to any static multicast group by default.

1.10 Configuring a Device Interface as a Simulated Host to Join a Group

1.10.1 Overview

In some test scenarios, no host is available or can be added to a multicast group. In this case, you need to configure device interfaces to simulate hosts and add the hosts to a specific multicast group.

1.10.2 Restrictions and Guidelines

- Only L3 interfaces can be configured as hosts.
- An interface can be added to multiple groups at the same time.

1.10.3 Prerequisites

The PIM protocol must be configured and the IPv6 multicast routing function must be enabled on the interfaces to be configured as hosts.

1.10.4 Procedure

(1) Enter the privileged EXEC mode.

   enable

(2) Enter the global configuration mode.

   configure terminal

(3) Enter the interface configuration mode.

   interface *interface-type interface-number*

(4) Configure a device interface as a host to join a group.

   ipv6 mld join-group *ipv6-group-address*

   No interface is added to any multicast group by default.

1.11 Enabling the MLD Proxy Function

1.11.1 Overview

The MLD router proxy function collects local member information. For a host, the MLD proxy functions as a router and sends query packets.

For the querier, the MLD proxy functions as a host and sends report packets.

1.11.2 Restrictions and Guidelines

- The MLD proxy service interface is configured on the interface of routers directly connected to the upstream devices unless otherwise specified.
- The MRoute proxy interface is configured on the interface of hosts directly connected to the downstream devices unless otherwise specified.
- A maximum of 32 proxy service interfaces can be configured on a device. After receiving MLD query packets, the proxy service interface sends report packets based on the MLD group member records.

1.11.3 Prerequisites

[Configuring Basic Functions of MLD.](#)

1.11.4 Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Enter the interface configuration mode.

interface *interface-type interface-number*

(4) Enable the MLD proxy service function.

ipv6 mld proxy-service

The MLD proxy service function is disabled by default.

(5) Enable the MLD MRoute proxy function.

ipv6 mld mroute-proxy *interface-type interface-number*

The MRoute proxy function is disabled by default.

1.12 Enabling the SSM Mapping Function

1.12.1 Overview

MLDv2 supports source filtering while MLDv1 does not. However, the multicast devices provide the SSM mapping function to implement source filtering and enable MLDv1 hosts to use the SSM service. Multicast device interfaces run MLDv2. When receiving MLDv1 report packets, a multicast device adds the static mapping source address.

1.12.2 Restrictions and Guidelines

The SSM service must be enabled and the SSM group address range must be consistent on all multicast devices.

1.12.3 Prerequisites

● [Configuring Basic Functions of MLD.](#)

● Before a static mapping entry is configured, ensure that the corresponding ACL is created and a multicast group range is specified. For details about ACL configuration, see *Configuring ACL*.

1.12.4 Procedure

(1) Enter the privileged EXEC mode.

enable

(2) Enter the global configuration mode.

configure terminal

(3) Enable the SSM mapping function.

ipv6 mld ssm-map enable

The SSM mapping function is disabled by default.

(4) (Optional) Configure a static mapping entry.

ipv6 mld ssm-map static *acl-name ipv6-source-address*

No static mapping entry is configured by default.

1.13 Monitoring

Run the **show** command to check the running status of a configured function to verify the configuration effect.

Run the **debug** command to output debugging information.

> ⚠ **Caution**
>
> The output debugging information occupies system resources. Therefore, disable the debugging function
> immediately after use.

Run the **clear** commands to clear information.

> ⚠ **Caution**
>
> Running the **clear** commands may lose vital information and thus interrupt services.

Table 1-1   Monitoring

Command	Purpose
clear ipv6 mld group [*ipv6-group-address*] [*interface-type interface-number*]	Clears dynamic group member records in the MLD cache.
clear ipv6 mld interface *interface-type interface-number*	Clears all MLD statistics and group member records on the interface.
show ipv6 mld groups [*ipv6-group-address* | *interface-type interface-number*] [**detail**]	Displays groups directly connected to the device and group information learned from MLD.
show ipv6 mld interface [*interface-type interface-number*]	Displays configurations of the interface.
show ipv6 mld ssm-mapping [*ipv6-group-address*]	Displays the SSM mapping information.
show debugging	Displays the MLD debugging switch status.
debug ipv6 mld all	Debugs all MLD information.
debug ipv6 mld decode	Debugs MLD packet resolution.
debug ipv6 mld encode	Debugs MLD packet encoding.
debug ipv6 mld events	Debugs MLD event information.
debug ipv6 mld fsm	Debugs MLD event information.

Command	Purpose
debug ipv6 mld tib	Debugs MLD state machine information.
debug ipv6 mld warning	Debugs MLD alarms.

1.14 Examples

1.14.1 Configuring Basic Functions of MLD

1.   Requirements

As shown in <u>Figure 1-1</u>, Host A, Host B, and Host C residing in shared networks N1 and N2 of IPv6 want to receive video information from the source in multicast mode. The static multicast group FF13::1 is configured on N1 shared network, and hosts on N2 shared network can join the multicast group FF14::1.

- OSPFv3 runs in the network to make uniticast routes between any two nodes reachable.

- Device B and Device D are connected to the shared network N1 through SVI 50. The IPv6 address of Device B is smaller than the IPv6 address of Device D. Therefore, Device B acts as the querier, and Host A is the multicast information receiver in the shared network N1.

- Device C is connected to the shared network N2 through SVI 60, and Host B is the multicast information receiver in the shared network N2.

- Device B, Device C, and Device D are connected to other devices in the IPv6 PIM network through L3 interfaces.

2.   Topology

Figure 1-1   Topology for Basic Functions of MLD
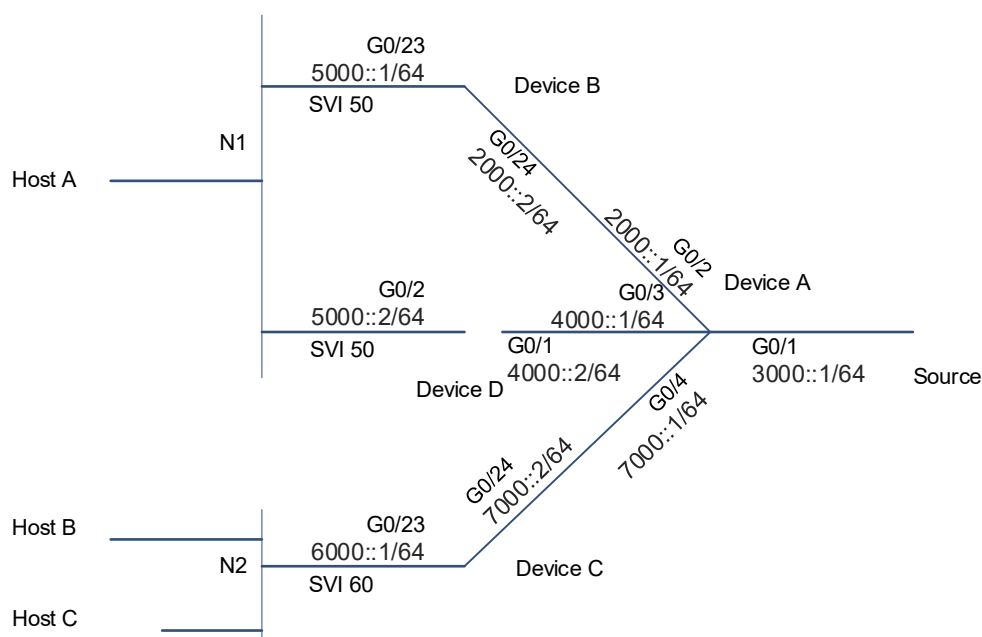
3.   **Notes**

- Configure an IPv6 unicast routing protocol OSPFv3 on a multicast device and ensure that unicast routes are reachable to the Loopback interface.

- Enable the IPv6 multicast routing function on all multicast devices.

- Configure the PIM-SMv6 protocol on the interconnected interfaces of devices, interfaces connected to hosts, and interfaces connected to sources.

- Configure a static multicast group on the interfaces of the devices on shared network N1.

- Enable the multicast group access control function on the interfaces of the devices on shared network N2.

4.   **Procedure**

(1) Configure an IPv6 address for each interface and configure the unicast routing protocol.

Configure an IPv6 address for the interface of Device A and configure the OSPFv3 protocol to implement internetworking. Perform the same configuration on Device B, Device C, and Device D.

```
DeviceA> enable
DeviceA# config terminal
DeviceA(config)# ipv6 router ospf 5050
DeviceA(config)# interface gigabitethernet 0/1
DeviceA(config-if-GigabitEthernet 0/1)# no switchport
DeviceA(config-if-GigabitEthernet 0/1)# ipv6 address 3000::1/64
DeviceA(config-if-GigabitEthernet 0/1)# ipv6 ospf 5050 area 0
DeviceA(config-if-GigabitEthernet 0/1)# exit
DeviceA(config)# interface GigabitEthernet 0/2
DeviceA(config-if-GigabitEthernet 0/2)# no switchport
DeviceA(config-if-GigabitEthernet 0/2)# ipv6 address 2000::1/64
DeviceA(config-if-GigabitEthernet 0/2)# ipv6 ospf 5050 area 0
DeviceA(config-if-GigabitEthernet 0/2)# exit
DeviceA(config)# interface GigabitEthernet 0/3
DeviceA(config-if-GigabitEthernet 0/3)# no switchport
DeviceA(config-if-GigabitEthernet 0/3)# ipv6 address 8000::1/64
DeviceA(config-if-GigabitEthernet 0/3)# ipv6 ospf 5050 area 0
DeviceA(config-if-GigabitEthernet 0/3)# exit
DeviceA(config)# interface GigabitEthernet 0/4
DeviceA(config-if-GigabitEthernet 0/4)# no switchport
DeviceA(config-if-GigabitEthernet 0/4)# ipv6 address 7000::1/64
DeviceA(config-if-GigabitEthernet 0/4)# ipv6 ospf 5050 area 0
DeviceA(config-if-GigabitEthernet 0/4)# exit
DeviceA(config)# interface loopback 0
DeviceA(config-if-Loopback 0)# ipv6 address 1111::1/128
DeviceA(config-if-Loopback 0)# ipv6 ospf 5050 area 0
DeviceA(config-if-Loopback 0)# exit
```

(2) Enable the IPv6 multicast routing function on all devices, and configure the PIM-SMv6 protocol on the interconnected interfaces of devices, interfaces connected to hosts, and interfaces connected to sources.

Enable the IPv6 multicast routing function and configure the PIM-SMv6 protocol on Device A. Perform the same configuration on Device B, Device C, and Device D.

```
DeviceA(config)# ipv6 multicast-routing
DeviceA(config)# interface GigabitEthernet 0/1
DeviceA(config-if-GigabitEthernet 0/1)# ipv6 pim sparse-mode
DeviceA(config-if-GigabitEthernet 0/1)# exit
DeviceA(config)# interface GigabitEthernet 0/2
DeviceA(config-if-GigabitEthernet 0/2)# ipv6 pim sparse-mode
DeviceA(config-if-GigabitEthernet 0/2)# exit
DeviceA(config)# interface GigabitEthernet 0/3
DeviceA(config-if-GigabitEthernet 0/3)# ipv6 pim sparse-mode
DeviceA(config-if-GigabitEthernet 0/3)# exit
DeviceA(config)# interface GigabitEthernet 0/4
DeviceA(config-if-GigabitEthernet 0/4)# ipv6 pim sparse-mode
DeviceA(config-if-GigabitEthernet 0/4)# exit
DeviceA(config)# interface loopback 0
DeviceA(config-if-Loopback 0)# ipv6 pim sparse-mode
DeviceA(config-if-Loopback 0)# exit
```

Configure an RP. Configure a C-BSR and a C-RP on Device A.

```
DeviceA(config)# ipv6 pim bsr-candidate Loopback 0
DeviceA(config)# ipv6 pim rp-candidate Loopback 0
```

(3) Configure a static multicast group on the interfaces of the devices on shared network N1.

Configure a static multicast group on SVI 50 of Device B, and set the static multicast group address to FF13::1. Perform the same configuration on Device D.

```
DeviceB> enable
DeviceB# config terminal
DeviceB(config)# interface VLAN 50
DeviceB (config-if-VLAN 50)# ipv6 mld static-group ff13::1
DeviceB(config-if-VLAN 50)# exit
DeviceB(config)# interface GigabitEthernet 0/23
DeviceB(config-if-GigabitEthernet 0/23)# switchport access vlan 50
DeviceB(config-if-GigabitEthernet 0/23)# exit
DeviceB(config)# interface TenGigabitEthernet 0/27
DeviceB(config-if-TenGigabitEthernet 0/27)# switchport mode trunk
DeviceB(config-if-TenGigabitEthernet 0/27)# switchport trunk native vlan 50
DeviceB(config-if-TenGigabitEthernet 0/27)# exit
```

(4) Enable the multicast group access control function on the interfaces of the devices on shared network N2.

Enable the multicast group access control function on SVI 60 of Device C, and add the hosts in network N2 to the multicast group FF14::1.

```
DeviceC> enable
DeviceC# config terminal
DeviceC(config)# ipv6 access-list ipv6-group
DeviceC(config-ipv6-acl)# permit ipv6 any host FF14::1
DeviceC(config-ipv6-acl)# exit
```

```
DeviceC(config)# interface VLAN 60
DeviceC(config-if-VLAN 60)# ipv6 mld access-group ipv6-group
DeviceC(config-if-VLAN 60)# exit
```

5. Verification

Run the **show ipv6 mld interface** command to display MLD configuration of each device. Device B is taken as an example. Device B is the querier, because the IPv6 address of SVI 50 on Device B in the shared network N1 is smaller.

```
DeviceB# show ipv6 mld interface VLAN 50
Interface VLAN 50 (Index 4146)
 MLD Enabled, Active, Querier, Version 2 (default)
 Internet address is fe80::274:9cff:feee:53cb
 MLD interface limit is 4000
 MLD interface has 0 group-record states
 MLD interface has 0 join-group records
 MLD interface has 1 static-group records
 MLD activity: 10 joins, 1 leaves
 MLD query interval is 125 seconds
 MLD querier timeout is 255 seconds
 MLD max query response time is 10 seconds
 Last member query response interval is 10 (1/10s)
 Last member query count is 2
 Group Membership interval is 260
 Robustness Variable is 2
```

Run the **show ipv6 pim sparse-mode mroute** command to display the multicast routing entries on each device. The multicast routing entries on Device B are as follows:

```
DeviceB# show ipv6 pim sparse-mode mroute
IPv6 Multicast Routing Table
(*,*,RP) Entries: 0
(*,G) Entries: 1
(S,G) Entries: 0
(S,G,rpt) Entries: 0
FCR Entries: 0
REG Entries: 0

(*, ff13::1)
RP: 1111::1
RPF nbr: fe80::274:9cff:fe11:c9e7
RPF idx: GigabitEthernet 0/24
Upstream State: NOT JOINED
 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
26 27 28 29 30 31
Local
0  .i  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
.  .  .  .  .  .
```

```
1    . . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . .
2    . . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . . .
3    . . . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . . .
4    . . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . . .
5    . . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . . .
6    . . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . . .
7    . . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . . .
Joined
0    . . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . . .
1    . . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . . .
2    . . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . . .
3    . . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . . .
4    . . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . . .
5    . . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . . .
6    . . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . . .
7    . . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . . .
Asserted
0    . . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . . .
1    . . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . . .
2    . . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . . .
3    . . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . . .
4    . . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . . .
5    . . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . . .
6    . . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . . . .
```

```
7  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
.  .  .  .  .  .
FCR:
```

Run the **show ipv6 mld groups** command to display the static multicast group FF13::1 that SVI50 joins on Device B and Device D.

```
DeviceB# show ipv6 mld groups
MLD Connected Group Membership
Group Address                           Interface          Uptime     Expires
Last Reporter
ff13::1                                 VLAN 50            00:11:07   stopped
::
```

Try to add a host to the multicast groups FF13::1 and FF14::1 through SVI 60, and run the **show ipv6 mld groups** command to display that the host joins in only the multicast group FF14::1 through SVI 60.

```
DeviceC# show ipv6 mld groups
MLD Connected Group Membership
Group Address                           Interface          Uptime     Expires
Last Reporter
ff14::1                                 VLAN 60            00:01:03
00:03:51  fe80::274:9cff:feee:f49f
```

6. **Configuration Files**

   ● Device A configuration file

```
hostname DeviceA
!
ipv6 multicast-routing
!
interface GigabitEthernet 0/1
 no switchport
 ipv6 address 3000::1/64
 ipv6 ospf 5050 area 0
 ipv6 pim sparse-mode
!
interface GigabitEthernet 0/2
 no switchport
 ipv6 address 2000::1/64
 ipv6 ospf 5050 area 0
 ipv6 pim sparse-mode
!
interface GigabitEthernet 0/3
 no switchport
 ipv6 address 4000::1/64
 ipv6 ospf 5050 area 0
 ipv6 pim sparse-mode
!
interface GigabitEthernet 0/4
```

```
 no switchport
 ipv6 address 7000::1/64
 ipv6 ospf 5050 area 0
 ipv6 pim sparse-mode
!
interface Loopback 0
 ipv6 address 1111::1/128
 ipv6 ospf 5050 area 0
 ipv6 pim sparse-mode
!
ipv6 router ospf 5050
 graceful-restart
!
ipv6 pim bsr-candidate Loopback 0
ipv6 pim rp-candidate Loopback 0
!
end
```

- Device B configuration file

```
hostname DeviceB
!
ipv6 multicast-routing
!
vlan range 1,50
!
interface GigabitEthernet 0/23
 switchport access vlan 50
!
interface GigabitEthernet 0/24
 no switchport
 ipv6 address 2000::2/64
 ipv6 ospf 5050 area 0
 ipv6 pim sparse-mode
!
interface TenGigabitEthernet 0/27
 switchport mode trunk
 switchport trunk native vlan 50
!
interface Loopback 0
 ipv6 address 2222::2/128
 ipv6 ospf 5050 area 0
 ipv6 pim sparse-mode
!
interface VLAN 50
 ipv6 address 5000::1/64
 ipv6 ospf 5050 area 0
 ipv6 mld static-group ff13::1
```

```
 ipv6 pim sparse-mode
!
ipv6 router ospf 5050
 graceful-restart
!
End
```

- Device C configuration file

```
hostname DeviceC
!
ipv6 access-list ipv6-group
 10 permit ipv6 any host FF14::1
!
ipv6 multicast-routing
!
vlan range 1,60
!
interface GigabitEthernet 0/23
 switchport access vlan 60
!
interface GigabitEthernet 0/24
 no switchport
 ipv6 address 7000::2/64
 ipv6 ospf 5050 area 0
 ipv6 pim sparse-mode
!
interface Loopback 0
 ipv6 address 3333::3/128
 ipv6 ospf 5050 area 0
 ipv6 pim sparse-mode
!
interface VLAN 60
 ipv6 address 6000::1/64
 ipv6 mld access-group ipv6-group
 ipv6 mld join-group ff13::1
 ipv6 mld join-group ff14::1
 ipv6 pim sparse-mode
!
ipv6 router ospf 5050
 graceful-restart
!
end
```

- Device D configuration file

```
hostname DeviceD
!
ipv6 multicast-routing
```

```
!
interface GigabitEthernet 0/1
 no switchport
 ipv6 address 4000::2/64
 ipv6 ospf 5050 area 0
!
interface TenGigabitEthernet 0/51
 switchport mode trunk
 switchport trunk native vlan 50
!
interface Loopback 0
 ipv6 address 4444::4/128
!
interface VLAN 50
 ipv6 address 5000::2/64
 ipv6 ospf 5050 area 0
 ipv6 mld static-group ff13::1
 ipv6 pim sparse-mode
!
ipv6 router ospf 5050
 graceful-restart
!
end
```

7. Common Errors

● The multicast routing function is not enabled on a multicast device.

● No multicast interface is available on the network.

1.14.2 Configuring the MLD Proxy Function

1. Requirements

As shown in Figure 1-1, the PIM-SMv6 protocol is configured in the network. Host A and Host B in the stub network receive multicast data from the source. The multicast group addresses are FF13::1 and FF14::1. The MLD proxy function is enabled on Device B to maintain membership and normal forwarding of multicast data.

2. Topology

Figure 1-1   Topology of the MLD Proxy
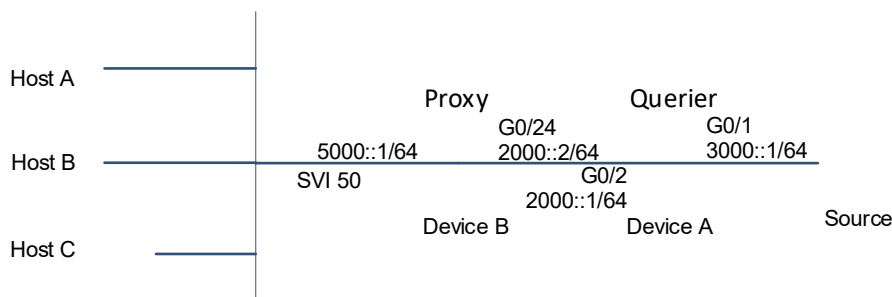
3. **Notes**

    ● Configure an IPv6 unicast routing protocol OSPFv3 on a multicast device and ensure that unicast routes are reachable to the Loopback interface.

    ● Enable the IPv6 multicast routing function on all multicast devices, and configure the PIM-SMv6 protocol on the interconnected interfaces of devices, interfaces connected to hosts, and interfaces connected to sources.

    ● Configure a proxy service interface.

    ● Configure an MRoute proxy interface.

4. **Procedure**

    (1) Configure an IPv6 unicast routing protocol OSPFv3 on a multicast device and ensure that unicast routes are reachable to the Loopback interface.

    Configure an IPv6 address for the interface of Device A and configure the OSPFv3 protocol to implement internetworking. Perform the same configuration on Device B.

```
DeviceA> enable
DeviceA# config terminal
DeviceA(config)# ipv6 router ospf 5050
DeviceA(config)# interface GigabitEthernet 0/1
DeviceA(config-if-GigabitEthernet 0/1)# no switchport
DeviceA(config-if-GigabitEthernet 0/1)# ipv6 address 3000::1/64
DeviceA(config-if-GigabitEthernet 0/1)# ipv6 ospf 5050 area 0
DeviceA(config-if-GigabitEthernet 0/1)# exit
DeviceA(config)# interface GigabitEthernet 0/2
DeviceA(config-if-GigabitEthernet 0/2)# no switchport
DeviceA(config-if-GigabitEthernet 0/2)# ipv6 address 2000::1/64
DeviceA(config-if-GigabitEthernet 0/2)# ipv6 ospf 5050 area 0
DeviceA(config-if-GigabitEthernet 0/2)# exit
DeviceA(config)# interface loopback 0
DeviceA(config-if-Loopback 0)# ipv6 address 1111::1/128
DeviceA(config-if-Loopback 0)# ipv6 ospf 5050 area 0
DeviceA(config-if-Loopback 0)# exit
```

    (2) Enable the IPv6 multicast routing function on all multicast devices, and configure the PIM-SMv6 protocol on the interconnected interfaces of devices, interfaces connected to hosts, and interfaces connected to sources.

    Enable the IPv6 multicast routing function and configure the PIM-SMv6 protocol on Device A. Perform the same configuration on Device B.

```
DeviceA(config)# ipv6 multicast-routing
DeviceA(config)# interface GigabitEthernet 0/1
DeviceA(config-if-GigabitEthernet 0/1)# ipv6 pim sparse-mode
DeviceA(config-if-GigabitEthernet 0/1)# exit
DeviceA(config)# interface GigabitEthernet 0/2
DeviceA(config-if-GigabitEthernet 0/2)# ipv6 pim sparse-mode
DeviceA(config-if-GigabitEthernet 0/2)# exit
```

```
DeviceA(config)# interface loopback 0
DeviceA(config-if-Loopback 0)# ipv6 pim sparse-mode
DeviceA(config-if-Loopback 0)# exit
```
Configure an RP. Configure a C-BSR and a C-RP on Device A.

```
DeviceA(config)# ipv6 pim bsr-candidate Loopback 0
DeviceA(config)# ipv6 pim rp-candidate Loopback 0
```
(3) Configure a proxy service interface.

Configure GigabitEthernet 0/24 on Device B as a proxy service interface.

```
DeviceB> enable
DeviceB# config terminal
DeviceB(config)# interface GigabitEthernet 0/24
DeviceB(config-if-GigabitEthernet 0/24)# ipv6 mld proxy-service
DeviceB(config-if-GigabitEthernet 0/24)# exit
```
(4) Configure an MRoute proxy interface.

Configure SVI 50 of Device B as an MRoute proxy interface.

```
DeviceB(config)# interface VLAN 50
DeviceB(config-if-VLAN 50)# ipv6 mld mroute-proxy GigabitEthernet 0/24
```

5. Verification

Run the **show ipv6 mld groups** command on Device B to display the proxy entries.

```
DeviceB# show ipv6 mld groups
MLD Connected Group Membership
Group Address                          Interface           Uptime     Expires
Last Reporter
ff13::1                                VLAN 50             00:03:24
00:04:14  fe80::274:9cff:feee:f49f
ff14::1                                VLAN 50             00:00:06
00:04:14  fe80::274:9cff:feee:54cb


MLD Proxy-server Connected Group Membership
Group Address                          Interface           Uptime
ff13::1                                GigabitEthernet 0/24   00:03:24
ff14::1                                GigabitEthernet 0/24   00:00:06
```
Run the **show ipv6 mld groups** command on Device A to display that addresses of members joining the multicast groups FF13::1 and FF14::1 are IPv6 addresses of the Device B proxies.

```
DeviceA# show ipv6 mld groups
MLD Connected Group Membership
Group Address                          Interface           Uptime     Expires
Last Reporter
ff13::1                                GigabitEthernet 0/2  00:09:56
00:03:44  fe80::274:9cff:feee:53cb
ff14::1                                GigabitEthernet 0/2  00:00:23
00:03:56  fe80::274:9cff:feee:53cb
```

6. Configuration Files

- Device A configuration file

```
hostname DeviceA
!
ipv6 multicast-routing
!
interface GigabitEthernet 0/1
 no switchport
 ipv6 address 3000::1/64
 ipv6 ospf 5050 area 0
 ipv6 pim sparse-mode
!
interface GigabitEthernet 0/2
 no switchport
 ipv6 address 2000::1/64
 ipv6 ospf 5050 area 0
 ipv6 pim sparse-mode
!
interface Loopback 0
 ipv6 address 1111::1/128
 ipv6 ospf 5050 area 0
 ipv6 pim sparse-mode
!
ipv6 router ospf 5050
 graceful-restart
!
ipv6 pim bsr-candidate Loopback 0
ipv6 pim rp-candidate Loopback 0
!
End
```

- Device B configuration file

```
hostname DeviceB
!
ipv6 multicast-routing
!
vlan range 1,50
!
interface GigabitEthernet 0/23
 switchport access vlan 50
!
interface GigabitEthernet 0/24
 no switchport
 ipv6 address 2000::2/64
 ipv6 ospf 5050 area 0
ipv6 mld proxy-service
```

```
 ipv6 pim sparse-mode
!
interface TenGigabitEthernet 0/27
 switchport mode trunk
 switchport trunk native vlan 50
!
interface Loopback 0
 ipv6 address 2222::2/128
 ipv6 ospf 5050 area 0
 ipv6 pim sparse-mode
!
interface VLAN 50
 ipv6 address 5000::1/64
 ipv6 ospf 5050 area 0
ipv6 mld mroute-proxy GigabitEthernet 0/24
 ipv6 pim sparse-mode
!
ipv6 router ospf 5050
 graceful-restart
!
End
```

7. Common Errors

The basic functions of MLD are not enabled.

1.14.3 Configuring SSM Mapping

1. Requirements

As shown in Figure 1-1, the SSM model is used to provide multicast service in an IPv6 multicast network. The default SSM group address range in the network is FF3X::/32. Hosts run MLDv1 and do not support MLDv2. Hosts are expected to receive multicast packets from Source 2 and ignore multicast packets from Source 1.

2. Topology

Figure 1-1   Topology of SSM Mapping
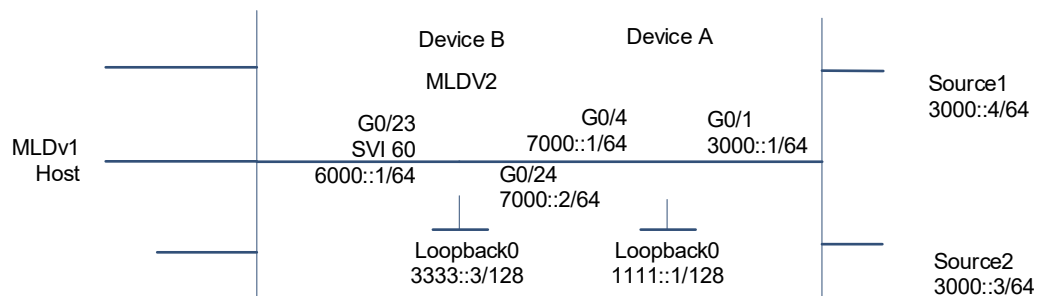
3. **Notes**

- Configure an IPv6 unicast routing protocol OSPFv3 on a multicast device and ensure that unicast routes are reachable to the Loopback interface.

- Enable the IPv6 multicast routing function on all multicast devices, and configure the PIM-SMv6 protocol on the interconnected interfaces of devices, interfaces connected to hosts, and interfaces connected to sources.

- Configure an SSM group address range.

- Enable the SSM mapping function.

- Configure an SSM mapping static linked list.

4. **Procedure**

(1) Configure an IPv6 unicast routing protocol OSPFv3 on a multicast device and ensure that unicast routes are reachable to the Loopback interface.

Configure an IPv6 address for the interface of Device A and configure the OSPFv3 protocol to implement internetworking. Perform the same configuration on Device B.

```
DeviceA> enable
DeviceA# config terminal
DeviceA(config)# ipv6 router ospf 5050
DeviceA(config)# interface GigabitEthernet 0/1
DeviceA(config-if-GigabitEthernet 0/1)# no switchport
DeviceA(config-if-GigabitEthernet 0/1)# ipv6 address 3000::1/64
DeviceA(config-if-GigabitEthernet 0/1)# ipv6 ospf 5050 area 0
DeviceA(config-if-GigabitEthernet 0/1)# exit
DeviceA(config)# interface GigabitEthernet 0/4
DeviceA(config-if-GigabitEthernet 0/4)# no switchport
DeviceA(config-if-GigabitEthernet 0/4)# ipv6 address 7000::1/64
DeviceA(config-if-GigabitEthernet 0/4)# ipv6 ospf 5050 area 0
DeviceA(config-if-GigabitEthernet 0/4)# exit
DeviceA(config)# interface loopback 0
DeviceA(config-if-Loopback 0)# ipv6 address 1111::1/128
DeviceA(config-if-Loopback 0)# ipv6 ospf 5050 area 0
DeviceA(config-if-Loopback 0)# exit
```

(2) Enable the IPv6 multicast routing function on all multicast devices, and configure the PIM-SMv6 protocol on the interconnected interfaces of devices, interfaces connected to hosts, and interfaces connected to sources.

Enable the IPv6 multicast routing function and configure the PIM-SMv6 protocol on Device A. Perform the same configuration on Device B.

```
DeviceA(config)# ipv6 multicast-routing
DeviceA(config)# interface GigabitEthernet 0/1
DeviceA(config-if-GigabitEthernet 0/1)# ipv6 pim sparse-mode
DeviceA(config-if-GigabitEthernet 0/1)# exit
DeviceA(config)# interface GigabitEthernet 0/4
DeviceA(config-if-GigabitEthernet 0/4)# ipv6 pim sparse-mode
```

```
DeviceA(config-if-GigabitEthernet 0/4)# exit
DeviceA(config)# interface loopback 0
DeviceA(config-if-Loopback 0)# ipv6 pim sparse-mode
DeviceA(config-if-Loopback 0)# exit
```

Set the MLD version on SVI 60 connected to hosts to 2 on Device B.

```
DeviceB> enable
DeviceB# config terminal
DeviceB(config)# interface VLAN 60
DeviceB(config-if-VLAN 60)# ipv6 mld version 2
DeviceB(config-if-VLAN 60)# exit
```

(3) Configure an SSM group address range.

Configure an SSM multicast address range on all devices. Take Device A as an example and perform the same configuration on Device B.

```
DeviceB(config)# ipv6 pim ssm default
```

(4) Enable the SSM mapping function.

Enable the SSM mapping function on Device B.

```
DeviceB(config)# ipv6 mld ssm-map enable
```

(5) Configure an SSM mapping static linked list.

Map the multicast addresses in FF34::/64 to Source 1 on Device B.

```
DeviceB(config)# ipv6 access-list map-acl
DeviceB(config-ipv6-acl)# permit ipv6 any FF34::/64
DeviceB(config)# ipv6 mld ssm-map static map-acl 3000::3
```

5. Verification

Display the SSM mapping information.

```
DeviceB# show ipv6 mld ssm-mapping
SSM Mapping : Enabled
Database    : Static mappings configured
```

Display multicast source information corresponding to the multicast group FF34::1.

```
DeviceB# show  ipv6 mld ssm-mapping FF34::1
Group address: ff34::1
Database     : Static
Source list  : 3000::3
```

6. Configuration Files

● Device A configuration file

```
hostname DeviceA
!
ipv6 multicast-routing
!
interface GigabitEthernet 0/1
 no switchport
```

```
 ipv6 address 3000::1/64
 ipv6 ospf 5050 area 0
 ipv6 pim sparse-mode
!
interface GigabitEthernet 0/4
 no switchport
 ipv6 address 7000::1/64
 ipv6 ospf 5050 area 0
 ipv6 pim sparse-mode
!
interface Loopback 0
 ipv6 address 1111::1/128
 ipv6 ospf 5050 area 0
 ipv6 pim sparse-mode
!
ipv6 router ospf 5050
 graceful-restart
!
ipv6 pim ssm default
!
end
```

● Device B configuration file

```
hostname DeviceB
!
ipv6 access-list map-acl
 30 permit ipv6 any FF34::/64
!
ipv6 multicast-routing
!
vlan range 1,60
!
interface GigabitEthernet 0/23
 switchport access vlan 60
!
interface GigabitEthernet 0/24
 no switchport
 ipv6 address 7000::2/64
 ipv6 ospf 5050 area 0
 ipv6 pim sparse-mode
!
interface Loopback 0
 ipv6 address 3333::3/128
 ipv6 ospf 5050 area 0
 ipv6 pim sparse-mode
!
interface VLAN 60
```

```
 ipv6 address 6000::1/64
 ipv6 ospf 5050 area 0
 ipv6 pim sparse-mode
 ipv6 mld version 2
!
ipv6 router ospf 5050
 graceful-restart
!
ipv6 mld ssm-map enable
ipv6 mld ssm-map static map-acl 3000::3
ipv6 pim ssm default
!
end
```

7.   Common Errors

- The basic functions of MLD are not enabled.
- The SSM service is not enabled.
- No SSM address range is configured.

1.15   Common Misconfigurations

- Basic functions of MLD are not configured on the proxy service interface.
- No SSM service address is configured when the SSM service is used.
- The SSM service address ranges on different multicast devices are inconsistent.

1.15.1 What Can I Do when On-demand Multicast Service Is Unavailable on Client

- Fault Symptom

  The multicast function is enabled. But I failed to use the on-demand multicast service through a client.

- Troubleshooting

  a   Check whether the connection between the on-demand client and multicast server is normal.

      Run the **show ipv6 route** command to check for any entry of unicast route to the multicast source on the server. If no, configure a unicast routing protocol.

  b   Check configuration on the devices.

      Run the **show ipv6 pim sparse-mode interface** command to check for PIM information on an interface. If no information about the interface is displayed, the PIM-SMv6 function is not enabled. Run the **ipv6 pim sparse-mode** command to enable the PIM-SMv6 function on the interface.

  c   Check whether the multicast receiver normally joins the group.

      Run the **show ipv6 mld groups** command to check whether the host joins the corresponding multicast group on the multicast device residing in the same network segment as the host.

  d   Check whether the multicast entries on the multicast source and receiver are normal.

Run the **show ipv6 pim sparse-mode mroute** command to check whether the multicast entries on the devices are normal.