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Configuring MLD

About MLD

Multicast Listener Discovery (MLD) establishes and maintains IPv6 multicast group memberships between a Layer 3 multicast device and the hosts on the directly connected subnet.

MLD versions

MLD has the following versions:

- MLDv1 (defined by RFC 2710), which is derived from IGMPv2.
- MLDv2 (defined by RFC 3810), which is derived from IGMPv3.

MLDv1 and MLDv2 support the ASM model. MLDv2 can directly implement the SSM model, but MLDv1 must work with the MLD SSM mapping feature to implement the SSM model. For more information about the ASM and SSM models, see "Multicast overview."

How MLDv1 works

MLDv1 implements IPv6 multicast listener management based on the query and response mechanism.

Electing the MLD querier

All IPv6 multicast devices that run MLD on the same subnet can monitor MLD listener report messages (often called reports) from hosts. However, only one device can act as the MLD querier to send MLD query messages (often called queries). A querier election mechanism determines which device acts as the MLD querier on the subnet.

1. Initially, every MLD device assumes itself as the querier. Each device sends MLD general query messages (often called general queries) to all hosts and devices on the local subnet. The destination address of the general queries is FF02::1.

2. After receiving a general query, every MLD device compares the source IPv6 address of the query with its own link-local interface address. The device with the lowest IPv6 address wins the querier election and becomes the querier. All the other devices become non-queriers.

3. All the non-queriers start a timer called the "other querier present timer." If a device receives an MLD query from the querier before the timer expires, it resets this timer. Otherwise, it considers that the querier has timed out. In this case, the device initiates a new querier election process.

Joining an IPv6 multicast group

Figure 1 MLD queries and reports
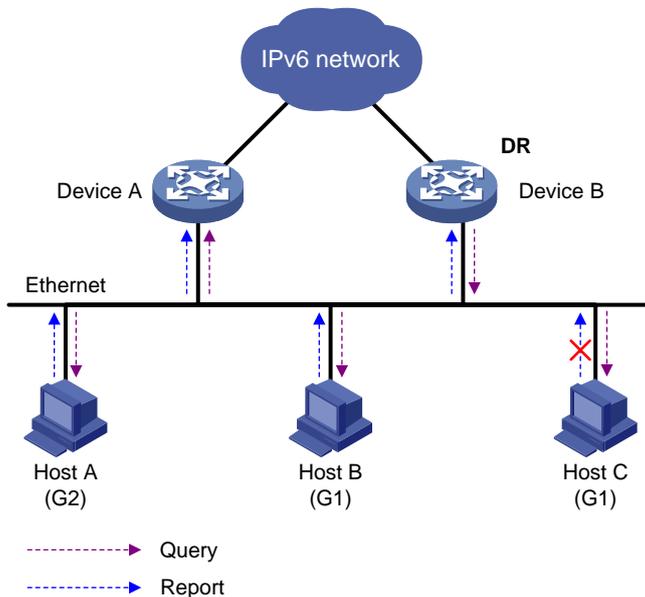
As shown in Figure 1, Host B and Host C want to receive the IPv6 multicast data addressed to IPv6 multicast group G1. Host A wants to receive the IPv6 multicast data addressed to G2. The following process describes how the hosts join the IPv6 multicast groups and how the MLD querier (Device B in Figure 1) maintains the IPv6 multicast group memberships:

1. The hosts send unsolicited MLD reports to the IPv6 multicast groups they want to join without having to wait for the MLD queries.

2. The MLD querier periodically multicasts MLD queries (with the destination address FF02::1) to all hosts and devices on the local subnet.

3. After receiving a query, the host whose report delay timer expires first sends an MLD report to the IPv6 multicast group G1 to announce its membership for G1. In this example, Host B sends the report. After hearing the report from Host B, Host C, which is on the same subnet as Host B, suppresses its own report for G1.

   Because the MLD devices already know that G1 has a minimum of one member, other members do not need to report their memberships. This mechanism, known as the host MLD report suppression, helps reduce traffic on the local subnet.

4. At the same time, because Host A is interested in G2, it sends a report to the IPv6 multicast group G2.

5. Through the query/report process, the MLD devices determine that G1 and G2 have members on the local subnet. The IPv6 multicast routing protocol (for example, IPv6 PIM) that is running on the devices generates (*, G1) and (*, G2) multicast forwarding entries. These entries are the basis for subsequent IPv6 multicast forwarding. The asterisk (*) represents any IPv6 multicast source.

6. When the IPv6 multicast data addressed to G1 or G2 reaches an MLD device, the device looks up the IPv6 multicast forwarding table. Based on the (*, G1) and (*, G2) entries, the device forwards the IPv6 multicast data to the local subnet. Then, the receivers on the subnet receive the data.

Leaving an IPv6 multicast group

When a host is leaving an IPv6 multicast group, the following process occurs:

1. The host sends an MLD done message to all IPv6 multicast devices on the local subnet. The destination address of done messages is FF02::2.

2. After receiving the MLD done message, the querier sends a configurable number of multicast-address-specific queries to the group that the host is leaving. The IPv6 multicast addresses queried include both the destination address field and the group address field of the message.

3. One of the remaining members (if any on the subnet) in the group sends a report within the time of the maximum response time advertised in the multicast-address-specific queries.

4. If the querier receives a report for the group within the maximum response time, it maintains the memberships of the IPv6 multicast group. Otherwise, the querier assumes that no hosts on the subnet are interested in IPv6 multicast traffic addressed to that group and stops maintaining the memberships of the group.

MLDv2 enhancements

MLDv2 is based on and backwards-compatible with MLDv1. MLDv2 provides hosts with enhanced control capabilities and enhances the MLD state.

Enhancements in control capability of hosts

MLDv2 has introduced IPv6 multicast source filtering modes (Include and Exclude). These modes allow a host to receive or reject multicast data from the specified IPv6 multicast sources. When a host joins an IPv6 multicast group, one of the following occurs:

- If the host expects IPv6 multicast data from specific IPv6 multicast sources like S1, S2, …, it sends a report with Filter-Mode denoted as "Include Sources (S1, S2, …)."

- If the host does not expect IPv6 multicast data from specific IPv6 multicast sources like S1, S2, …, it sends a report with Filter-Mode denoted as "Exclude Sources (S1, S2, …)."

As shown in Figure 2, the network has two IPv6 multicast sources, Source 1 (S1) and Source 2 (S2). Both of the sources can send IPv6 multicast data to IPv6 multicast group G. Host B wants to receive IPv6 multicast data addressed to G from Source 1 but not from Source 2.

Figure 2 Flow paths of multicast-address-and-source-specific multicast traffic
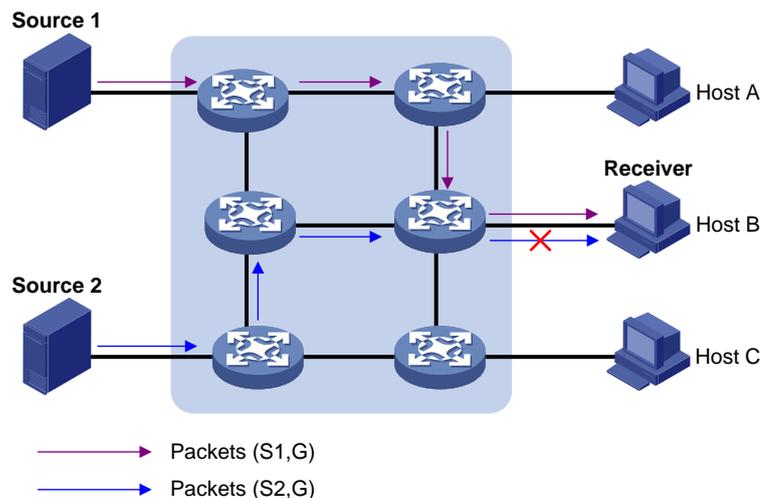
In MLDv1, Host B cannot select IPv6 multicast sources when it joins IPv6 multicast group G. The IPv6 multicast streams from both Source 1 and Source 2 flow to Host B whether it needs them or not.

In MLDv2, Host B can explicitly express its interest in IPv6 multicast data destined to G from Source 1 but not from Source 2. Then, Host B receives only IPv6 multicast data from Source 1.

Enhancement in MLD state

A multicast device that is running MLDv2 maintains the multicast address state for each multicast address on each attached subnet. The multicast address state consists of the following information:

- **Filter mode**—Device keeps tracing the Include or Exclude state.
- **List of sources**—Device keeps tracing the newly added or deleted IPv6 multicast source.
- **Timers**—Filter timers, which include the time that the device waits before switching to the Include mode after an IPv6 multicast address times out, and source timers for source recording.

MLD SSM mapping

An MLDv2 host can explicitly specify multicast sources in its MLDv2 reports. From the reports, the MLD device can obtain the multicast source addresses and directly provide the SSM service. However, an MLDv1 host cannot specify multicast sources in its MLDv1 reports.

The MLD SSM mapping feature enables the MLD device to provide SSM support for MLDv1 receiver host. The device translates (*, G) in MLDv1 reports into (G, INCLUDE, (S1, S2...)) based on the configured MLD SSM mappings.

Figure 3 Network diagram
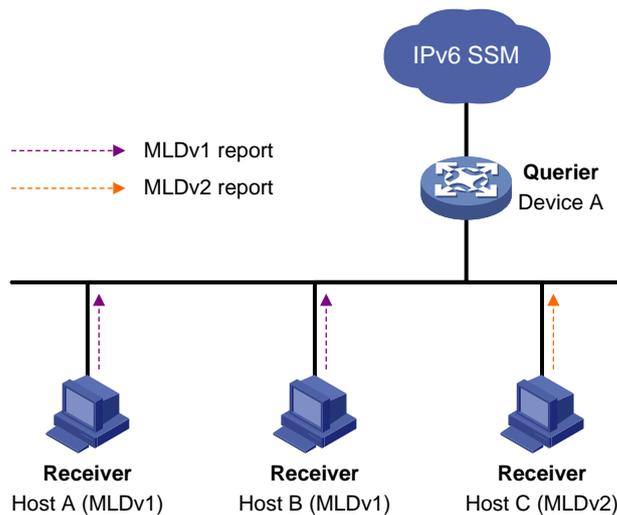
As shown in Figure 3, Host A and Host B on the IPv6 SSM network run MLDv1, and Host C runs MLDv2. To provide the SSM service for Host A and Host B, you must configure the MLD SSM mapping feature on Device A.

After MLD SSM mappings are configured, Device A checks the IPv6 multicast group address G carried in the message, and performs the following operations:

- If G is not in the IPv6 SSM group range, Device A provides the ASM service.
- If G is in the IPv6 SSM group range but does not match any MLD SSM mapping, Device A drops the report.
- If G is in the IPv6 SSM group range and matches MLD SSM mappings, Device A translates (*, G) in the report to (G, INCLUDE, (S1, S2...)) to provide SSM services.

NOTE:

The MLD SSM mapping feature does not process MLDv2 reports.

For more information about the IPv6 SSM group ranges, see "Configuring IPv6 PIM."

MLD proxying

As shown in Figure 4, in a simple tree-shaped topology, it is not necessary to configure IPv6 multicast routing protocols, such as IPv6 PIM, on edge devices. Instead, you can configure MLD proxying on these devices. With MLD proxying configured, the edge device acts as an MLD proxy:

- For the upstream MLD querier, the MLD proxy device acts as a host.
- For the downstream receiver hosts, the MLD proxy device acts as an MLD querier.

Figure 4 Network diagram
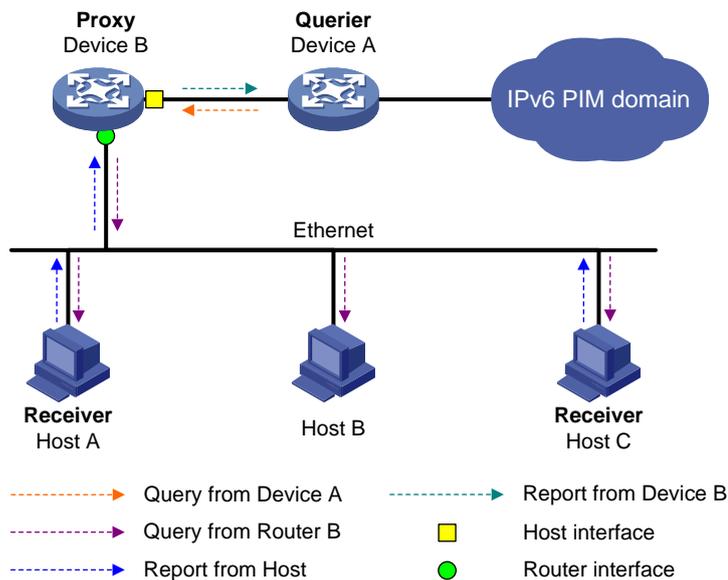
The following interfaces are defined in MLD proxying:

- **Host interface**—An interface that is in the direction toward the root of the multicast forwarding tree. A host interface acts as a receiver host that is running MLD. MLD proxying must be enabled on this interface. This interface is also called the "proxy interface."
- **Router interface**—An interface that is in the direction toward the leaf of the multicast forwarding tree. A router interface acts as a router that is running MLD. MLD must be configured on this interface.

An MLD proxy device maintains a group membership database, which stores the group memberships on all the router interfaces. The host interfaces and router interfaces perform actions based on this membership database.

- The host interfaces respond to queries according to the membership database or sends join/done messages when the database changes.
- The router interfaces participate in the querier election, send queries, and maintain memberships based on received MLD reports.

Protocols and standards

- RFC 2710, *Multicast Listener Discovery (MLD) for IPv6*
- RFC 3810, *Multicast Listener Discovery Version 2 (MLDv2) for IPv6*

Restrictions and guidelines: MLD configuration

As a best practice to ensure correct multicast data forwarding for a VLAN in a Layer 2 multicast network, do not enable MLD on the VLAN interface of the VLAN.

In a Layer 3 multicast network, an MLD-enabled VLAN interface floods multicast data packets within its associated VLAN by default. To implement on-demand multicast forwarding for the VLAN, enable MLD snooping in the VLAN.

MLD tasks at a glance

To configure MLD, perform the following tasks:

1. Enabling MLD
2. (Optional.) Configuring basic MLD features
   - Specifying an MLD version
   - Configuring a static group member
   - Configuring an IPv6 multicast group policy
3. (Optional.) Adjusting MLD performance
   - Configuring MLD query and response parameters
   - Enabling fast-leave processing
4. (Optional.) Configuring MLD SSM mappings
5. (Optional.) Configuring MLD proxying
   - Enabling MLD proxying
   - Enabling IPv6 multicast forwarding on a non-querier interface
   - Enabling IPv6 multicast load splitting for MLD proxy interfaces
6. (Optional.) Enabling MLD NSR
7. (Optional.) Setting the DSCP value for outgoing MLD protocol packets

Prerequisites for MLD

Before you configure MLD, you must configure an IPv6 unicast routing protocol so that all devices can interoperate at the network layer.

Enabling MLD

Restrictions and guidelines

Perform this task on interfaces where IPv6 multicast group memberships are created and maintained.

Procedure

1. Enter system view.

   system-view

2. Enable IPv6 multicast routing and enter IPv6 MRIB view.

   ipv6 multicast routing

   By default, IPv6 multicast routing is disabled.

   For more information about this command, see *IP Multicast Command Reference*.

3. Return to system view.

   `quit`

4. Enter interface view.

   `interface` *interface-type interface-number*

5. Enable MLD.

   `mld enable`

   By default, MLD is disabled.

Configuring basic MLD features

Specifying an MLD version

Restrictions and guidelines

For MLD to operate correctly, specify the same MLD version for all devices on the same subnet.

Procedure

1. Enter system view.

   `system-view`

2. Enter interface view.

   `interface` *interface-type interface-number*

3. Specify an MLD version on the interface.

   `mld version` *version-number*

   By default, the MLD version on an interface is MLDv1.

Configuring a static group member

About static group members

You can configure an interface as a static member of an IPv6 multicast group. Then, the interface can always receive IPv6 multicast data for the group.

A static group member does not respond to MLD queries. When you complete or cancel this configuration on an interface, the interface does not send an unsolicited MLD report or done message.

Restrictions and guidelines

The interface to be configured as a static member of an IPv6 multicast group has the following restrictions:

- If the interface is MLD and IPv6 PIM-SM enabled, it must be an IPv6 PIM-SM DR.
- If the interface is MLD enabled but not IPv6 PIM-SM enabled, it must be an MLD querier.

For more information about IPv6 PIM-SM and DR, see "Configuring IPv6 PIM."

Procedure

1. Enter system view.

   `system-view`

2. Enter interface view.

   `interface` *interface-type interface-number*

3. Configure a static group member.

```
mld static-group ipv6-group-address [ source ipv6-source-address ]
```

Configuring an IPv6 multicast group policy

About IPv6 multicast group policies

This feature enables an interface to filter MLD reports by using an ACL that specifies IPv6 multicast groups and the optional sources. It is used to control the IPv6 multicast groups that the hosts attached to an interface can join.

Restrictions and guidelines

This configuration does not take effect on static group members, because static group members do not send MLD reports.

Procedure

1. Enter system view.
   ```
   system-view
   ```
2. Enter interface view.
   ```
   interface interface-type interface-number
   ```
3. Configure an IPv6 multicast group policy on the interface.
   ```
   mld group-policy ipv6-acl-number [ version-number ]
   ```

Adjusting MLD performance

Configuring MLD query and response parameters

About MLD query and response parameters

The following are MLD query and response parameters:

- **MLD querier's robustness variable**—Number of times for retransmitting MLD queries in case of packet loss. A higher robustness variable makes the MLD querier more robust, but increases the timeout time for IPv6 multicast groups.
- **MLD startup query interval**—Interval at which an MLD querier sends MLD general queries at startup.
- **MLD startup query count**—Number of MLD general queries that an MLD querier sends at startup.
- **MLD general query interval**—Interval at which an MLD querier sends MLD general queries to check for IPv6 multicast group members on the network.
- **MLD last listener query interval**—In MLDv1, it sets the interval at which a querier sends multicast-address-specific queries after receiving a done message. In MLDv2, it sets the interval at which a querier sends multicast-address-and-source-specific queries after receiving a report that changes IPv6 multicast source and group mappings.
- **MLD last listener query count**—In MLDv1, it sets the number of multicast-address-specific queries that the querier sends after receiving a done message. In MLDv2, it sets the number of multicast-address-and-source-specific queries that the querier sends after receiving a report that changes IPv6 multicast group and source mappings.
- **MLD maximum response time**—Maximum time before a receiver responds with a report to an MLD general query. This per-group timer is initialized to a random value in the range of 0 to the maximum response time specified in the MLD query. When the timer value decreases to 0, the receiver sends an MLD report to the group.

- **MLD other querier present timer**—Lifetime for an MLD querier after a non-querier receives an MLD general query. If the non-querier does not receive a new query when this timer expires, the non-querier considers that the querier has failed and starts a new querier election.

Restrictions and guidelines

- To avoid frequent MLD querier changes, set the MLD other querier present timer greater than the MLD general query interval. In addition, configure the same MLD other querier present timer for all MLD devices on the same subnet.
- To speed up the response to MLD queries and avoid simultaneous timer expirations that cause MLD report traffic bursts, you must set an appropriate maximum response time.
  - For MLD general queries, the maximum response time is set by the **max-response-time** command.
  - For MLD multicast-address-specific queries or MLD multicast-address-and-source-specific queries, the maximum response time equals the MLD last listener query interval.
- You can configure MLD query and response parameters globally for all interfaces in MLD view or for an interface in interface view. The interface-specific configuration takes priority over the global configuration.

Configuring the MLD query and response parameters globally

1. Enter system view.

   system-view

2. Enter MLD view.

   mld

3. Set the MLD querier's robustness variable.

   robust-count *count*

   By default, the MLD querier's robustness variable is 2.

4. Set the MLD startup query interval.

   startup-query-interval *interval*

   By default, the MLD startup query interval is equal to one quarter of the MLD general query interval.

5. Set the MLD startup query count.

   startup-query-count *count*

   By default, the MLD startup query count is equal to the MLD querier's robustness variable.

6. Set the MLD general query interval.

   query-interval *interval*

   By default, the MLD general query interval is 125 seconds.

7. Set the MLD last listener query interval.

   last-listener-query-interval *interval*

   By default, the MLD last listener query interval is 1 second.

8. Set the MLD last listener query count.

   last-listener-query-count *count*

   By default, the MLD last listener query count is equal to the MLD querier's robustness variable.

9. Set the maximum response time for MLD general queries.

   max-response-time *time*

   By default, the maximum response time for MLD general queries is 10 seconds.

10. Set the MLD other querier present timer.

    other-querier-present-timeout *time*

By default, the MLD other querier present timer is calculated by using the following formula:
[MLD general query interval] × [MLD robustness variable] + [maximum response time for
MLD general queries] / 2.

Configuring the MLD query and response parameters on an interface

1. Enter system view.

   system-view

2. Enter interface view.

   interface *interface-type interface-number*

3. Set the MLD querier's robustness variable.

   mld robust-count *count*

   By default, the MLD querier's robustness variable is 2.

4. Set the MLD startup query interval.

   mld startup-query-interval *interval*

   By default, the MLD startup query interval is equal to one quarter of the MLD general query
   interval.

5. Set the MLD startup query count.

   mld startup-query-count *count*

   By default, the MLD startup query count is equal to the MLD querier's robustness variable.

6. Set the MLD general query interval.

   mld query-interval *interval*

   By default, the MLD general query interval is 125 seconds.

7. Set the MLD last listener query interval.

   mld last-listener-query-interval *interval*

   By default, the MLD last listener query interval is 1 second.

8. Set the MLD last listener query count.

   mld last-listener-query-count *count*

   By default, the MLD last listener query count is equal to the MLD querier's robustness variable.

9. Set the maximum response time for MLD general queries.

   mld max-response-time *time*

   By default, the maximum response time for MLD general queries is 10 seconds.

10. Set the MLD other querier present timer.

    mld other-querier-present-timeout *time*

    By default, the MLD other querier present timer is calculated by using the following formula:
    [MLD general query interval] × [MLD robustness variable] + [maximum response time for
    MLD general queries] / 2.

Enabling fast-leave processing

About fast-leave processing

This feature enables an MLD querier to send leave notifications to the upstream without sending
multicast-address-specific or multicast-address-and-source-specific queries after receiving a done
message. Use this feature to reduce leave latency and to preserve the network bandwidth.

Procedure

1. Enter system view.

   system-view

2. Enter interface view.

   interface *interface-type interface-number*

3. Enable fast-leave processing.

   mld fast-leave [**group-policy** *ipv6-acl-number*]

   By default, fast-leave processing is disabled.

Configuring MLD SSM mappings

About MLD SSM mappings

This feature enables the device to provide SSM services for MLDv1 hosts.

Restrictions and guidelines

This feature does not process MLDv2 messages. Enable MLDv2 on the receiver-side interface to ensure that MLDv2 reports from MLDv2 receiver hosts can be processed.

Procedure

1. Enter system view.

   system-view

2. Enter MLD view.

   mld

3. Configure an MLD SSM mapping.

   ssm-mapping *ipv6-source-address ipv6-acl-number*

Configuring MLD proxying

Prerequisites for MLD proxying

Before you configure MLD proxying, determine the router interfaces and host interface based on the network topology. Then, enable MLD on the router interfaces.

Enabling MLD proxying

Restrictions and guidelines

- Enable MLD proxying on the receiver-side interfaces.
- On an interface enabled with MLD proxying, only the **mld version** command takes effect and other MLD commands do not take effect.
- If you enable both MLD proxying and an IPv6 multicast routing protocol on the same device, the IPv6 multicast routing protocol does not take effect.

Procedure

1. Enter system view.

   system-view

2. Enter interface view.

   interface *interface-type interface-number*

3. Enable MLD proxying.

   mld proxy enable

By default, MLD proxying is disabled.

Enabling IPv6 multicast forwarding on a non-querier interface

About IPv6 multicast forwarding capability of non-querier interfaces

Typically, only MLD queriers can forward IPv6 multicast traffic and non-queriers cannot. This prevents IPv6 multicast data from being repeatedly forwarded. If a router interface on the MLD proxy failed the querier election, enable IPv6 multicast forwarding on the interface to forward IPv6 multicast data to downstream receivers.

Restrictions and guidelines

A shared-media network might have multiple MLD proxies, including one proxy acting as a querier. To avoid duplicate IPv6 multicast traffic, do not enable IPv6 multicast forwarding on any of the non-querier MLD proxies for the network.

Procedure

1. Enter system view.

    system-view

2. Enter interface view.

    interface *interface-type interface-number*

3. Enable IPv6 multicast forwarding on a non-querier interface.

    mld proxy forwarding

    By default, IPv6 multicast forwarding is disabled on a non-querier interface.

Enabling IPv6 multicast load splitting for MLD proxy interfaces

About enabling IPv6 multicast load splitting for MLD proxy interfaces

If multiple MLD proxy interfaces exist on the device, only the proxy interface with the highest IP address forwards IPv6 multicast traffic. You can enable IPv6 multicast load splitting on the device so that all the proxy interfaces can share IPv6 multicast traffic.

Procedure

1. Enter system view.

    system-view

2. Enter MLD view.

    mld

3. Enable IPv6 multicast load splitting for MLD proxy interfaces.

    proxy multipath

    By default, IPv6 multicast load splitting is disabled for MLD proxy interfaces.

Enabling MLD NSR

About MLD NSR

This feature backs up information about MLD interfaces and MLD multicast groups to the standby process. The device recovers the information without cooperation of other devices when an active/standby switchover occurs. Use this feature to prevent an active/standby switchover from affecting the IPv6 multicast service.

Procedure

1. Enter system view.

   system-view

2. Enable MLD NSR.

   mld non-stop-routing

   By default, MLD NSR is disabled.

Setting the DSCP value for outgoing MLD protocol packets

About the DSCP value for outgoing MLD protocol packets

The DSCP value determines the packet transmission priority. A greater DSCP value represents a higher priority.

Procedure

1. Enter system view.

   system-view

2. Enter MLD view.

   mld

3. Set the DSCP value for outgoing MLD protocol packets.

   dscp *dscp-value*

   By default, the DSCP value is 48 for outgoing MLD protocol packets.

Display and maintenance commands for MLD

> △ **CAUTION:**
> The **reset mld group** command might cause IPv6 multicast data transmission failures.

Execute **display** commands in any view and **reset** commands in user view.

Task	Command
Display information about MLD multicast groups.	**display mld group** [*ipv6-group-address* | **interface** *interface-type interface-number*] [**static** | **verbose**]
Display MLD information for interfaces.	**display mld interface** [*interface-type interface-number*] [**proxy**] [**verbose**]
Display IPv6 multicast routing entries maintained by the MLD proxy.	**display mld proxy group** [*ipv6-group-address* | **interface** *interface-type interface-number*] [**verbose**]
Display information about the MLD proxy routing table.	**display mld proxy routing-table** [*ipv6-source-address* [*prefix-length*] | *ipv6-group-address* [*prefix-length*]] * [**verbose**]

Task	Command
Display MLD SSM mappings.	`display mld ssm-mapping` *ipv6-group-address*
Clear dynamic MLD multicast group entries.	`reset mld group` { `all` | `interface` *interface-type interface-number* { `all` | *ipv6-group-address* [*prefix-length*] [*ipv6-source-address* [*prefix-length*]] } }

MLD configuration examples

## Example: Configuring basic MLD features

Network configuration

As shown in Figure 5:

- OSPFv3 and IPv6 PIM-DM run on the network.
- VOD streams are sent to receiver hosts in multicast. Receiver hosts of different organizations form stub networks N1 and N2. Host A and Host C are multicast receiver hosts in N1 and N2, respectively.
- MLDv1 runs between Switch A and N1, and between the other two switches (Switch B and Switch C) and N2.
- Switch A acts as the MLD querier in N1. Switch B acts as the MLD querier in N2 because it has a lower IPv6 address.

Configure the switches to meet the following requirements:

- The hosts in N1 can join only IPv6 multicast group FF1E::101.
- The hosts in N2 can join any IPv6 multicast groups.

Figure 5 Network diagram
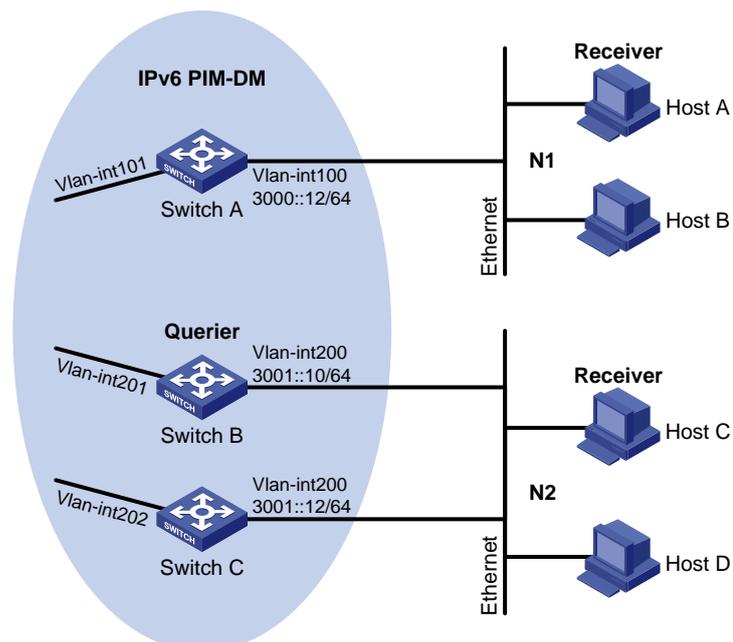
Procedure

1. Assign an IPv6 address and prefix length to each interface, as shown in Figure 5. (Details not shown.)

2. Configure OSPFv3 on the switches in the IPv6 PIM-DM domain. (Details not shown.)

3. Enable the IPv6 multicast routing, MLD, and IPv6 PIM-DM:

   # On Switch A, enable IPv6 multicast routing.

   ```
   <SwitchA> system-view
   [SwitchA] ipv6 multicast routing
   [SwitchA-mrib6] quit
   ```

   # Enable MLD on VLAN-interface 100.

   ```
   [SwitchA] interface vlan-interface 100
   [SwitchA-Vlan-interface100] mld enable
   [SwitchA-Vlan-interface100] quit
   ```

   # Enable IPv6 PIM-DM on VLAN-interface 101.

   ```
   [SwitchA] interface vlan-interface 101
   [SwitchA-Vlan-interface101] ipv6 pim dm
   [SwitchA-Vlan-interface101] quit
   ```

   # On Switch B, enable IPv6 multicast routing.

   ```
   <SwitchB> system-view
   [SwitchB] ipv6 multicast routing
   [SwitchB-mrib6] quit
   ```

   # Enable MLD on VLAN-interface 200.

   ```
   [SwitchB] interface vlan-interface 200
   [SwitchB-Vlan-interface200] mld enable
   [SwitchB-Vlan-interface200] quit
   ```

   # Enable IPv6 PIM-DM on VLAN-interface 201.

   ```
   [SwitchB] interface vlan-interface 201
   [SwitchB-Vlan-interface201] ipv6 pim dm
   [SwitchB-Vlan-interface201] quit
   ```

   # On Switch C, enable IPv6 multicast routing.

   ```
   <SwitchC> system-view
   [SwitchC] ipv6 multicast routing
   [SwitchC-mrib6] quit
   ```

   # Enable MLD on VLAN-interface 200.

   ```
   [SwitchC] interface vlan-interface 200
   [SwitchC-Vlan-interface200] mld enable
   [SwitchC-Vlan-interface200] quit
   ```

   # Enable IPv6 PIM-DM on VLAN-interface 202.

   ```
   [SwitchC] interface vlan-interface 202
   [SwitchC-Vlan-interface202] ipv6 pim dm
   [SwitchC-Vlan-interface202] quit
   ```

4. Configure an IPv6 multicast group policy on Switch A so that the hosts connected to VLAN-interface 100 can join only IPv6 multicast group FF1E::101.

   ```
   [SwitchA] acl ipv6 basic 2001
   [SwitchA-acl-ipv6-basic-2001] rule permit source ff1e::101 128
   [SwitchA-acl-ipv6-basic-2001] quit
   [SwitchA] interface vlan-interface 100
   ```

```
    [SwitchA-Vlan-interface100] mld group-policy 2001
    [SwitchA-Vlan-interface100] quit
```

Verifying the configuration

Display MLD information for VLAN-interface 200 on Switch B.

```
[SwitchB] display mld interface vlan-interface 200
 Vlan-interface200(FE80::200:5EFF:FE66:5100):
   MLD is enabled.
   MLD version: 1
   Query interval for MLD: 125s
   Other querier present time for MLD: 255s
   Maximum query response time for MLD: 10s
   Querier for MLD: FE80::200:5EFF:FE66:5100 (This router)
 MLD groups reported in total: 1
```

Example: Configuring MLD SSM mapping

Network configuration

As shown in Figure 6:

- OSPFv3 runs on the network.

- The IPv6 PIM-SM domain uses the SSM model for IPv6 multicast delivery. The SSM group range is FF3E::/64.

- MLDv2 runs on VLAN-interface 400 of Router D. The receiver host runs MLDv1, and does not support MLDv2. The receiver host cannot specify IPv6 multicast sources in its membership reports.

- Source 1, Source 2, and Source 3 send IPv6 multicast packets to multicast groups in IPv6 SSM group range FF3E::/64.

Configure the MLD SSM mapping feature on Switch D so that the receiver host will receive IPv6 multicast data only from Source 1 and Source 3.

Figure 6 Network diagram
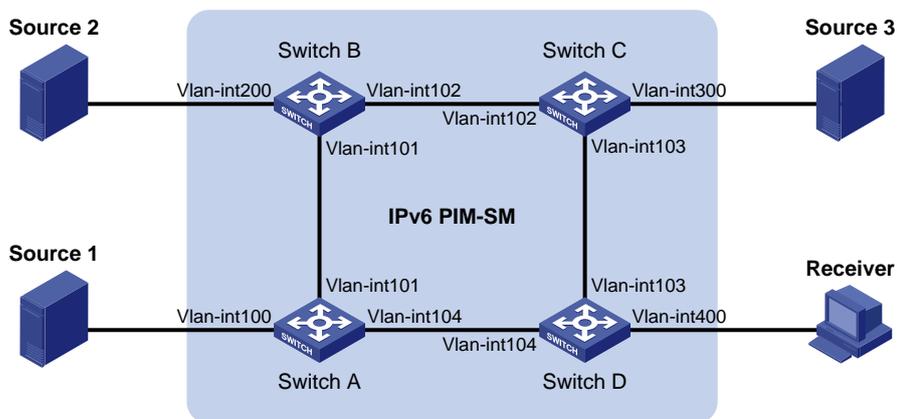
Table 1 Interface and IPv6 address assignment

Device	Interface	IPv6 address	Device	Interface	IPv6 address
Source 1	—	1001::1/64	Source 3	—	3001::1/64
Source 2	—	2001::1/64	Receiver	—	4001::1/64

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Device	Interface	IPv6 address	Device	Interface	IPv6 address
Switch A	Vlan-int100	1001::2/64	Switch C	Vlan-int300	3001::2/64
Switch A	Vlan-int101	1002::1/64	Switch C	Vlan-int103	3002::1/64
Switch A	Vlan-int104	1003::1/64	Switch C	Vlan-int102	2002::2/64
Switch B	Vlan-int200	2001::2/64	Switch D	Vlan-int400	4001::2/64
Switch B	Vlan-int101	1002::2/64	Switch D	Vlan-int103	3002::2/64
Switch B	Vlan-int102	2002::1/64	Switch D	Vlan-int104	1003::2/64

Procedure

1. Assign an IPv6 address and prefix length to each interface, as shown in Table 1. (Details not shown.)

2. Configure OSPFv3 on the switches in the IPv6 PIM-SM domain. (Details not shown.)

3. Enable IPv6 multicast routing, and enable IPv6 PIM-SM and MLD:

   # On Switch D, enable IPv6 multicast routing.

   ```
   <SwitchD> system-view
   [SwitchD] ipv6 multicast routing
   [SwitchD-mrib6] quit
   ```

   # Enable MLDv2 on the receiver-side interface (VLAN-interface 400).

   ```
   [SwitchD] interface vlan-interface 400
   [SwitchD-Vlan-interface400] mld enable
   [SwitchD-Vlan-interface400] mld version 2
   [SwitchD-Vlan-interface400] quit
   ```

   # Enable IPv6 PIM-SM on the other interfaces.

   ```
   [SwitchD] interface vlan-interface 103
   [SwitchD-Vlan-interface103] ipv6 pim sm
   [SwitchD-Vlan-interface103] quit
   [SwitchD] interface vlan-interface 104
   [SwitchD-Vlan-interface104] ipv6 pim sm
   [SwitchD-Vlan-interface104] quit
   ```

   # On Switch A, enable IPv6 multicast routing.

   ```
   <SwitchA> system-view
   [SwitchA] ipv6 multicast routing
   [SwitchA-mrib6] quit
   ```

   # Enable IPv6 PIM-SM on each interface.

   ```
   [SwitchA] interface vlan-interface 100
   [SwitchA-Vlan-interface100] ipv6 pim sm
   [SwitchA-Vlan-interface100] quit
   [SwitchA] interface vlan-interface 101
   [SwitchA-Vlan-interface101] ipv6 pim sm
   [SwitchA-Vlan-interface101] quit
   [SwitchA] interface vlan-interface 104
   [SwitchA-Vlan-interface104] ipv6 pim sm
   [SwitchA-Vlan-interface104] quit
   ```

   # Configure Switch B and Switch C in the same way Switch A is configured. (Details not shown.)

4. Configure the IPv6 SSM group range:

On Switch D, specify FF3E::/64 as the IPv6 SSM group range.

```
[SwitchD] acl ipv6 basic 2000
[SwitchD-acl-ipv6-basic-2000] rule permit source ff3e:: 64
[SwitchD-acl-ipv6-basic-2000] quit
[SwitchD] pim ipv6
[SwitchD-pim6] ssm-policy 2000
[SwitchD-pim6] quit
```

Configure Switch A, Switch B and Switch C in the same way Switch D is configured. (Details not shown.)

5. Configure MLD SSM mappings on Switch D.

```
[SwitchD] mld
[SwitchD-mld] ssm-mapping 1001::1 2000
[SwitchD-mld] ssm-mapping 3001::1 2000
[SwitchD-mld] quit
```

Verifying the configuration

Display MLD SSM mappings for IPv6 multicast group FF3E::101 on Switch D.

```
[SwitchD] display mld ssm-mapping ff3e::101
 Group: FF3E::101
 Source list:
        1001::1
        3001::1
```

On Switch D, display information about MLD multicast groups that hosts have dynamically joined.

```
[SwitchD] display mld group
MLD groups in total: 1
 Vlan-interface400(FE80::101):
  MLD groups reported in total: 1
   Group address: FF3E::101
    Last reporter: FE80::1
    Uptime: 00:02:04
    Expires: Off
```

Display IPv6 PIM routing entries on Switch D.

```
[SwitchD] display ipv6 pim routing-table
 Total 0 (*, G) entry; 2 (S, G) entry

 (1001::1, FF3E::101)
     Protocol: pim-ssm, Flag:
     UpTime: 00:13:25
     Upstream interface: Vlan-interface104
         Upstream neighbor: 1003::1
         RPF prime neighbor: 1003::1
     Downstream interface(s) information:
     Total number of downstreams: 1
         1: Vlan-interface400
             Protocol: mld, UpTime: 00:13:25, Expires: -

 (3001::1, FF3E::101)
     Protocol: pim-ssm, Flag:
```

```
UpTime: 00:13:25
Upstream interface: Vlan-interface103
    Upstream neighbor: 3002::1
    RPF prime neighbor: 3002::1
Downstream interface(s) information:
Total number of downstreams: 1
    1: Vlan-interface400
        Protocol: mld, UpTime: 00:13:25, Expires: -
```

Example: Configuring MLD proxying

Network configuration

As shown in Figure 7:

- IPv6 PIM-DM runs on the core network.
- Host A and Host C on the stub network receive VOD information destined to IPv6 multicast group FF3E::101.

Configure the MLD proxying feature on Switch B so that Switch B can maintain group memberships and forward IPv6 multicast traffic without running IPv6 PIM-DM.

Figure 7 Network diagram
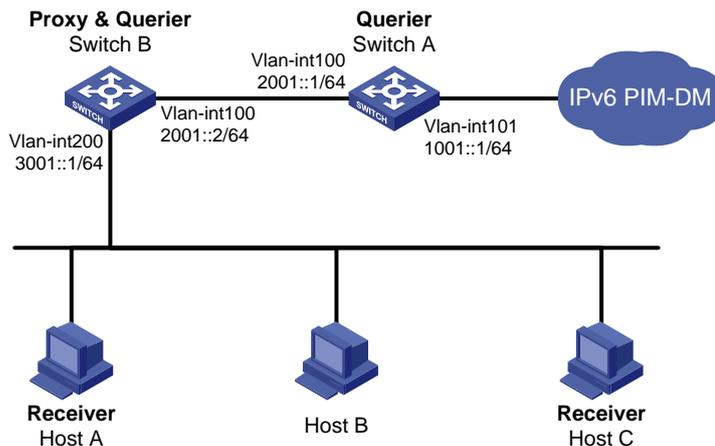
Procedure

1. Assign an IPv6 address and prefix length to each interface, as shown in Figure 7. (Details not shown.)

2. Enable IPv6 multicast routing, IPv6 PIM-DM, MLD, and MLD proxying:

   # On Switch A, enable IPv6 multicast routing.
   ```
   <SwitchA> system-view
   [SwitchA] ipv6 multicast routing
   [SwitchA-mrib6] quit
   ```
   # Enable IPv6 PIM-DM on VLAN-interface 101.
   ```
   [SwitchA] interface vlan-interface 101
   [SwitchA-Vlan-interface101] ipv6 pim dm
   [SwitchA-Vlan-interface101] quit
   ```
   # Enable MLD on VLAN-interface 100.
   ```
   [SwitchA] interface vlan-interface 100
   ```

```
[SwitchA-Vlan-interface100] mld enable
[SwitchA-Vlan-interface100] quit
```
On Switch B, enable IPv6 multicast routing.
```
<SwitchB> system-view
[SwitchB] multicast ipv6 routing-enable
[SwitchB-mrib6] quit
```
Enable MLD proxying on VLAN-interface 100.
```
[SwitchB] interface vlan-interface 100
[SwitchB-Vlan-interface100] mld proxying enable
[SwitchB-Vlan-interface100] quit
```
Enable MLD on VLAN-interface 200.
```
[SwitchB] interface vlan-interface 200
[SwitchB-Vlan-interface200] mld enable
[SwitchB-Vlan-interface200] quit
```

Verifying the configuration

Display IPv6 multicast group membership information maintained by the MLD proxy on Switch B.
```
[SwitchB] display mld proxy group
MLD proxy group records in total: 1
 Vlan-interface100(FE80::16:1):
  MLD proxy group records in total: 1
   Group address: FF1E::1
    Member state: Delay
    Expires: 00:00:02
```

Troubleshooting MLD

No member information exists on the receiver-side device

Symptom

When a host sends a message to announce that it is joining IPv6 multicast group G, no member information of multicast group G exists on the immediate device.

Solution

To resolve the problem:

1. Use the **display mld interface** command to verify that the networking, interface connections, and IP address configuration are correct.

2. Use the **display current-configuration** command to verify that the IPv6 multicast routing is enabled. If it is not enabled, use the **ipv6 multicast routing** command in system view to enable IPv6 multicast routing. In addition, verify that MLD is enabled on the associated interfaces.

3. Use the **display mld interface** command to verify that the MLD version on the interface is lower than that on the host.

4. Use the **display current-configuration interface** command to verify that no IPv6 multicast group policies have been configured to filter MLD reports for IPv6 multicast group G.

5. If the problem persists, contact H3C Support.

Inconsistent membership information on the devices on the same subnet

Symptom

Different memberships are maintained on different MLD devices on the same subnet.

Solution

To resolve the problem:

1. Use the **display current-configuration** command to verify the MLD information on the interface. Make sure the devices on the subnet have the same MLD settings on their interfaces.
2. Use the **display mld interface** command on all devices on the same subnet to check the MLD timers for inconsistent configurations.
3. Use the **display mld interface** command to verify that all devices are running the same MLD version.
4. If the problem persists, contact H3C Support.