IPv6 Ready

Multicast Listener Discovery Version 2
Router Conformance Test Suite

Technical Document

Revision 1.0.1

MODIFICATION RECORD

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The mistakes of description were modified.

- Test MLD.1.6:
  Eliminate Part C.
- Test MLD.2.19:
  Eliminate Part C.
  Add Part E, Part F.
- Test MLD.2.20:
  Eliminate all Parts (A-F).
- Test MLD.2.25, Observable Results:
  Part C Step 24: The Source Address [i] fields.
- Test MLD.2.27, Procedure:
  Part C Step 21: Change Packet
- Test MLD.2.27, Observable Results:
  Part A Step 8: The Source Address [i] fields.
- Test MLD.3.1, Procedure:
  Part G Step 38: Robustness Variable.
- Test MLD.3.3:
  Eliminate Part D, Part E.
- Test MLD.3.4, Observable Results:
  Part K Step 111: Existence of messages (addition).
  Part N Step 147: Existence of messages (addition).
- Test MLD.3.5, Observable Results:
  Part K Step 111: Existence of messages (addition).
  Part N Step 147: Existence of messages (addition).
- Test MLD.4.6, Observable Results:
  Part C Step 32: The Source Address [i] fields.
  Part D Step 42: The Source Address [i] fields.
- Test MLD.4.16, Observable Results:
  Part B Step 14: The Source Address [i] fields.
- Test MLD.4.19, Observable Results:
  Part K Step 106: The Source Address [i] fields.
  Part L Step 116: The Source Address [i] fields.

Part L Step 118: The Source Address [i] fields.
- Test MLD.4.23, Observable Results:
  Part C Step 24: The Source Address [i] fields.
- Test MLD.4.26, Observable Results:
  Part E Step 48: The count of messages.
  Part K Step 110: Existence of messages (deletion).
- Test MLD.4.27, Procedure:
  Part D Step 45: The addition of a procedure (wait).
- Test MLD.4.28, Observable Results:
  Part B Step 18: Existence of messages (addition).
- Test MLD.5.2, Procedure:
  Part B Step 15: The waiting time.
  Part F Step 51: The waiting time.
- Test MLD.5.3, Observable Results:
  Part D Step 32: Existence of messages (deletion).

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INTRODUCTION

Overview

The IPv6 forum plays a major role to bring together industrial actors, to develop and deploy the new generation of IP protocols. Contrary to IPv4, which started with a small closed group of implementers, the universality of IPv6 leads to a huge number of implementations. Interoperability has always been considered as a critical feature in the Internet community.

Due to the large number of IPv6 implementations, it is important to provide the market a strong signal proving the level of interoperability across various products.

To avoid confusion in the mind of customers, a globally unique logo programme should be defined. The IPv6 logo will give confidence to users that IPv6 is currently operational. It will also be a clear indication that the technology will still be used in the future. To summarize, this logo programme will contribute to the feeling that IPv6 is available and ready to be used.

The IPv6 Logo Program consists of three phases:

Phase I
In a first stage, the Logo will indicate that the product includes IPv6 mandatory core protocols and can interoperate with other IPv6 implementations.

Phase II
The "IPv6 ready" step implies a proper care, technical consensus and clear technical references. The IPv6 ready logo will indicate that a product has successfully satisfied strong requirements stated by the IPv6 Logo Committee (v6LC).

To avoid confusion, the logo "IPv6 Ready" will be generic. The v6LC will define the test profiles with associated requirements for specific functionalities.

Phase III
Same as Phase 2 with IPsec mandated.

Abbreviations and Acronyms

> HUT: Host Under Test
> NUT: Node Under Test
> RUT: Router Under Test
> TN: Testing Node
> TR: Testing Router

TEST ORGANIZATION

This document organizes tests by group based on related test methodology or goals. Each group begins with a brief set of comments pertaining to all tests within that group. This is followed by a series of description blocks; each block describes a single test. The format of the description block is as follows:

Test Label: The test label and title comprise the first line of the test block. The test label is composed by concatenating the short test suite name, the group number, and the test number within the group, separated by periods. The **Test Number** is the group and test number, also separated by a period.

Purpose: The Purpose is a short statement describing what the test attempts to achieve. It is usually phrased as a simple assertion of the feature or capability to be tested.

References: The References section lists cross-references to the specifications and documentation that might be helpful in understanding and evaluating the test and results.

Discussion: The Discussion is a general discussion of the test and relevant section of the specification, including any assumptions made in the design or implementation of the test as well as known limitations.

Requirement: The Requirement section specifies the function requested from implementation. In this document, it did not describe in each test item, but the Common Requirement has described.

Test Setup: The Test Setup section describes the configuration of all devices prior to the start of the test. Different parts of the procedure may involve configuration steps that deviate from what is given in the test setup. If a value is not provided for a protocol parameter, then the protocol's default is used for that parameter. In this document, it did not describe in each test item, but the Common Test Setup has described.

Procedure: This section of the test description contains the step-by-step instructions for carrying out the test. These steps include such things as enabling interfaces, unplugging devices from the network, or sending packet from a test station. The test procedure also cues the tester to make observations, which are interpreted in accordance with the observable results given for that test part.

Observable Results: This section lists observable results that can be examined by the tester to verify that the RUT is operating properly. When multiple observable results are possible, this section provides a short discussion on how to interpret them. The determination of a pass or fail for each test is usually based on how the NUT's behavior compares to the results described in this section.

Possible Problems: This section contains a description of known issues with the test procedure, which may affect test results in certain situations.

REFERENCES

The following documents are referenced in this text:

[MLD]   Multicast Listener Discovery Version 2 (MLDv2) for IPv6, RFC 3810, June 2004.

[SSM]   Using Internet Group Management Protocol Version 3 (IGMPV3) and Multicast Listener Discovery Protocol 2 (MLDv2) for Source-Specific Multicast, RFC 4604 August 2006.

Timers and Default Values:

MLDv2 defines several timers and default values. For the purpose of testing, all configurable timers and values are set to their defaults, unless otherwise noted in the test description. These defaults are given here for reference, taken or calculated from RFC 3810:

Robustness Variable [RV]:   2

Query Interval [QI]:   125 seconds

Query Response Interval [QRI]:   100 tenths of a second (10 seconds)

Mulitcast Address Listeners Interval [MALI]:   260 seconds
                                                     [RV * QI + QRI]

Other Querier Present Interval [OQPT]:   255 seconds
                                                     [RV] * [QI] + 1/2 * [QRI]

Startup Query Interval [SQI]:   31.25 seconds
                                                     1/4 * [QI]

Startup Query Count [SQC]:   2
                                                     [RV]

Last Listener Query Interval [LLQI]:   10 tenths of a second (1 second)

Last Listener Query Count [LLQC]:   2
                                                     [RV]

Unsolicited Report Interval [URI]:   1 second

Last Listener Query Time [LLQT]:   2 seconds
                                                     [LLQI] * [LLQT]

Older Version Querier Present Timeout [OVQPT]:   260 seconds
                                                     [RV] * [QI] + [QRI]

Older Version Host Present Interval [OVHPT]:   260 seconds
                                                     [RV] * [QI] + [QRI]

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Common Requirement

To obtain the IPv6 Ready Logo for MLDv2 Router, the RUT must satisfy all of the following requirements.

Configuring Timers and Counters

Robustness Variable [RV]:   2 - 8
(See *Test MLD.1.2: Robustness Variable*)

Query Interval [QI]:   60 – 31744 seconds
(See *Test MLD.1.3: Query Interval,*
       Test MLD.1.5: Multicast Address Listener Interval)

Query Response Interval [QRI]:   10 - 128 seconds
(See *Test MLD.1.4: Query Response Interval*)

Last Listener Query Interval [LLQI]:   1 - 2 seconds
(See *Test MLD.1.6: Last Listener Query Timer*)

SSM-aware

The RUT should have a configuration option to set the SSM address range(s).
(See *GROUP 6: Source Specific Multicast*)

Multiple Interfaces

Some tests require multiple interfaces which the RUT has.
(See *Test MLD.1.7: RUT has an interface in each link.,*
       Test MLD.1.8: RUT has two interfaces in same link.,
       Test MLD.5.4: MLDv1 Compatibility Mode Scope)

MLDv2 Fixed mode (Advanced Function)

The RUT may have a configuration switch to ignore Version 1 messages completely.
(See *Test MLD.5.5: MLDv2 fixed mode*)

Common Test Setup

Test in this test suite may refer common test setup procedure defined for this section.

Common Topology 1
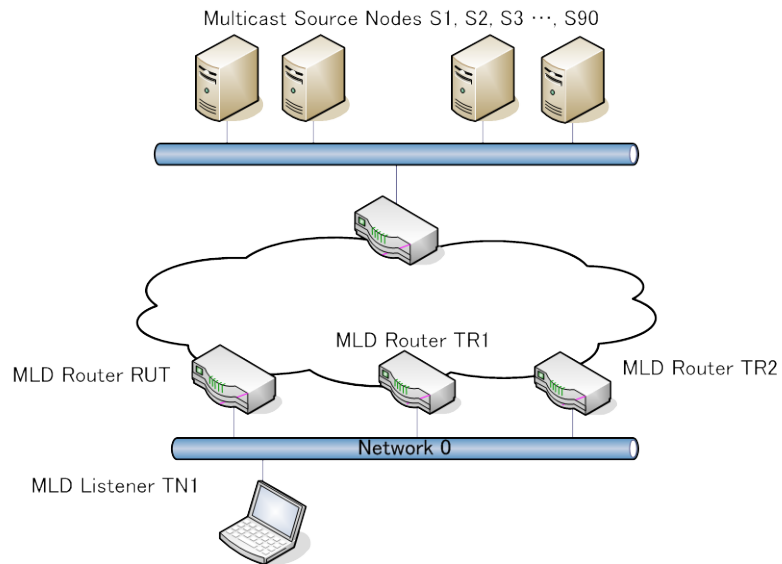
Common Topology 2

This topology is used by multiple interfaces test. Two interfaces of RUT are connected to Network 0 and Network 1 respectively.
(See *Test MLD.1.7: RUT has an interface in each link.* etc)
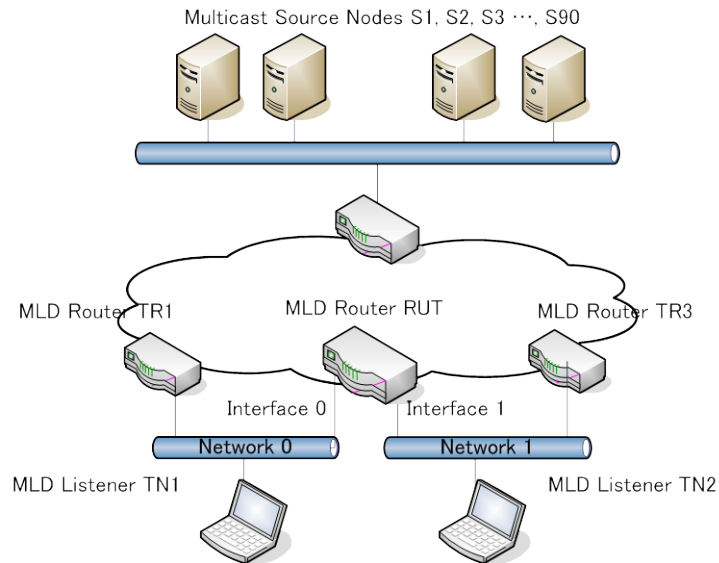
Common Topology 3

This topology is used by multiple interfaces test. Two interfaces of RUT are connected to Network 0.
(See *Test MLD.1.8: RUT has two interfaces in same link.*)
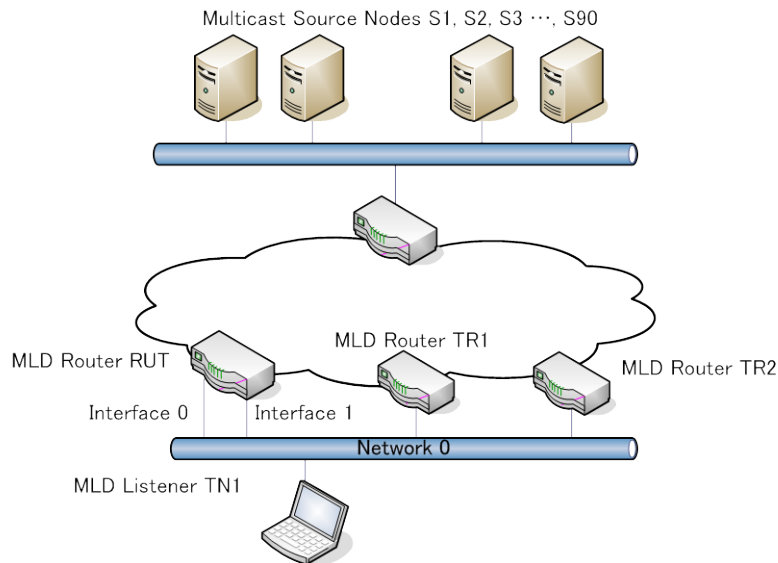
- Network
  - Network0: The network which RUT has connected.
  - Network1: The network which RUT has connected.
- Testing Router
  - TR1, TR2: MLDv1/MLDv2 Router on the Network 0.
    The priorities as a Querier are TR1, and TR2.
  - TR3: MLDv1/MLDv2 Router on the Network 1.
- Testing Host
  - TN1: MLDv1/MLDv2 Listener on the Network 0.
  - TN2: MLDv1/MLDv2 Listener on the Network 1.
- Multicast Address
  - M1: A multicast other than the SSM range.
  - M2: A multicast other than the SSM range.
  - SSM1: Head of the SSM range specified by [IANA].
  - SSM2: Bottom of the SSM range specified by [IANA].
  - SSM3: Head of the SSM range specified by configuration.
  - SSM4: Bottom of the SSM range specified by configuration.
- Multicast Source Node
  - S1, S2, S3, ⋯ S90: On foreign network.

Common Test Setup

Summary: This basic setup procedure configures the routers with the base MLDv2 setting for use with the Common Topology. Some tests may not utilize all nodes in the Common Test Setup. In those cases, disregard the un-used nodes.

1. Configure RUT to have:
   - Robustness Variable of 2
   - Query Interval of 125
   - Query Response Interval of 100 $1/10^{th}$ of a second (10 seconds)
   - Last Member Query Interval of 10 $1/10^{th}$ of a second (1 second)
2. Configure TR1, TR2, TR3, and TR4 to have:
   - Robustness Variable of 2
   - Query Interval of 125
   - Query Response Interval of 100 $1/10^{th}$ of a second (10 seconds)
   - Last Member Query Interval of 10 $1/10^{th}$ of a second (1 second)

Common Test Cleanup

Summary: The cleanup procedure causes the devices to remove any MLD information.

1. Disable MLD on all devices.
2. Return all timers and variables to their defaults values.
3. The Query Interval of RUT can be shortened to decrease time.

GROUP 1: Basic Functionality

Scope:

The following tests are designed to verify basic MLDv2 conformance on the RUT.

Overview:

These tests verify that the basic MLDv2 router functionalities are performed correctly on the RUT. These functionalities include value configuration, Querier Election, Report reception, Query transmission, MLDv2 security, and Router-Side Processing Suppression.

Test MLD.1.1: General Query

Purpose: To verify that an MLDv2 router properly accepts Query Interval configurations and to ensure an MLDv2 router transmits General Queries as expected.

References:

- [MLD] – 7. Description of the Protocol for Multicast Routers

  Multicast routers may themselves become multicast address listeners, and therefore also perform the multicast listener part of MLDv2, described in section 6.

- [MLD] – 7.1. Conditions for MLD Queries

  The Querier periodically sends General Queries to request Multicast Address Listener information from an attached link. These queries are used to build and refresh the Multicast Address Listener state of routers on attached links.

- [MLD] – 7.6.2. Querier Election

  When a router starts operating on a subnet, by default it considers itself as being the Querier. Thus, it sends several General Queries separated by a small time interval (see sections 9.6 and 9.7 for details).

- [MLD] – 9.6. Startup Query Interval

  The Startup Query Interval is the interval between General Queries sent by a Querier on startup. Default value: 1/4 the [Query Interval].

- [MLD] – 9.7. Startup Query Count

  The Startup Query Count is the number of Queries sent out on startup, separated by the Startup Query Interval. Default value: [Robustness Variable].

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Procedure:

1. Configure the default values of RFC as each variable on the RUT.
2. Boot the RUT.
3. Enable MLDv2 on the RUT.
4. Observe the packets on all networks.
5. Wait [QI] seconds.
6. Observe the packets on all networks.
7. Wait [QI] seconds.
8. Observe the packets on all networks.

Observable Results:

Step 4: The RUT must transmit 2 Reports with Multicast Address Record for RUT Solicited-Node Multicast address, T0_EX(), one second apart. The RUT must transmit 2 Reports with Multicast Address Record for FF02::2, TO_EX(), one second apart. The RUT must transmit 2 Reports with Multicast Address Record for FF02::16, TO_EX(), one second apart. Then, the RUT must transmit 2 General Queries 31.25 seconds apart with a Max Response Code 10000 or less, a QRV of 2 and a QQIC of 125.
Step 6: The RUT must transmit a General Query with a Max Response Code 10000 or less a QRV of 2 and QQIC of 125.
Step 8: The RUT must transmit a General Query with a Max Response Code 10000 or less a QRV of 2 and QQIC of 125.

Possible Problems:

- None.

Test MLD.1.2: Robustness Variable

Purpose: To verify that an MLD router properly configures the robustness variable.

References:

- [MLD] – 5.1.8. QRV (Querier's Robustness Variable)

   If non-zero, the QRV field contains the [Robustness Variable] value used by the Querier. If the Querier's [Robustness Variable] exceeds 7 (the maximum value of the QRV field), the QRV field is set to zero.

- [MLD] – 9.1. Robustness Variable

   The Robustness Variable allows tuning for the expected packet loss on a link. If a link is expected to be lossy, the value of the Robustness Variable may be increased. MLD is robust to [Robustness Variable] - 1 packet losses. The value of the Robustness Variable MUST NOT be zero, and SHOULD NOT be one. Default value: 2.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Procedure:

Part A: Robustness 3, Query Interval 60
1. Configure a Robustness Variable of 3 and a Query Interval of 60 on the RUT.
2. Enable MLDv2 on the RUT.
3. Observe the packets on all networks.
4. Wait [QI] seconds.
5. Observe the packets on all networks.
6. Wait [QI] seconds.
7. Observe the packets on all networks.
Part B: Exceed Query Robustness Variable
8. Configure a Robustness Variable of 8 and a Query Interval of 60 on the RUT.
9. Enable MLDv2 on the RUT.
10. Observe the packets on all networks.
11. Wait [QI] seconds.
12. Observe the packets on all networks.
13. Wait [QI] seconds.
14. Observe the packets on all networks.

Observable Results:

- *Part A*
   Step 3: The RUT must transmit 3 General Queries 15 seconds apart with a QRV of 3 and a QQIC of 60.
   Step 5: The RUT must transmit a General Query with a QRV of 3 and a QQIC of 60.
   Step 7: The RUT must transmit a General Query with a QRV of 3 and a QQIC of 60.

- *Part B*

      Step 10: The RUT must transmit 8 General Queries 15 seconds apart with a QRV of 0 and a QQIC of 60.

      Step 12: The RUT must transmit a General Query with a QRV of 0 and a QQIC of 60.

      Step 14: The RUT must transmit a General Query with a QRV of 0 and a QQIC of 60.

Possible Problems:

- None.

Test MLD.1.3: Query Interval

Purpose: To verify that an MLD router properly accepts Query Interval configurations and to verify Queries are transmitted.

References:

- [MLD] – 5.1.9. QQIC (Querier's Query Interval Code)

  The Querier's Query Interval Code field specifies the [Query Interval] used by the Querier. The actual interval, called the Querier's Query Interval (QQI), is represented in units of seconds, and is derived from the Querier's Query Interval Code as follows:

  If QQIC < 128, QQI = QQIC

  If QQIC >= 128, QQIC represents a floating-point value as follows:

  ```
   0 1 2 3 4 5 6 7
  +-+-+-+-+-+-+-+-+
  |1| exp | mant  |
  +-+-+-+-+-+-+-+-+
  ```
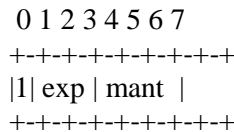
  $QQI = (mant \mid 0x10) << (exp + 3)$

- [MLD] – 9.2. Query Interval

  The Query Interval variable denotes the interval between General Queries sent by the Querier. Default value: 125 seconds.

  By varying the [Query Interval], an administrator may tune the number of MLD messages on the link; larger values cause MLD Queries to be sent less often.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Procedure:

Part A: Query Interval Below 128 seconds
  1. Configure a Query Interval of 127 seconds on the RUT.
  2. Enable MLDv2 on the RUT.
  3. Observe the packets on all networks.
  4. Wait [QI] seconds.
  5. Observe the packets on all networks.
  6. Wait [QI] seconds.
  7. Observe the packets on all networks.
Part B: Query Interval 128 Seconds
  8. Configure a Query Interval of 128 seconds on the RUT.
  9. Enable MLDv2 on the RUT.

10. Observe the packets on all networks.
11. Wait [QI] seconds.
12. Observe the packets on all networks.
13. Wait [QI] seconds.
14. Observe the packets on all networks.

Part C: Query Interval 160 Seconds
15. Configure a Query Interval of 160 seconds on the RUT.
16. Enable MLDv2 on the RUT.
17. Observe the packets on all networks.
18. Wait [QI] seconds.
19. Observe the packets on all networks.
20. Wait [QI] seconds.
21. Observe the packets on all networks.

Part D: Query Interval 164 Seconds
22. Configure a Query Interval of 164 seconds on the RUT.
23. Enable MLDv2 on the RUT.
24. Observe the packets on all networks.
25. Wait [QI] seconds.
26. Observe the packets on all networks.
27. Wait [QI] seconds.
28. Observe the packets on all networks.

Part E: Query Interval 31744 seconds
29. Configure a Query Interval of 31744 on the RUT.
30. Enable MLDv2 on the RUT.
31. Observe the packets on all networks.

Observable Results:

- *Part A*
  Step 3: The RUT must transmit 2 General Queries 31.75 seconds apart with a QRV of 2 and a QQIC of 127.
  Step 5: The RUT must transmit a General Query with a QRV of 2 and a QQIC of 127.
  Step 7: The RUT must transmit a General Query with a QRV of 2 and a QQIC of 127.
- *Part B*
  Step 10: The RUT must transmit 2 General Queries 32 seconds apart with a QRV of 2 and a QQIC of 128.
  Step 12: The RUT must transmit a General Query with a QRV of 2 and a QQIC of 128.
  Step 14: The RUT must transmit a General Query with a QRV of 2 and a QQIC of 128.
- *Part C*
  Step 17: The RUT must transmit 2 General Queries 40 seconds apart with a QRV of 2 and a QQIC of 132.
  Step 19: The RUT must transmit a General Query with a QRV of 2 and a QQIC of 132.
  Step 21: The RUT must transmit a General Query with a QRV of 2 and a QQIC of 132.
- *Part D*
  Step 24: The RUT must transmit 2 General Queries 41 seconds apart with a QRV of 2 and a QQIC of 132.
  Step 26: The RUT must transmit a General Query with a QRV of 2 and a QQIC of 132.
  Step 28: The RUT must transmit a General Query with a QRV of 2 and a QQIC of 132.
- *Part E*

Step 31: The RUT must transmit a General Queries with a QRV of 2 and a QQIC of 0xff.

Possible Problems:

- None.

Test MLD.1.4: Query Response Interval

Purpose: To verify that an MLDv2 router properly configures Query Response Interval.

References:

- [MLD] – 5.1.3. Maximum Response Code

  The Maximum Response Code field specifies the maximum time allowed before sending a responding Report. The actual time allowed, called the Maximum Response Delay, is represented in units of milliseconds, and is derived from the Maximum Response Code as follows:

  If Maximum Response Code < 32768,

     Maximum Response Delay = Maximum Response Code

  If Maximum Response Code >=32768, Maximum Response Code represents a

  floating-point value as follows:

  ```
   0 1 2 3 4 5 6 7 8 9 A B C D E F
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |1| exp |       mant        |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
  ```

  Maximum Response Delay = (mant | 0x1000) << (exp+3)

- [MLD] – 9. List of Timers, Counters, and their Default Values

  Most of these timers are configurable. If non-default settings are used, they MUST be consistent among all nodes on a single link. Note that parentheses are used to group expressions to make the algebra clear.

- [MLD] – 9.3. Query Response Interval

  The Maximum Response Delay used to calculate the Maximum Response Code inserted into the periodic General Queries. Default value: 10000 (10 seconds)

  By varying the [Query Response Interval], an administrator may tune the burstiness of MLD messages on the link; larger values make the traffic less bursty, as host responses are spread out over a larger interval. The number of seconds represented by the [Query Response Interval] must be less than the [Query Interval].

- [MLD] – 9.14.3. Maximum Response Delay

  The Maximum Response Delay may be dynamically calculated per Query by using the expected number of Reporters for that Query as follows:

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Procedure:

Part A: Query Response Interval 32767, Query Interval 132
1. Configure a Query Interval of 132 seconds and a Query Response Interval of 32767 milliseconds.
2. Enable MLDv2 on the RUT.
3. Observe the packets on all networks.
4. Wait [QI] seconds.
5. Observe the packets on all networks.

Part B: Query Response Interval 32768, Query Interval 132
6. Configure a Query Interval of 132 seconds and a Query Response Interval of 32768 milliseconds.
7. Enable MLDv2 on the RUT.
8. Observe the packets on all networks.
9. Wait [QI] seconds.
10. Observe the packets on all networks.

Part C: Query Response Interval 40000, Query Interval 160
11. Configure a Query Interval of 160 seconds and a Query Response Interval of 40000 milliseconds.
12. Enable MLDv2 on the RUT.
13. Observe the packets on all networks.
14. Wait [QI] seconds.
15. Observe the packets on all networks.

Part D: Query Response Interval 40007, Query Interval 161
16. Configure a Query Interval of 161 seconds and a Query Response Interval of 40007 milliseconds.
17. Enable MLDv2 on the RUT.
18. Observe the packets on all networks.
19. Wait [QI] seconds.
20. Observe the packets on all networks.

Part E: Query Response Interval 128000, Query Interval 512
21. Configure a Query Interval of 512 seconds and a Query Response Interval of 128000 milliseconds.
22. Enable MLDv2 on the RUT.
23. Observe the packets on all networks.
24. Wait [QI] seconds.
25. Observe the packets on all networks.

Observable Results:

- *Part A*

  Step 3: The RUT must transmit 2 General Query 33 seconds apart with a Max Response Code of 0x7fff or less, a QRV of 2 and QQIC of 132.
  Step 5: The RUT must transmit a General Query with a Max Response Code 0x7fff or less,

a QRV of 2 and a QQIC of 132.

- *Part B*

   Step 8: The RUT must transmit 2 General Query 33 seconds apart with a Max Response Code of 0x8000 or less, a QRV of 2 and QQIC of 132.
   Step 10: The RUT must transmit a General Query with a Max Response Code 0x8000 or less, a QRV of 2 and a QQIC of 132.

- *Part C*

   Step 13: The RUT must transmit 2 General Query 40 seconds apart with a Max Response Code of 0x8388 or less, a QRV of 2 and QQIC of 160.
   Step 15: The RUT must transmit a General Query with a Max Response Code 0x8388 or less, a QRV of 2 and a QQIC of 160.

- *Part D*

   Step 18: The RUT must transmit 2 General Query 40.25 seconds apart with a Max Response Code of 0x8388 or less, a QRV of 2 and QQIC of 161.
   Step 20: The RUT must transmit a General Query with a Max Response Code 0x8388 or less, a QRV of 2 and a QQIC of 161.

- *Part E*

   Step 23: The RUT must transmit 2 General Query 128 seconds apart with a Max Response Code of 0x9f40 or less, a QRV of 2 and QQIC of 512.
   Step 25: The RUT must transmit a General Query with a Max Response Code 0x9f40 or less, a QRV of 2 and a QQIC of 512.

Possible Problems:

- None.

Test MLD.1.5: Multicast Address Listener Interval

Purpose: To verify that an MLDv2 router properly processes Multicast Address Listener Interval.

References:

- [MLD] – 7.2.2. Definition of Filter Timers

  The Filter Timer is only used when the router is in EXCLUDE mode for a specific multicast address, and it represents the time for the Router Filter Mode of the multicast address to expire and switch to INCLUDE mode. A Filter Timer is a decrementing timer with a lower bound of zero. One Filter Timer exists per multicast address record. Filter Timers are updated according to the types of Multicast Address Records received.

  If a Filter Timer expires, with the Router Filter Mode for that multicast address being EXCLUDE, it means that there are no more listeners in EXCLUDE mode on the attached link. At this point, the router transitions to INCLUDE filter mode. Section 7.5 describes the actions taken when a Filter Timer expires while in EXCLUDE mode.

- [MLD] – 7.2.3. Definition of Source Timers

  A Source Timer is a decrementing timer with a lower bound of zero. One Source Timer is kept per source record. Source timers are updated according to the type and filter mode of the Multicast Address Record received. Section 7.4 describes the setting of source timers per type of Multicast Address Records received.

  …

  If the router is in INCLUDE filter mode, a source can be added to the current Include List if a listener in INCLUDE mode sends a Current State or a State Change Report which includes that source. Each source from the Include List is associated with a source timer that is updated whenever a listener in INCLUDE mode sends a report that confirms its interest in that specific source. If the timer of a source from the Include List expires, the source is deleted from the Include List. If there are no more source records left, the multicast address record is deleted from the router.

- [MLD] – 7.4.1. Reception of Current State Records

  Router State   Report Received New Router State   Actions
  ------------   --------------- ----------------   -------

  INCLUDE (A)   IS_IN (B)   INCLUDE (A+B)   (B)=MALI

  INCLUDE (A)   IS_EX (B)   EXCLUDE (A*B, B-A) (B-A)=0
                                                                     Delete (A-B)
                                                                       Filter Timer=MALI

- [MLD] – 7.4.2. Reception of Filter Mode Change and Source List Change Records

```
Router State   Report Received  New Router State    Actions
------------   ---------------  ----------------    -------

INCLUDE (A)    TO_IN (B)        INCLUDE (A+B)       (B)=MALI
                                                    Send Q(MA,A-B)

EXCLUDE (X,Y)  TO_IN (A)        EXCLUDE (X+A,Y-A)   (A)=MALI
                                                    Send Q(MA,X-A)
                                                    Send Q(MA)
```

- [MLD] – 7.5. Switching Router Filter Modes

  The Filter Timer is used as a mechanism for transitioning the Router Filter Mode from EXCLUDE to INCLUDE.

  When a Filter Timer expires with a Router Filter Mode of EXCLUDE, a router assumes that there are no nodes with a *filter mode* of EXCLUDE present on the attached link. Thus, the router transitions to INCLUDE filter mode for the multicast address.

- [MLD] – 9.4. Multicast Address Listening Interval

  The Multicast Address Listening Interval (MALI) is the amount of time that must pass before a multicast router decides there are no more listeners of a multicast address or a particular source on a link. This value MUST be ([Robustness Variable] times [Query Interval]) plus [Query Response Interval].

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A

| IPv6 Header |
| Source Address: TN1's Link-local Address |
| Destination Address: FF02::16 |
| Router Alert |
| MLDv2 Report |
| Multicast Address Record: M1, IS_EX () |

Report B

| IPv6 Header |
| Source Address: TN1's Link-local Address |
| Destination Address: FF02::16 |
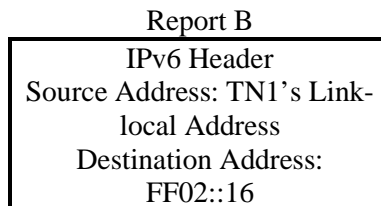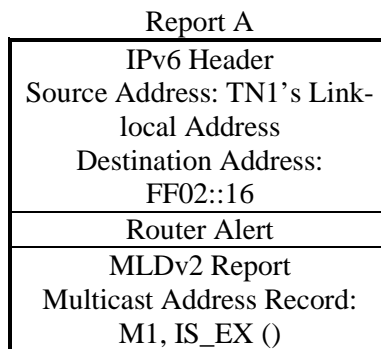
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN ()

Report C

IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S1)

Procedure:

Part A: Default MALI of RFC, Before Filter Timer Expires
1. Configure the default values on the RUT.
2. Enable MLDv2 on the RUT.
3. Observe the packets on all networks.
4. TN1 transmits Report A.
5. Observe the packets on all networks.
6. Wait [MALI-LLQT-∝] seconds.
7. TN1 transmits Report B.
8. Observe the packets on all networks.

Part B: Default MALI of RFC, After Filter Timer Expires
9. Configure the default values on the RUT.
10. Enable MLDv2 on the RUT.
11. Observe the packets on all networks.
12. TN1 transmits Report A.
13. Observe the packets on all networks.
14. Wait [MALI] seconds.
15. TN1 transmits Report B.
16. Observe the packets on all networks.

Part C: Configure MALI, Before Filter Timer Expires
17. Configure a Robustness Variable of 3 and a Query Interval of 60 on the RUT.
18. Enable MLDv2 on the RUT.
19. Observe the packets on all networks.
20. TN1 transmits Report A.
21. Observe the packets on all networks.
22. Wait [MALI-LLQT-∝] seconds.
23. TN1 transmits Report B.
24. Observe the packets on all networks.

Part D: Configure MALI, After Filter Timer Expires
25. Configure a Robustness Variable of 3 and a Query Interval of 60 on the RUT.
26. Enable MLDv2 on the RUT.

27. Observe the packets on all networks.
28. TN1 transmits Report A.
29. Observe the packets on all networks.
30. Wait [MALI] seconds.
31. TN1 transmits Report B.
32. Observe the packet on all networks.

Part E: Updating Filter Timer, Before Timer Expires
33. Configure a Query Interval of 60 on the RUT.
34. Enable MLDv2 on the RUT.
35. Observe the packets on all networks.
36. TN1 transmits Report A.
37. Observe the packets on all networks.
38. Wait [QI] seconds.
39. TN1 transmits Report A.
40. Observe the packets on all networks.
41. Wait [MALI-LLQT-∝] seconds.
42. TN1 transmits Report B.
43. Observe the packets on all networks.

Part F: Updating Filter Timer, After Timer Expires
44. Configure a Query Interval of 60 on the RUT.
45. Enable MLDv2 on the RUT.
46. Observe the packets on all networks.
47. TN1 transmits Report A.
48. Observe the packets on all networks.
49. Wait [QI] seconds.
50. TN1 transmits Report A.
51. Observe the packets on all networks.
52. Wait [MALI] seconds.
53. TN1 transmits Report B.
54. Observe the packets on all networks.

Part G: Default MALI, Before Source Timer Expires
55. Configure the default values on the RUT.
56. Enable MLDv2 on the RUT.
57. Observe the packets on all networks.
58. TN1 transmits Report C.
59. Observe the packets on all networks.
60. Wait [MALI-LLQT-∝] seconds.
61. TN1 transmits Report B.
62. Observe the packets on all networks.

Part H: Default MALI, After Source Timer Expires
63. Configure the default values on the RUT.
64. Enable MLDv2 on the RUT.
65. Observe the packets on all networks.
66. TN1 transmits Report C.
67. Observe the packets on all networks.
68. Wait [MALI] seconds.
69. TN1 transmits Report B.
70. Observe the packets on all networks.

Part I: Configure MALI, Before Source Timer Expires

---

71. Configure a Query Interval of 60 and Robustness Variable of 3 on the RUT.
72. Enable MLDv2 on the RUT.
73. Observe the packets on all networks.
74. TN1 transmits Report C.
75. Observe the packets on all networks.
76. Wait [MALI-LLQT-∝] seconds.
77. TN1 transmits Report B.
78. Observe the packets on all networks.

Part J: Configure MALI, After Source Timer Expires
79. Configure a Query Interval of 60 and Robustness Variable of 3 on the RUT.
80. Enable MLDv2 on the RUT.
81. Observe the packets on all networks.
82. TN1 transmits Report C.
83. Observe the packets on all networks.
84. Wait [MALI] seconds.
85. TN1 transmits Report B.
86. Observe the packets on all networks.

Part K: Update Source Timer, Before Timer Expires
87. Configure a Query Interval of 60 on the RUT.
88. Enable MLDv2 on the RUT.
89. Observe the packets on all networks.
90. TN1 transmits Report C.
91. Observe the packets on all networks.
92. Wait [QI] seconds.
93. TN1 transmits Report C.
94. Observe the packets on all networks.
95. Wait [MALI-LLQT-∝] seconds.
96. TN1 transmits Report B.
97. Observe the packets on all networks.

Part L: Update Source Timer, After Timer Expires
98. Configure a Query Interval of 60 on the RUT.
99. Enable MLDv2 on the RUT.
100. Observe the packets on all networks.
101. TN1 transmits Report C.
102. Observe the packets on all networks.
103. Wait [QI] seconds.
104. TN1 transmits Report C.
105. Observe the packets on all networks.
106. Wait [MALI] seconds.
107. TN1 transmits Report B.
108. Observe the packets on all networks.

Observable Results:

- *Part A*
  Step 3: The RUT must transmit 2 General Queries 31.25 seconds apart with a QRV of 2 and a QQIC of 125.
  Step 5: The RUT must not transmit Queries other then periodic General Queries.
  Step 8: The RUT must transmit 2 Queries Multicast Address Specific Queries with

Multicast Address of M1 1 second apart with a QRV of 2 and QQIC of 125.

- *Part B*

   Step 11: The RUT must transmit 2 General Queries 31.25 seconds apart with a QRV of 2 and a QQIC of 125.
   Step 13: The RUT must not transmit Queries other then periodic General Queries.
   Step 16: The RUT must not transmit Queries other then periodic General Queries.

- *Part C*

   Step 19: The RUT must transmit 3 General Queries 15 seconds apart with a QRV of 3 and a QQIC of 60.
   Step 21: The RUT must not transmit Queries other then periodic General Queries.
   Step 24: The RUT must transmit 3 Multicast Address Specific Queries with a Multicast Address of M1 1 second apart with a QRV of 3 and a QQIC of 60.

- *Part D*

   Step 27: The RUT must transmit 3 General Queries 15 seconds apart with a QRV of 3 and a QQIC of 60.
   Step 29: The RUT must not transmit Queries other then periodic General Queries.
   Step 32: The RUT must not transmit Queries other then periodic General Queries.

- *Part E*

   Step 35: The RUT must transmit 2 General Queries 15 seconds apart with a QRV of 2 and a QQIC of 60.
   Step 37: The RUT must not transmit Queries other then periodic General Queries.
   Step 40: The RUT must not transmit Queries other then periodic General Queries.
   Step 43: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 1 seconds apart with a QRV of 2 and QQIC of 60.

- *Part F*

   Step 46: The RUT must transmit 2 General Queries 15 seconds apart with a QRV of 2 and a QQIC of 60.
   Step 48: The RUT must not transmit Queries other then periodic General Queries.
   Step 51: The RUT must not transmit Queries other then periodic General Queries.
   Step 54: The RUT must not transmit Queries other then periodic General Queries.

- *Part G*

   Step 57: The RUT must transmit 2 General Queries 31.25 seconds apart with a QRV of 2 and a QQIC of 125.
   Step 59: The RUT must not transmit Queries other then periodic General Queries.
   Step 62: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and Source Address of S1 1 second apart with a Max Response Code of 1000 or less, a QRV of 2 and QQIC of 125.

- *Part H*

   Step 65: The RUT must transmit 2 General Queries 31.25 seconds apart with a QRV of 2 and a QQIC of 125.
   Step 67: The RUT must not transmit Queries other then periodic General Queries..
   Step 70: The RUT must not transmit Queries other then periodic General Queries.

- *Part I*

   Step 73: The RUT must transmit 3 General Queries 15 seconds apart with a QRV of 3 and a QQIC of 60.
   Step 75: The RUT must not transmit Queries other then periodic General Queries.
   Step 78: The RUT must transmit 3 Multicast Address and Source Specific Queries with a Multicast Address of M1 and Source Address of S1 1 seconds apart with a QRV of 3 and a QQIC of 60.

- *Part J*
  Step 81: The RUT must transmit 3 General Queries 15 seconds apart with a QRV of 3 and a QQIC of 60.
  Step 83: The RUT must not transmit Queries other then periodic General Queries.
  Step 86: The RUT must not transmit Queries other then periodic General Queries.
- *Part K*
  Step 89: The RUT must transmit 2 General Queries 15 seconds apart with a QRV of 2 and a QQIC of 60.
  Step 91: The RUT must not transmit Queries other then periodic General Queries.
  Step 94: The RUT must not transmit Queries other then periodic General Queries.
  Step 97: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and Source Address of S1 1 seconds apart with a QRV of 2 and a QQIC of 60.
- *Part L*
  Step 100: The RUT must transmit 2 General Queries 15 seconds apart with a QRV of 2 and a QQIC of 60.
  Step 102: The RUT must not transmit Queries other then periodic General Queries.
  Step 105: The RUT must not transmit Queries other then periodic General Queries.
  Step 108: The RUT must not transmit Queries other then periodic General Queries.

Possible Problems:

- None.

Test MLD.1.6: Last Listener Query Timer

Purpose: To verify that an MLDv2 router properly processes Last Listener Query Timer. (LLQT)

References:

- [MLD] – 7.6.3.1. Building and Sending Multicast Address Specific Queries

  The Querier must then immediately send a Multicast Address Specific query as well as schedule [Last Listener Query Count - 1] query retransmissions to be sent every [Last Listener Query Interval], over [Last Listener Query Time].

- [MLD] – 7.6.3.2. Building and Sending Multicast Address and Source Specific Queries

  When a table action "Send Q(MA,X)" is encountered by the Querier in the table in section 7.4.2, the following actions must be performed for each of the sources in X that send to multicast address MA, with source timer larger than LLQT:

  o Lower source timer to LLQT;

  o Add the sources to the Retransmission List;

  o Set the Source Retransmission Counter for each source to [Last Listener Query Count].

  The Querier must then immediately send a Multicast Address and Source Specific Query as well as schedule [Last Listener Query Count -1] query retransmissions to be sent every [Last Listener Query Interval], over [Last Listener Query Time].

- [MLD] – 9.8. Last Listener Query Interval

  The Last Listener Query Interval is the Maximum Response Delay used to calculate the Maximum Response Code inserted into Multicast Address Specific Queries sent in response to Version 1 Multicast Listener Done messages. It is also the Maximum Response Delay used to calculate the Maximum Response Code inserted into Multicast Address and Source Specific Query messages. Default value: 1000 (1 second).

  Note that for values of LLQI greater than 32.768 seconds, a limited set of values can be represented, corresponding to sequential values of Maximum Response Code. When converting a configured time to a Maximum Response Code value, it is recommended to use the exact value if possible, or the next lower value if the requested value is not exactly representable.

  This value may be tuned to modify the "leave latency" of the link. A reduced value results in reduced time to detect the departure of the last listener for a multicast address or source.

- [MLD] – 9.9. Last Listener Query Count

  The Last Listener Query Count is the number of Multicast Address Specific Queries sent before the router assumes there are no local listeners. The Last Listener Query Count is also the number of Multicast Address and Source Specific Queries sent before the router assumes there are no listeners for a particular source. Default value: [Robustness Variable].

- [MLD] – 9.10. Last Listener Query Time

  The Last Listener Query Time is the time value represented by the Last Listener Query Interval, multiplied by [Last Listener Query Count]. It is not a tunable value, but may be tuned by changing its components.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_EX ()

Report B

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN ()

Report C

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record:

M1, IS_IN (S1)

Report D

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record: M1, BLOCK (S1)

Procedure:

Part A: Default LLQT
1. Configure the default values on the RUT.
2. Enable MLDv2 on the RUT.
3. Observe the packets on all networks.
4. TN1 transmits Report A.
5. Observe the packets on all networks.
6. TN1 transmits Report B.
7. Observe the packets on all networks.
8. Wait [LLQI] seconds.
9. TN1 transmits Report B.
10. Observe the packets on all networks.

Part B: Robustness Variable and LLQI
11. Configure a LLQI of 2000 and RV of 3 on the RUT.
12. Enable MLDv2 on the RUT.
13. Observe the packets on all networks.
14. TN1 transmits Report A.
15. Observe the packets on all networks.
16. TN1 transmits Report B.
17. Observe the packets on all networks.
18. Wait [LLQI] seconds.
19. TN1 transmits Report B.
20. Observe the packets on all networks.

Part C:
   missing number

Part D: Source Specific Default LLQT
29. Configure the default values on the RUT.
30. Enable MLDv2 on the RUT.
31. Observe the packets on all networks.
32. TN1 transmits Report C.
33. Observe the packets on all networks.
34. TN1 transmits Report D.
35. Observe the packets on all networks.
36. Wait [LLQI] seconds.
37. TN1 transmits Report B.

38. Observe the packets on all networks.

Part E: Source Specific Robustness Variable and LLQI
39. Configure a LLQI of 2000 and RV of 3 on the RUT.
40. Enable MLDv2 on the RUT.
41. Observe the packets on all networks.
42. TN1 transmits Report C.
43. Observe the packets on all networks.
44. TN1 transmits Report D.
45. Observe the packets on all networks.
46. Wait [LLQI] seconds.
47. TN1 transmits Report B.
48. Observe the packets on all networks.

Part F: Source Specific Remaining time is below LLQT
49. Configure a Robustness Variable of 5 and a Query Interval of 60 seconds on the RUT.
50. Enable MLDv2 on the RUT.
51. Observe the packet on all networks.
52. TN1 transmits Report C.
53. Observe the packets on all networks.
54. Wait [MALI –LLQT] seconds.
55. TN1 transmits Report D.
56. Observe the packets on all networks.

Observable Results:

- *Part A*
  Step 3: The RUT must transmit 2 General Queries 31.25 seconds apart with a QRV of 2 and a QQIC of 125.
  Step 5: The RUT must not transmit Queries other then periodic General Queries.
  Step 7: The RUT must transmit 2 Multicast Address Specific Queries with a Multicast Address of M1 1 second apart with a Max Response Code of 1000 or less, a QRV of 2 and QQIC of 125.
  Step 10: The RUT must not transmit Queries other then periodic General Queries.
- *Part B*
  Step 13: The RUT must transmit 3 General Queries 31.25 seconds apart with a QRV of 3 and a QQIC of 125.
  Step 15: The RUT must not transmit Queries other then periodic General Queries.
  Step 17: The RUT must 3 Multicast Address Specific Queries with a Multicast Address of M1 2 seconds apart with a Max Response Code of 2000 or less, a QRV of 3 and a QQIC of 125.
  Step 20: The RUT must not transmit Queries other then periodic General Queries.
- *Part C*
  missing number
- *Part D*
  Step 31: The RUT must transmit 2 General Queries 31.25 seconds apart with a QRV of 2 and a QQIC of 125.
  Step 33: The RUT must not transmit Queries other then periodic General Queries.
  Step 35: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and Source Address of S1 1 second apart with a Max Response Code of 1000 or less, a QRV of 2 and QQIC of 125.

Step 38: The RUT must not transmit Queries other then periodic General Queries.

- *Part E*

    Step 41: The RUT must transmit 3 General Queries 31.25 seconds apart with a QRV of 3 and a QQIC of 125.
    Step 43: The RUT must not transmit Queries other then periodic General Queries.
    Step 45: The RUT must 3 Multicast Address and Source Specific Queries with a Multicast Address of M1 and Source Address of S1 2 seconds apart with a Max Response Code of 2000 or less, a QRV of 3 and a QQIC of 125.
    Step 48: The RUT must not transmit Queries other then periodic General Queries.

- *Part F*

    Step 51: The RUT must transmit 5 General Queries 15 seconds apart with a QRV of 5 and a QQIC of 60.
    Step 53: The RUT must not transmit Queries other then periodic General Queries.
    Step 56: The RUT must not transmit Queries other then periodic General Queries.

Possible Problems:

- None.

Test MLD.1.7: RUT has an interface in each link

Purpose: To verify that an MLDv2 router keeps state per multicast address per attached link.

References:

- [MLD] – 7.2. MLD State Maintained by Multicast Routers

  Multicast routers that implement the MLDv2 protocol keep state per multicast address per attached link. This multicast address state consists of a filter mode, a list of sources, and various timers. For each attached link on which MLD runs, a multicast router records the listening state for that link. That state conceptually consists of a set of records of the form:

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A
IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record:
M1, IS_IN (S1,S2)

Report B
IPv6 Header
Source Address: TN2's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record:
M1, IS_IN (S1,S3)

Report C
IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record:
M1, TO_IN ()

Report D
IPv6 Header
Source Address: TN2's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record:
M1, TO_IN ()

Report E
IPv6 Header
Source Address: TN2's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record:
M1, IS_IN (S1,S2)

Report F
IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record:
M1, BLOCK (S1)

Report G	Report H
IPv6 Header Source Address: TN2's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN2's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, BLOCK (S2)	MLDv2 Report Multicast Address Record: M1, BLOCK (S1)

Query A

IPv6 Header Source Address: TR1's Link-local Address Destination Address: FF02::1
Router Alert
MLD General Query Max Response Code: 10000 QRV: 2 QQIC: 125

Procedure:

Part A: Include list
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A on the Network 0.
4. Observe the packets on all networks.
5. TN2 transmits Report B on the Network 1.
6. Observe the packets on all networks.
7. TN1 transmits Report C on the Network 0.
8. Observe the packets on all networks.
9. TN2 transmits Report D on the Network 1.
10. Observe the packets on all networks.

Part B: Update
11. Enable MLDv2 on the RUT.
12. Observe the packets on all networks.
13. TN1 transmits Report A on the Network 0.
14. Observe the packets on all networks.
15. TN2 transmits Report E on the Network 1.
16. Observe the packets on all networks.
17. TN1 transmits Report F on the Network 0.
18. Observe the packets on all networks.
19. TN2 transmits Report G on the Network 1.
20. Observe the packets on all networks.

Part C: Querier election
21. Enable MLDv2 on the RUT.
22. Observe the packets on all networks.

23. TN1 transmits Report A on the Network 0.
24. Observe the packets on all networks.
25. TN2 transmits Report E on the Network 1.
26. Observe the packets on all networks.
27. TR1 transmits General Query A on the Network 0.
28. Observe the packets on all networks.
29. TN1 transmits Report F on the Network 0.
30. Observe the packets on all networks.
31. TN2 transmits Report H on the Network 1.
32. Observe the packets on all networks.

Observable Results:

- *Part A*
    Step 2: The RUT must transmit 2 MLDv2 General Queries on the Network 0. The RUT must transmit 2 MLDv2 General Queries on the Network 1.
    Step 4: The RUT must not transmit Queries other then periodic General Queries.
    Step 6: The RUT must not transmit Queries other then periodic General Queries.
    Step 8: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 on the Network 0.
    Step 10: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S3 on the Network 1.
- *Part B*
    Step 12: The RUT must transmit 2 MLDv2 General Queries on the Network 0. The RUT must transmit 2 MLDv2 General Queries on the Network 1.
    Step 14: The RUT must not transmit Queries other then periodic General Queries.
    Step 16: The RUT must not transmit Queries other then periodic General Queries.
    Step 18: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Addresses of S1 on the Network 0.
    Step 20: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Addresses of S2 on the Network 1.
- *Part C*
    Step 22: The RUT must transmit 2 MLDv2 General Queries on the Network 0. The RUT must transmit 2 MLDv2 General Queries on the Network 1.
    Step 24: The RUT must not transmit Queries other then periodic General Queries.
    Step 26: The RUT must not transmit Queries other then periodic General Queries.
    Step 28: The RUT must transmit a Report on the Network 0. The RUT must not transmit any Queries on the Network 0.
    Step 30: The RUT must not transmit any Queries on the Network 0.
    Step 32: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Addresses of S1 on the Network 1.

Possible Problems:

- None.

Test MLD.1.8: RUT has two interfaces in same link

Purpose: To verify that an MLDv2 router operates MLD router protocol over one of interfaces in the one link.

References:

- [MLD] – 2. Protocol Overview

  A multicast router performs the *router part* of the MLDv2 protocol (described in details in section 7) on each of its directly attached links. If a multicast router has more than one interface connected to the same link, it only needs to operate the protocol on one of those interfaces.

- [MLD] – 7. Description of the Protocol for Multicast Routers

  A multicast router performs the protocol described in this section over each of its directly attached links. If a multicast router has more than one interface to the same link, it only needs to operate this protocol over one of those interfaces.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A	Report B
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S1,S2)	MLDv2 Report Multicast Address Record: M1, BLOCK (S1)

Procedure:

1. Configure the RUT to have two interfaces on Network 0.
2. Enable MLDv2 on the RUT.
3. Observe the packets on all networks.
4. TN1 transmits Report A.
5. Observe the packets on all networks.
6. TN1 transmits Report B.
7. Observe the packets on all networks.

Observable Results:

Step 3: The RUT must transmit 2 MLDv2 General Queries from a priority interface.
Step 5: The RUT must not transmit Queries other then periodic General Queries.

Step 7: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 from a priority interface.

Possible Problems:

- None.

GROUP 2: Message Format

Scope:

The following tests are designed to verify that the MLDv2 Router properly formats MLDv2 Packets.

Overview:

These tests verify that the following MLDv2 packet types are properly formatted: General Queries, Group-Specific Queries, and Group-and-Source Specific Queries. In particular these test check the formats of the Checksum, Group Address, Reserved, Max Response Code, and Querier's Query Interval Code fields. These tests also verify that the MLDv2 Router validates the IP Destination, validates the checksum, and that the Router properly handles unrecognized codes. Finally, these test verify Additional Data, and Auxiliary Data report reception.

Test MLD.2.1: Transmitting General Query

Purpose: To verify that an MLDv2 router properly transmits MLDv2 General Query.

References:

- [MLD] – 5. Message Formats

  MLDv2 is a sub-protocol of ICMPv6, that is, MLDv2 message types are a subset of ICMPv6 messages, and MLDv2 messages are identified in IPv6 packets by a preceding Next Header value of 58. All MLDv2 messages described in this document MUST be sent with a link-local IPv6 Source Address, an IPv6 Hop Limit of 1, and an IPv6 Router Alert option [RFC2711] in a Hop-by-Hop Options header. (The Router Alert option is necessary to cause routers to examine MLDv2 messages sent to IPv6 multicast addresses in which the routers themselves have no interest.)

  o Multicast Listener Query (Type = decimal 130)

- [MLD] – 5.1.1. Code

  Initialized to zero by the sender; ignored by receivers.

- [MLD] – 5.1.2. Checksum

  The standard ICMPv6 checksum; it covers the entire MLDv2 message, plus a "pseudo-header" of IPv6 header fields [RFC2463]. For computing the checksum, the Checksum field is set to zero. When a packet is received, the checksum MUST be verified before processing it.

- [MLD] – 5.1.3. Maximum Response Code

  The Maximum Response Code field specifies the maximum time allowed before sending a responding Report. The actual time allowed, called the Maximum Response Delay, is represented in units of milliseconds, and is derived from the Maximum Response Code as follows:

- [MLD] – 5.1.4. Reserved

  Initialized to zero by the sender; ignored by receivers.

- [MLD] – 5.1.5. Multicast Address

  For a General Query, the Multicast Address field is set to zero. For a Multicast Address Specific Query or Multicast Address and Source Specific Query, it is set to the multicast address being queried (see section 5.1.10, below).

- [MLD] – 5.1.8. QRV (Querier's Robustness Variable)

  If non-zero, the QRV field contains the [Robustness Variable] value used by the Querier. If the Querier's [Robustness Variable] exceeds 7 (the maximum value of the QRV field), the QRV field is set to zero.

- [MLD] – 5.1.9. QQIC (Querier's Query Interval Code)

  The Querier's Query Interval Code field specifies the [Query Interval] used by the Querier. The actual interval, called the Querier's Query Interval (QQI), is represented in units of seconds, and is derived from the Querier's Query Interval Code as follows:

- [MLD] – 5.1.10. Number of Sources (N)

  The Number of Sources (N) field specifies how many source addresses are present in the Query. This number is zero in a General Query or a Multicast Address Specific Query, and non-zero in a Multicast Address and Source Specific Query.

- [MLD] – 5.1.12. Additional Data

  When sending a Query, an MLDv2 implementation MUST NOT include additional octets beyond the fields described above.

- [MLD] – 5.1.13. Query Variants

  o A "General Query" is sent by the Querier to learn which multicast addresses have listeners on an attached link. In a General Query, both the Multicast Address field and the Number of Sources (N) field are zero.

- [MLD] – 5.1.14. Source Addresses for Queries

  All MLDv2 Queries MUST be sent with a valid IPv6 link-local source address.

- [MLD] – 5.1.15. Destination Addresses for Queries

  In MLDv2, General Queries are sent to the link-scope all-nodes multicast address (FF02::1).

- [MLD] – 7.6.2. Querier Election

  All MLDv2 queries MUST be sent with the FE80::/64 link-local source address prefix.

- [MLD] – 9.1. Robustness Variable

  Default value: 2.

- [MLD] – 9.2. Query Interval

  Default value: 125 seconds

- [MLD] – 9.3. Query Response Interval

  Default value: 10000 (10 seconds)

- [MLD] – 9.14.3. Maximum Response Delay

  The burstiness of MLD traffic is inversely proportional to the Maximum Response Delay. A longer Maximum Response Delay will spread Report messages over a longer interval. However, a longer Maximum Response Delay in Multicast Address Specific and Multicast Address And Source Specific Queries extends the leave latency (the time between when the last listener stops listening to a source or multicast address and when the traffic stops flowing.) The expected rate of Report messages can be calculated by dividing the expected number of Reporters by the Maximum Response Delay. The Maximum Response Delay may be dynamically calculated per Query by using the expected number of Reporters for that Query as follows:

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Procedure:

1. Configure the RUT to use Default Variables for all fields.
2. Enable MLDv2 on the RUT.
3. Observe the packets on all networks.

Observable Results:

Step 3: The RUT must transmit a Query with the following values:

IPv6 Payload Length	36
IPv6 Next Header	0
IPv6 Hop Limit	1
IPv6 Source Address	RUT link-local address
IPv6 Destination Address	All nodes address
Hop-by-Hop Next Header	58
Router Alert Option	Included
Type	130
Code	0
Checksum	MUST be Valid
Maximum Response Code	1000 or less
Reserved Field	0
Reserved Field	0
Multicast Address	::
S Flag	false
QRV	2

QQIC	125
Number of Sources	0
Multicast Source Address	Not included
Additional Data	Not included

Possible Problems:

- None.

Test MLD.2.2: Transmitting Multicast Address Specific Query

Purpose: To verify that an MLDv2 router properly transmits a Multicast Address Specific Query.

References:

- [MLD] – 2.2. Exchanging Messages between the Querier and the Listening Nodes

  Protocol robustness is also enhanced through the use of the S flag (Suppress Router-Side Processing). As described above, when a Multicast Address Specific or a Multicast Address and Source Specific Query is sent by the Querier, a number of retransmissions of the query are scheduled. In the original (first) query the S flag is clear.

- [MLD] – 5. Message Formats

  MLDv2 is a sub-protocol of ICMPv6, that is, MLDv2 message types are a subset of ICMPv6 messages, and MLDv2 messages are identified in IPv6 packets by a preceding Next Header value of 58. All MLDv2 messages described in this document MUST be sent with a link-local IPv6 Source Address, an IPv6 Hop Limit of 1, and an IPv6 Router Alert option [RFC2711] in a Hop-by-Hop Options header. (The Router Alert option is necessary to cause routers to examine MLDv2 messages sent to IPv6 multicast addresses in which the routers themselves have no interest.)

  o Multicast Listener Query (Type = decimal 130)

- [MLD] – 5.1.1. Code

  Initialized to zero by the sender; ignored by receivers.

- [MLD] – 5.1.2. Checksum

  The standard ICMPv6 checksum; it covers the entire MLDv2 message, plus a "pseudo-header" of IPv6 header fields [RFC2463]. For computing the checksum, the Checksum field is set to zero. When a packet is received, the checksum MUST be verified before processing it.

- [MLD] – 5.1.3. Maximum Response Code

  The Maximum Response Code field specifies the maximum time allowed before sending a responding Report. The actual time allowed, called the Maximum Response Delay, is represented in units of milliseconds, and is derived from the Maximum Response Code as follows:

- [MLD] – 5.1.4. Reserved

  Initialized to zero by the sender; ignored by receivers.

- [MLD] – 5.1.5. Multicast Address

For a General Query, the Multicast Address field is set to zero. For a Multicast Address Specific Query or Multicast Address and Source Specific Query, it is set to the multicast address being queried (see section 5.1.10, below).

- [MLD] – 5.1.8. QRV (Querier's Robustness Variable)

If non-zero, the QRV field contains the [Robustness Variable] value used by the Querier. If the Querier's [Robustness Variable] exceeds 7 (the maximum value of the QRV field), the QRV field is set to zero.

- [MLD] – 5.1.9. QQIC (Querier's Query Interval Code)

The Querier's Query Interval Code field specifies the [Query Interval] used by the Querier. The actual interval, called the Querier's Query Interval (QQI), is represented in units of seconds, and is derived from the Querier's Query Interval Code as follows:

- [MLD] – 5.1.10. Number of Sources (N)

The Number of Sources (N) field specifies how many source addresses are present in the Query. This number is zero in a General Query or a Multicast Address Specific Query, and non-zero in a Multicast Address and Source Specific Query.

- [MLD] – 5.1.12. Additional Data

When sending a Query, an MLDv2 implementation MUST NOT include additional octets beyond the fields described above.

- [MLD] – 5.1.13. Query Variants

o A "General Query" is sent by the Querier to learn which multicast addresses have listeners on an attached link. In a General Query, both the Multicast Address field and the Number of Sources (N) field are zero.

- [MLD] – 5.1.14. Source Addresses for Queries

All MLDv2 Queries MUST be sent with a valid IPv6 link-local source address.

- [MLD] – 5.1.15. Destination Addresses for Queries

Multicast Address Specific and Multicast Address and Source Specific Queries are sent with an IP destination address equal to the multicast address of interest.

- [MLD] – 7.6.2. Querier Election

  All MLDv2 queries MUST be sent with the FE80::/64 link-local source address prefix.

- [MLD] – 9.1. Robustness Variable

  Default value: 2.

- [MLD] – 9.2. Query Interval

  Default value: 125 seconds

- [MLD] – 9.8. Last Listener Query Interval

  Default value: 1000 (1 second)

- [MLD] – 9.14.3. Maximum Response Delay

  The burstiness of MLD traffic is inversely proportional to the Maximum Response Delay. A longer Maximum Response Delay will spread Report messages over a longer interval. However, a longer Maximum Response Delay in Multicast Address Specific and Multicast Address And Source Specific Queries extends the leave latency (the time between when the last listener stops listening to a source or multicast address and when the traffic stops flowing.) The expected rate of Report messages can be calculated by dividing the expected number of Reporters by the Maximum Response Delay. The Maximum Response Delay may be dynamically calculated per Query by using the expected number of Reporters for that Query as follows:

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_EX ()

Report B

IPv6 Header Source Address: TN1's Link-local Address Destination Address:

FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN ()

Procedure:

1. Configure the RUT to use Default Variables for all fields.
2. Enable MLDv2 on the RUT.
3. Observe the packets on all networks.
4. TN1 transmits Report A.
5. Observe the packets on all networks.
6. TN1 transmits Report B.
7. Observe the packets on all networks.

Observable Results:

Step 3: The RUT must transmit 2 General Queries.
Step 5: The RUT must not transmit Queries other then periodic General Queries.
Step 7: The RUT must transmit 2 Multicast Address Specific Queries with the following values:

IPv6 Payload Length	36
IPv6 Next Header	0
IPv6 Hop Limit	1
IPv6 Source Address	RUT link-local address
IPv6 Destination Address	M1
Hop-by-Hop Next Header	58
Router Alert Option	Included
Type	130
Code	0
Checksum	Valid
Maximum Response Code	1000 or less
Reserved Field	0
Reserved Field	0
Multicast Address	M1 address
S Flag	false
QRV	2
QQIC	125
Number of Sources	0
Multicast Source Address	Not included
Additional Data	Not included

Possible Problems:

- None.

Test MLD.2.3: Transmitting Multicast Address and Source Specific Query

Purpose: To verify that an MLDv2 router properly transmits a Multicast Address and Source Specific Query.

References:

- [MLD] – 2.2. Exchanging Messages between the Querier and the Listening Nodes

   Protocol robustness is also enhanced through the use of the S flag (Suppress Router-Side Processing). As described above, when a Multicast Address Specific or a Multicast Address and Source Specific Query is sent by the Querier, a number of retransmissions of the query are scheduled. In the original (first) query the S flag is clear.

- [MLD] – 5. Message Formats

   MLDv2 is a sub-protocol of ICMPv6, that is, MLDv2 message types are a subset of ICMPv6 messages, and MLDv2 messages are identified in IPv6 packets by a preceding Next Header value of 58. All MLDv2 messages described in this document MUST be sent with a link-local IPv6 Source Address, an IPv6 Hop Limit of 1, and an IPv6 Router Alert option [RFC2711] in a Hop-by-Hop Options header. (The Router Alert option is necessary to cause routers to examine MLDv2 messages sent to IPv6 multicast addresses in which the routers themselves have no interest.)

   o Multicast Listener Query (Type = decimal 130)

- [MLD] – 5.1.1. Code

   Initialized to zero by the sender; ignored by receivers.

- [MLD] – 5.1.2. Checksum

   The standard ICMPv6 checksum; it covers the entire MLDv2 message, plus a "pseudo-header" of IPv6 header fields [RFC2463]. For computing the checksum, the Checksum field is set to zero. When a packet is received, the checksum MUST be verified before processing it.

- [MLD] – 5.1.3. Maximum Response Code

   The Maximum Response Code field specifies the maximum time allowed before sending a responding Report. The actual time allowed, called the Maximum Response Delay, is represented in units of milliseconds, and is derived from the Maximum Response Code as follows:

- [MLD] – 5.1.4. Reserved

   Initialized to zero by the sender; ignored by receivers.

- [MLD] – 5.1.5. Multicast Address

  For a General Query, the Multicast Address field is set to zero. For a Multicast Address Specific Query or Multicast Address and Source Specific Query, it is set to the multicast address being queried (see section 5.1.10, below).

- [MLD] – 5.1.8. QRV (Querier's Robustness Variable)

  If non-zero, the QRV field contains the [Robustness Variable] value used by the Querier. If the Querier's [Robustness Variable] exceeds 7 (the maximum value of the QRV field), the QRV field is set to zero.

- [MLD] – 5.1.9. QQIC (Querier's Query Interval Code)

  The Querier's Query Interval Code field specifies the [Query Interval] used by the Querier. The actual interval, called the Querier's Query Interval (QQI), is represented in units of seconds, and is derived from the Querier's Query Interval Code as follows:

- [MLD] – 5.1.10. Number of Sources (N)

  The Number of Sources (N) field specifies how many source addresses are present in the Query. This number is zero in a General Query or a Multicast Address Specific Query, and non-zero in a Multicast Address and Source Specific Query.

- [MLD] – 5.1.11. Source Address [i]

  The Source Address [i] fields are a vector of n unicast addresses, where n is the value in the Number of Sources (N) field.

- [MLD] – 5.1.12. Additional Data

  When sending a Query, an MLDv2 implementation MUST NOT include additional octets beyond the fields described above.

- [MLD] – 5.1.13. Query Variants

  o A "General Query" is sent by the Querier to learn which multicast addresses have listeners on an attached link. In a General Query, both the Multicast Address field and the Number of Sources (N) field are zero.

- [MLD] – 5.1.14. Source Addresses for Queries

  All MLDv2 Queries MUST be sent with a valid IPv6 link-local source address.

- [MLD] – 5.1.15. Destination Addresses for Queries

  Multicast Address Specific and Multicast Address and Source Specific Queries are sent with an IP destination address equal to the multicast address of interest.

- [MLD] – 7.6.2. Querier Election

  All MLDv2 queries MUST be sent with the FE80::/64 link-local source address prefix.

- [MLD] – 9.1. Robustness Variable

  Default value: 2.

- [MLD] – 9.2. Query Interval

  Default value: 125 seconds

- [MLD] – 9.8. Last Listener Query Interval

  Default value: 1000 (1 second)

- [MLD] – 9.14.3. Maximum Response Delay

  The burstiness of MLD traffic is inversely proportional to the Maximum Response Delay. A longer Maximum Response Delay will spread Report messages over a longer interval. However, a longer Maximum Response Delay in Multicast Address Specific and Multicast Address And Source Specific Queries extends the leave latency (the time between when the last listener stops listening to a source or multicast address and when the traffic stops flowing.) The expected rate of Report messages can be calculated by dividing the expected number of Reporters by the Maximum Response Delay. The Maximum Response Delay may be dynamically calculated per Query by using the expected number of Reporters for that Query as follows:

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, ALLOW (S1, S2)

Report B

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16

Router Alert
MLDv2 Report Multicast Address Record: M1, BLOCK (S1, S2)

Procedure:

1. Configure the RUT to use Default Variables for all fields.
2. Enable MLDv2 on the RUT.
3. Observe the packets on all networks.
4. TN1 transmits Report A.
5. Observe the packets on all networks.
6. TN1 transmits Report B.
7. Observe the packets on all networks.

Observable Results:

Step 3: The RUT must transmit 2 General Queries.
Step 5: The RUT must not transmit Queries other then periodic General Queries.
Step 7: The RUT must transmit 2 Multicast Address and Source Specific Query with the following values:

IPv6 Payload Length	68
IPv6 Next Header	0
IPv6 Hop Limit	1
IPv6 Source Address	RUT link-local address
IPv6 Destination Address	M1
Hop-by-Hop Next Header	58
Router Alert Option	Included
Type	130
Code	0
Checksum	Valid
Maximum Response Code	1000 or less
Reserved Field	0
Reserved Field	0
Multicast Address	M1 address
S Flag	false
QRV	2
QQIC	125
Number of Sources	2
Multicast Source Address	S1
	S2
Additional Data	Not included

Possible Problems:

- None.

Test MLD.2.4: Query Hop Limit

Purpose: To verify that an MLDv2 router properly processes Hop Limit in Query messages.

References:

- [MLD] – 7.6. Action on Reception of Queries

  Upon reception of an MLD message that contains a Query, the router checks if the source address of the message is a valid link-local address, if the Hop Limit is set to 1, and if the Router Alert option is present in the Hop-By-Hop Options header of the IPv6 packet. If any of these checks fails, the packet is dropped.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

<div align="center">

Report A

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S1)

Report B

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN()

Query A

IPv6 Header Source Address: TR1's Link-local Address Destination Address: FF02::1
Router Alert
MLD General Query

Query B

</div>

IPv6 Header
Source Address: TR1's Link-local Address
Destination Address: M1
Router Alert
MLD MAS Query
Multicast Address: M1
Number of Sources: 1
Source Address: S1

Procedure:

Part A: Hop Limit of 0
1. TR1 has a lower IP address then the RUT.
2. Enable MLDv2 on the RUT.
3. Observe the packets on all networks.
4. TR1 transmits Query A with a Hop Limit of 0.
5. Observe the packets on all networks.
6. TN1 transmits Report A.
7. Observe the packets on all networks.
8. TR1 transmits Query B with a Hop Limit of 0.
9. Observe the packets on all networks.
10. TN1 transmits Report B.
11. Observe the packets on all networks.

Part B: Hop Limit of 2
12. TR1 has a lower IP address then the RUT.
13. Enable MLDv2 on the RUT.
14. Observe the packets on all networks.
15. TR1 transmits Query A with a Hop Limit of 2.
16. Observe the packets on all networks.
17. TN1 transmits Report A.
18. Observe the packets on all networks.
19. TR1 transmits Query B with a Hop Limit of 2.
20. Observe the packets on all networks.
21. TN1 transmits Report B.
22. Observe the packets on all networks.

Part C: Hop Limit of 0xff
23. TR1 has a lower IP address then the RUT.
24. Enable MLDv2 on the RUT.
25. Observe the packets on all networks.
26. TR1 transmits Query A with a Hop Limit of 0xff.
27. Observe the packets on all networks.
28. TN1 transmits Report A.
29. Observe the packets on all networks.
30. TR1 transmits Query B with a Hop Limit of 0xff.
31. Observe the packets on all networks.
32. TN1 transmits Report B.
33. Observe the packets on all networks.

Observable Results:

- *Part A*
  Step 3: The RUT must transmit 2 MLDv2 General Queries.
  Step 5: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
  Step 7: The RUT must not transmit Queries other then periodic General Queries.
  Step 9: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
  Step 11: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S1.
- *Part B*
  Step 14: The RUT must transmit 2 MLDv2 General Queries.
  Step 16: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
  Step 18: The RUT must not transmit Queries other then periodic General Queries.
  Step 20: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
  Step 22: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
- *Part C*
  Step 25: The RUT must transmit 2 MLDv2 General Queries.
  Step 27: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
  Step 29: The RUT must not transmit Queries other then periodic General Queries.
  Step 31: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
  Step 33: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.

Possible Problems:

- None.

Test MLD.2.5: Query Source Address

Purpose: To verify that an MLDv2 router properly processes Source Address in Query Message.

References:

- [MLD] – 5.1.14. Source Addresses for Queries

  If a node (router or host) receives a Query message with the IPv6 Source Address set to the unspecified address (::), or any other address that is not a valid IPv6 link-local address, it MUST silently discard the message and SHOULD log a warning.

- [MLD] – 7.6. Action on Reception of Queries

  Upon reception of an MLD message that contains a Query, the router checks if the source address of the message is a valid link-local address, if the Hop Limit is set to 1, and if the Router Alert option is present in the Hop-By-Hop Options header of the IPv6 packet. If any of these checks fails, the packet is dropped.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Query A

IPv6 Header Source Address: TR1's Link-local Address Destination Address: FF02::1
Router Alert
MLD General Query

Query B

IPv6 Header Source Address: TR1's Link-local Address Destination Address: M1
Router Alert
MLD MAS Query Multicast Address: M1 Number of Sources: 1 Source Address: S1

Report A

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16

Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S1)

Report B

IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN()

Procedure:

Part A: Unspecified Address
1. TR1 has a lower IP address then the RUT.
2. Enable MLDv2 on the RUT.
3. Observe the packets on all networks.
4. TR1 transmits Query A with IPv6 Source Address of Unspecified Address (::).
5. Observe the packets on all networks.
6. TN1 transmits Report A.
7. Observe the packets on all networks.
8. TR1 transmits Query B with IPv6 Source Address of Unspecified Address (::).
9. Observe the packets on all networks.
10. TN1 transmits Report B.
11. Observe the packets on all networks.
Part B: On-link Global Unicast Address
12. TR1 has a lower IP address then the RUT.
13. Enable MLDv2 on the RUT.
14. Observe the packets on all networks.
15. TR1 transmits Query A with a global on-link IPv6 Source Address.
16. Observe the packets on all networks.
17. TN1 transmits Report A.
18. Observe the packets on all networks.
19. TR1 transmits Query B with a global on-link IPv6 Source Address.
20. Observe the packets on all networks.
21. TN1 transmits Report B.
22. Observe the packets on all networks.
Part C: Off-link Global Unicast Address
23. TR1 has a lower IP address then the RUT.
24. Enable MLDv2 on the RUT.
25. Observe the packets on all networks.
26. TR1 transmits Query A with a global off-link IPv6 Source Address.
27. Observe the packets on all networks.
28. TN1 transmits Report A.

29. Observe the packets on all networks.
30. TR1 transmits Query B with a global off-link IPv6 Source Address.
31. Observe the packets on all networks.
32. TN1 transmits Report B.
33. Observe the packets on all networks.

Part D: All MLDv2 Routers Address
34. TR1 has a lower IP address then the RUT.
35. Enable MLDv2 on the RUT.
36. Observe the packets on all networks.
37. TR1 transmits Query A with a IPv6 Source Address of FF02::16.
38. Observe the packets on all networks.
39. TN1 transmits Report A.
40. Observe the packets on all networks.
41. TR1 transmits Query B with a IPv6 Source Address of FF02::16.
42. Observe the packets on all networks.
43. TN1 transmits Report B.
44. Observe the packets on all networks.

Observable Results:

- *Part A*
    Step 3: The RUT must transmit 2 MLDv2 General Queries.
    Step 5: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
    Step 7: The RUT must not transmit Queries other then periodic General Queries.
    Step 9: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
    Step 11: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
- *Part B*
    Step 14: The RUT must transmit 2 MLDv2 General Queries.
    Step 16: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
    Step 18: The RUT must not transmit Queries other then periodic General Queries.
    Step 20: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
    Step 22: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
- *Part C*
    Step 25: The RUT must transmit 2 MLDv2 General Queries.
    Step 27: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
    Step 29: The RUT must not transmit Queries other then periodic General Queries.
    Step 31: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
    Step 33: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
- *Part D*
    Step 36: The RUT must transmit 2 MLDv2 General Queries.

Step 38: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.

Step 40: The RUT must not transmit Queries other then periodic General Queries.

Step 42: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.

Step 44: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.

Possible Problems:

- None.

Test MLD.2.6: Query Destination Address

Purpose: To verify that an MLDv2 router properly processes destination address in Query messages.

References:

- [MLD] – 5.1.15. Destination Addresses for Queries

  However, a node MUST accept and process any Query whose IP Destination Address field contains *any* of the addresses (unicast or multicast) assigned to the interface on which the Query arrives.

- [MLD] – 7. Description of the Protocol for Multicast Routers

  This section describes the part of MLDv2 that is performed by multicast routers. Multicast routers may themselves become multicast address listeners, and therefore also perform the multicast listener part of MLDv2, described in section 6.

- [MLD] – 7.6. Action on Reception of Queries

  Upon reception of an MLD message that contains a Query, the router checks if the source address of the message is a valid link-local address, if the Hop Limit is set to 1, and if the Router Alert option is present in the Hop-By-Hop Options header of the IPv6 packet. If any of these checks fails, the packet is dropped.

- [MLD] – 7.6.2. Querier Election

  When a router receives a query with a lower IPv6 address than its own, it sets the Other Querier Present timer to Other Querier Present Timeout; if it was previously in Querier state, it switches to Non-Querier state and ceases to send queries on the link.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Query A
IPv6 Header
Source Address: TR1's Link-local Address
Destination Address: FF02::1
Router Alert
MLD General Query

Query B
IPv6 Header
Source Address: TR1's Link-local Address
Destination Address: M1

Router Alert
MLD MAS Query Multicast Address: M1 Number of Sources: 1 Source Address: S1

Report A

IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S1)

Report B

IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN()

Procedure:

Part A: Link-local Address
1. TR1 has a lower IP address than the RUT.
2. Enable MLDv2 on the RUT.
3. Observe the packets on all networks.
4. TR1 transmits Query A with IPv6 Destination Address of RUT link-local address.
5. Observe the packets on all networks.
6. Wait [OQPT] seconds.
7. Observe the packets on all networks.

Part B: Global Address
8. TR1 has a lower IP address than the RUT.
9. Enable MLDv2 on the RUT.
10. Observe the packets on all networks.
11. TR1 transmits Query A with IPv6 Destination Address of RUT global address.
12. Observe the packets on all networks.
13. Wait [OQPT] seconds.
14. Observe the packets on all networks.

Part C: All MLDv2 Router Address
15. TR1 has a lower IP address than the RUT.

16. Enable MLDv2 on the RUT.
17. Observe the packets on all networks.
18. TR1 transmits Query A with IPv6 Destination Address of MLDv2 Capable Router.
19. Observe the packets on all networks.
20. Wait [OQPT] seconds.
21. Observe the packets on all networks.

Part D: Link Local Specific Query
22. TR1 has a lower IP address than the RUT.
23. Enable MLDv2 on the RUT.
24. Observe the packets on all networks.
25. TN1 transmits Report A.
26. Observe the packets on all networks.
27. TR1 transmits Query B with IPv6 Destination Address of RUT link-local address.
28. Observe the packets on all networks.
29. Wait [LLQT] seconds.
30. TN1 transmits Report B.
31. Observe the packets on all networks.

Part E: Global Specific Query
32. TR1 has a lower IP address than the RUT.
33. Enable MLDv2 on the RUT.
34. Observe the packets on all networks.
35. TN1 transmits Report A.
36. Observe the packets on all networks.
37. TR1 transmits Query B with IPv6 Destination Address of RUT global address.
38. Observe the packets on all networks.
39. Wait [LLQT] seconds.
40. TN1 transmits Report B.
41. Observe the packets on all networks.

Part F: All Nodes Specific Query
42. TR1 has a lower IP address than the RUT.
43. Enable MLDv2 on the RUT.
44. Observe the packets on all networks.
45. TN1 transmits Report A.
46. Observe the packets on all networks.
47. TR1 transmits Query B with IPv6 Destination Address of all nodes address.
48. Observe the packets on all networks.
49. Wait [LLQT] seconds.
50. TN1 to transmit Report B.
51. Observe the packets on all networks.

Part G: Off-link global Address
52. TR1 has a lower IP address of all networks.
53. Enable MLDv2 on the RUT.
54. Observe the packets on all networks.
55. TR1 transmits Query A with a Hop Limit of 2 and IP Destination Address of Network1 without Router Alert option.
56. Observe the packets on all networks.

Observable Results:

- *Part A*
  Step 3: The RUT must transmit 2 MLDv2 General Queries.
  Step 5: The RUT must not transmit Queries. The RUT must transmits MLDv2 Reports with Multicast Address Records with IS_EX (FF02::2), IS_EX (FF02::16), IS_EX(RUT Solicited Node Address).
  Step 7: The RUT must transmit a General Queries.
- *Part B*
  Step 10: The RUT must transmit 2 MLDv2 General Queries.
  Step 12: The RUT must not transmit Queries. The RUT must transmits MLDv2 Reports with Multicast Address Records with IS_EX (FF02::2), IS_EX (FF02::16), IS_EX(RUT Solicited Node Address).
  Step 14: The RUT must transmit a General Queries.
- *Part C*
  Step 17: The RUT must transmit 2 MLDv2 General Queries.
  Step 19: The RUT must not transmit General Queries. The RUT must transmits MLDv2 Reports with Multicast Address Records with IS_EX (FF02::2), IS_EX (FF02::16), IS_EX(RUT Solicited Node Address).
  Step 21: The RUT must transmit a General Queries.
- *Part D*
  Step 24: The RUT must transmit 2 MLDv2 General Queries.
  Step 26: The RUT must not transmit Queries.
  Step 28: The RUT must not transmit Queries.
  Step 31: The RUT must not transmit Queries.
- *Part E*
  Step 34: The RUT must transmit 2 MLDv2 General Queries.
  Step 36: The RUT must not transmit Queries.
  Step 38: The RUT must not transmit Queries.
  Step 41: The RUT must not transmit Queries.
- *Part F*
  Step 44: The RUT must transmit 2 MLDv2 General Queries.
  Step 46: The RUT must not transmit Queries.
  Step 48: The RUT must not transmit Queries.
  Step 51: The RUT must not transmit Queries.
- *Part G*
  Step 54: The RUT must transmit 2 MLDv2 General Queries.
  Step 56: The RUT must not forward the Query onto Network1.

Possible Problems:

- None.

Test MLD.2.7: Query Router Alert Option

Purpose: To verify that an MLDv2 router properly processes Router Alerts in MLD Query messages.

References:

- [MLD] – 7.6. Action on Reception of Queries

  Upon reception of an MLD message that contains a Query, the router checks if the source address of the message is a valid link-local address, if the Hop Limit is set to 1, and if the Router Alert option is present in the Hop-By-Hop Options header of the IPv6 packet. If any of these checks fails, the packet is dropped.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Query A

IPv6 Header
Source Address: TR1's Link-local Address
Destination Address: FF02::1
MLD General Query

Query B

IPv6 Header
Source Address: TR1's Link-local Address
Destination Address: M1
MLD MAS Query
Multicast Address: M1
Number of Sources: 1
Source Address: S1

Report A

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record: M1, IS_IN (S1)

Report B

IPv6 Header
Source Address: TN1's Link-

local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN()

Procedure:

Part A: No Hop-by-Hop Option
1. TR1 has a lower IP address then the RUT.
2. Enable MLDv2 on the RUT.
3. Observe the packets on all networks.
4. TR1 transmits Query A without a Hop-by-Hop Option.
5. Observe the packets on all networks.
6. TN1 transmits Report A.
7. Observe the packets on all networks.
8. TR1 transmits Query B without a Hop-by-Hop Option.
9. Observe the packets on all networks.
10. TN1 transmits Report B.
11. Observe the packets on all networks.

Part B: No Router Alert
12. TR1 has a lower IP address then the RUT.
13. Enable MLDv2 on the RUT.
14. Observe the packets on all networks.
15. TR1 transmits Query A without a Router Alert Option.
16. Observe the packets on all networks.
17. TN1 transmits Report A.
18. Observe the packets on all networks.
19. TR1 transmits Query B without a Router Alert Option.
20. Observe the packets on all networks.
21. TN1 transmits Report B.
22. Observe the packets on all networks.

Observable Results:

- *Part A*
  Step 3: The RUT must transmit 2 MLDv2 General Queries.
  Step 5: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
  Step 7: The RUT must not transmit Queries other then periodic General Queries.
  Step 9: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
  Step 11: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S1.

- *Part B*
  Step 14: The RUT must transmit 2 MLDv2 General Queries.
  Step 16: The RUT must not crash or generate invalid packets. The RUT must not transmit

Queries other then periodic General Queries.
Step 18: The RUT must not transmit Queries other then periodic General Queries.
Step 20: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
Step 22: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S1.

Possible Problems:

- None.

Test MLD.2.8: Query Payload Length

Purpose: To verify that an MLDv2 router properly processes payload length in MLD query message.

References:

- [MLD] – 5.1.12. Additional Data

  If the Payload Length field in the IPv6 header of a received Query indicates that there are additional octets of data present, beyond the fields described here, MLDv2 implementations MUST include those octets in the computation to verify the received MLD Checksum, but MUST otherwise ignore those additional octets.

- [MLD] – 8.1. Query Version Distinctions

  The MLD version of a Multicast Listener Query message is determined as follows:

  MLDv1 Query: length = 24 octets

  MLDv2 Query: length >= 28 octets

  Query messages that do not match any of the above conditions (e.g., a Query of length 26 octets) MUST be silently ignored.

- [MLD] – 8.3.1. In the Presence of MLDv1 Routers

  o If a router is not explicitly configured to use MLDv1 and receives an MLDv1 General Query, it SHOULD log a warning. These warnings MUST be rate-limited.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Query A

IPv6 Header
Source Address: TR1's Link-local Address
Destination Address: FF02::1
Router Alert
MLD General Query

Query B

IPv6 Header
Source Address: TR1's Link-local Address
Destination Address: M1
Router Alert
MLD MAS Query

Multicast Address: M1
Number of Sources: 1
Source Address: S1

Query C

IPv6 Header
Source Address: TR1's Link-local Address
Destination Address: M1
Router Alert
MLD MAS Query
Multicast Address: M1
Number of Sources: 2
Source Address: S1, S2

Report A

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record: M1, IS_IN (S1)

Report B

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record: M1, TO_IN()

Report C

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record: M1, IS_IN (S1,S2)

Procedure:

Part A: Additional Data, payload doesn't match
1. TR1 has a lower IP address then the RUT.
2. Enable MLDv2 on the RUT.
3. Observe the packets on all networks.
4. TR1 transmits Query A with Additional Data. The payload length does not include the Additional Data.
5. Observe the packets on all networks.
6. TN1 transmits Report A.
7. Observe the packets on all networks.
8. TR1 transmits Query B with Additional Data.   The payload length does not include the Additional Data.
9. Observe the packets on all networks.
10. TN1 transmits Report B.
11. Observe the packets on all networks.

Part B: Two Sources, payload length for one source
12. TR1 has a lower IP address then the RUT.
13. Enable MLDv2 on the RUT.
14. Observe the packets on all networks.
15. TN1 transmits Report C.
16. Observe the packets on all networks.
17. TR1 transmits Query C with a payload length for one Source Address.
18. Observe the packets on all networks.
19. TN1 transmits Report B.
20. Observe the packets on all networks.

Part C: One Source, payload length for two sources
21. TR1 has a lower IP address then the RUT.
22. Enable MLDv2 on the RUT.
23. Observe the packets on all networks.
24. TN1 transmits Report A.
25. Observe the packets on all networks.
26. TR1 transmits Query B and a payload length for two Sources Addresses.
27. Observe the packets on all networks.
28. TN1 transmits Report B.
29. Observe the packets on all networks.

Part D: MLD Query Length 24 octets
30. TR1 has a lower IP address then the RUT.
31. Enable MLDv2 on the RUT.
32. Observe the packets on all networks.
33. TR1 transmits Query A with a length of 24 octets.
34. Wait [QI] seconds.
35. Observe the packets on all networks.

Part E: MLD Query Length greater than 24 octets and smaller than 28 octets
36. TR1 has a lower IP address then the RUT.
37. Enable MLDv2 on the RUT.
38. Observe the packets on all networks.
39. TR1 transmits Query A with a length of 26 octets.
40. Wait [QI] seconds.

41. Observe the packets on all networks.

Observable Results:

- *Part A*
  Step 3: The RUT must transmit 2 MLDv2 General Queries.
  Step 5: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
  Step 7: The RUT must not transmit Queries other then periodic General Queries.
  Step 9: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
  Step 11: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S1.
- *Part B*
  Step 14: The RUT must transmit 2 MLDv2 General Queries.
  Step 16: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
  Step 18: The RUT must not crash or generate invalid packets.
  Step 20: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and Source Addresses of S1 and S2.
- *Part C*
  Step 23: The RUT must transmit 2 MLDv2 General Queries.
  Step 25: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
  Step 27: The RUT must not crash or generate invalid packets.
  Step 29: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S1.
- *Part D*
  Step 32: The RUT must transmit 2 MLDv2 General Queries.
  Step 35: The RUT must not crash or generate invalid packets. The RUT must transmit periodic General Queries.
- *Part E*
  Step 38: The RUT must transmit 2 MLDv2 General Queries.
  Step 41: The RUT must not crash or generate invalid packets. The RUT must transmit periodic General Queries.

Possible Problems:

- None.

Test MLD.2.9: Report Hop Limit

Purpose: To verify that an MLDv2 router properly processes Hop Limit in Report messages.

References:

- [MLD] – 7.4. Action on Reception of Reports

  Upon reception of an MLD message that contains a Report, the router checks if the source address of the message is a valid link-local address, if the Hop Limit is set to 1, and if the Router Alert option is present in the Hop-By-Hop Options header of the IPv6 packet. If any of these checks fails, the packet is dropped. If the validity of the MLD message is verified, the router starts to process the Report.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S1)

Report B

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN(S2)

Report C

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report

Multicast Address Record:
M1, TO_IN()

Procedure:

Part A: Hop Limit of 0
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A with a Hop Limit of 0.
4. Observe the packets on all networks.
5. TN1 transmits Report B.
6. Observe the packets on all networks.
7. TN1 transmits Report C.
8. Observe the packets on all networks.

Part B: Hop Limit of 2
9. Enable MLDv2 on the RUT.
10. Observe the packets on all networks.
11. TN1 transmits Report A with a Hop Limit of 2.
12. Observe the packets on all networks.
13. TN1 transmits Report B.
14. Observe the packets on all networks.
15. TN1 transmits Report C.
16. Observe the packets on all networks.

Part C: Hop Limit of 0xff
17. Enable MLDv2 on the RUT.
18. Observe the packets on all networks.
19. TN1 transmits Report A with a Hop Limit of 0xFF.
20. Observe the packets on all networks.
21. TN1 transmits Report B.
22. Observe the packets on all networks.
23. TN1 transmits Report C.
24. Observe the packets on all networks.

Observable Results:

- *Part A*
  Step 2: The RUT must transmit 2 MLDv2 General Queries.
  Step 4: The RUT must not transmit Queries other then periodic General Queries.
  Step 6: The RUT must not transmit Queries other then periodic General Queries.
  Step 8: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2.
- *Part B*
  Step 10: The RUT must transmit 2 MLDv2 General Queries.
  Step 12: The RUT must not transmit Queries other then periodic General Queries.
  Step 14: The RUT must not transmit Queries other then periodic General Queries.
  Step 16: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2.
- *Part C*
  Step 18: The RUT must transmit 2 MLDv2 General Queries.

Step 20: The RUT must not transmit Queries other then periodic General Queries.
Step 22: The RUT must not transmit Queries other then periodic General Queries.
Step 24: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2.

Possible Problems:

- None.

Test MLD.2.10: Report Source Address

Purpose: To verify that an MLDv2 router properly processes IPv6 Source Address in Report messages.

References:

- [MLD] – 5.2.13. Source Addresses for Reports

  On the other hand, routers MUST silently discard a message that is not sent with a valid link-local address, without taking any action on the contents of the packet. Thus, a Report is discarded if the router cannot identify the source address of the packet as belonging to a link connected to the interface on which the packet was received. A Report sent with the unspecified address is also discarded by the router. This enhances security, as unidentified reporting nodes cannot influence the state of the MLDv2 router(s).

- [MLD] – 7.4. Action on Reception of Reports

  Upon reception of an MLD message that contains a Report, the router checks if the source address of the message is a valid link-local address, if the Hop Limit is set to 1, and if the Router Alert option is present in the Hop-By-Hop Options header of the IPv6 packet. If any of these checks fails, the packet is dropped. If the validity of the MLD message is verified, the router starts to process the Report.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S1)

Report B

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN(S2)

Report C
IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN()

Procedure:

Part A: Unspecified
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A with IPv6 source address of unspecified address (::).
4. Observe the packets on all networks.
5. TN1 transmits Report B.
6. Observe the packets on all networks.
7. TN1 transmits Report C.
8. Observe the packets on all networks.

Part B: On-link Global
9. Enable MLDv2 on the RUT.
10. Observe the packets on all networks.
11. TN1 transmits Report A with IPv6 source address of TN1 global address on Network 0.
12. Observe the packets on all networks.
13. TN1 transmits Report B.
14. Observe the packets on all networks.
15. TN1 transmits Report C.
16. Observe the packets on all networks.

Part C: Off-link Global
17. Enable MLDv2 on the RUT.
18. Observe the packets on all networks.
19. TN1 transmits Report A with IPv6 source address of TN1 global address on Network1.
20. Observe the packets on all networks.
21. TN1 transmits Report B.
22. Observe the packets on all networks.
23. TN1 transmits Report C.
24. Observe the packets on all networks.

Part D: All MLDv2 Router
25. Enable MLDv2 on the RUT.
26. Observe the packets on all networks.
27. TN1 transmits Report A with IPv6 source address of FF02::16.
28. Observe the packets on all networks.
29. TN1 transmits Report B.
30. Observe the packets on all networks.
31. TN1 transmits Report C.

32. Observe the packets on all networks.

Observable Results:

- *Part A*
    Step 2: The RUT must transmit 2 MLDv2 General Queries.
    Step 4: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
    Step 6: The RUT must not transmit Queries other then periodic General Queries.
    Step 8: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2.
- *Part B*
    Step 10: The RUT must transmit 2 MLDv2 General Queries.
    Step 12: The RUT must not transmit Queries other then periodic General Queries.
    Step 14: The RUT must not transmit Queries other then periodic General Queries.
    Step 16: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2.
- *Part C*
    Step 18: The RUT must transmit 2 MLDv2 General Queries.
    Step 20: The RUT must not transmit Queries other then periodic General Queries.
    Step 22: The RUT must not transmit Queries other then periodic General Queries.
    Step 24: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2.
- *Part D*
    Step 26: The RUT must transmit 2 MLDv2 General Queries.
    Step 28: The RUT must not transmit Queries other then periodic General Queries.
    Step 30: The RUT must not transmit Queries other then periodic General Queries.
    Step 32: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2.

Possible Problems:

- None.

Test MLD.2.11: Report Destination Address

Purpose: To verify that an MLDv2 router properly processes IPv6 Destination Address in Report messages.

References:

- [MLD] – 5.2.14. Destination Addresses for Reports

  In addition, a node MUST accept and process any version 1 Report whose IP Destination Address field contains *any* of the IPv6 addresses (unicast or multicast) assigned to the interface on which the Report arrives. This might be useful, e.g., for debugging purposes.

- [MLD] – 7.4. Action on Reception of Reports

  Upon reception of an MLD message that contains a Report, the router checks if the source address of the message is a valid link-local address, if the Hop Limit is set to 1, and if the Router Alert option is present in the Hop-By-Hop Options header of the IPv6 packet. If any of these checks fails, the packet is dropped. If the validity of the MLD message is verified, the router starts to process the Report.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S1)

Report B

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S2)

Report C

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN()

Procedure:

Part A: Link-local
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A with a destination address of RUT link-local address.
4. Observe the packets on all networks.
5. TN1 transmits Report B.
6. Observe the packets on all networks.
7. TN1 transmits Report C.
8. Observe the packets on all networks.

Part B: Global
9. Enable MLDv2 on the RUT.
10. Observe the packets on all networks.
11. TN1 transmits Report A with a destination address of RUT global address.
12. Observe the packets on all networks.
13. TN1 transmits Report B.
14. Observe the packets on all networks.
15. TN1 transmits Report C.
16. Observe the packets on all networks.

Part C: Multicast
17. Enable MLDv2 on the RUT.
18. Observe the packets on all networks.
19. TN1 transmits Report A with IPv6 destination address of M1.
20. Observe the packets on all networks.
21. TN1 transmits Report B.
22. Observe the packets on all networks.
23. TN1 transmits Report C.
24. Observe the packets on all networks.

Part D: Global Off-link
25. Enable MLDv2 on the RUT.
26. Observe the packets on all networks.
27. TN1 transmits Report A with a Hop Limit of 2 and IP Source Address of TR1 global address and IP Destination Address of TN2 global address without Router Alert option.
28. Observe the packets on all networks.
29. TN1 transmits Report B.
30. Observe the packets on all networks.
31. TN1 transmits Report C.
32. Observe the packets on all networks.

Observable Results:

- *Part A*
    Step 2: The RUT must transmit 2 MLDv2 General Queries.
    Step 4: The RUT must not transmit Queries other then periodic General Queries.
    Step 6: The RUT must not transmit Queries other then periodic General Queries.
    Step 8: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2.
- *Part B*
    Step 10: The RUT must transmit 2 MLDv2 General Queries.
    Step 12: The RUT must not transmit Queries other then periodic General Queries.
    Step 14: The RUT must not transmit Queries other then periodic General Queries.
    Step 16: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2.
- *Part C*
    Step 18: The RUT must transmit 2 MLDv2 General Queries.
    Step 20: The RUT must not transmit Queries other then periodic General Queries.
    Step 22: The RUT must not transmit Queries other then periodic General Queries.
    Step 24: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2.
- *Part D*
    Step 26: The RUT must transmit 2 MLDv2 General Queries.
    Step 28: The RUT must not transmit Queries other then periodic General Queries.
    Step 30: The RUT must not transmit Queries other then periodic General Queries.
    Step 32: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2.

Possible Problems:

- None.

Test MLD.2.12: Report Router Alert

Purpose: To verify that an MLDv2 router properly processes IPv6 Destination Address in Report messages.

References:

- [MLD] – 7.4. Action on Reception of Reports

  Upon reception of an MLD message that contains a Report, the router checks if the source address of the message is a valid link-local address, if the Hop Limit is set to 1, and if the Router Alert option is present in the Hop-By-Hop Options header of the IPv6 packet. If any of these checks fails, the packet is dropped. If the validity of the MLD message is verified, the router starts to process the Report.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

<div align="center">

Report A

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S1)

Report B

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S2)

Report C

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
MLDv2 Report

</div>

Multicast Address Record:
M1, TO_IN()

Procedure:

Part A: No Hop-by-Hop Option
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A with no Hop-by-Hop Options.
4. Observe the packets on all networks.
5. TN1 transmits Report B.
6. Observe the packets on all networks.
7. TN1 transmits Report C.
8. Observe the packets on all networks.

Part B: No Router Alert
9. Enable MLDv2 on the RUT.
10. Observe the packets on all networks.
11. TN1 transmits Report A with no Router Alert Option.
12. Observe the packets on all networks.
13. TN1 transmits Report B.
14. Observe the packets on all networks.
15. TN1 transmits Report C.
16. Observe the packets on all networks.

Observable Results:

- *Part A*

  Step 2: The RUT must transmit 2 MLDv2 General Queries.
  Step 4: The RUT must not transmit Queries other then periodic General Queries.
  Step 6: The RUT must not transmit Queries other then periodic General Queries.
  Step 8: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2.

- *Part B*

  Step 10: The RUT must transmit 2 MLDv2 General Queries.
  Step 12: The RUT must not transmit Queries other then periodic General Queries.
  Step 14: The RUT must not transmit Queries other then periodic General Queries.
  Step 16: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2.

Possible Problems:

- None.

Test MLD.2.13: Report Payload Length

Purpose: To verify that an MLDv2 router properly processes payload length in Report messages.

References:

- [MLD] – 5.2.11. Additional Data

  If the Payload Length field in the IPv6 header of a received Report indicates that there are additional octets of data present, beyond the last Multicast Address Record, MLDv2 implementations MUST include those octets in the computation to verify the received MLD Checksum, but MUST otherwise ignore those additional octets. When sending a Report, an MLDv2 implementation MUST NOT include additional octets beyond the last Multicast Address Record.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A

| IPv6 Header |
| Source Address: TN1's Link-local Address |
| Destination Address: FF02::16 |
| Router Alert |
| MLDv2 Report |
| Multicast Address Record: M1, IS_IN (S1) |

Report B

| IPv6 Header |
| Source Address: TN1's Link-local Address |
| Destination Address: FF02::16 |
| Router Alert |
| MLDv2 Report |
| Multicast Address Record: M1, IS_IN(S2) |

Report C

| IPv6 Header |
| Source Address: TN1's Link-local Address |
| Destination Address: FF02::16 |
| Router Alert |

Procedure:

Part A: Additional data not included in payload
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A with additional data, the payload does not include that size.
4. Observe the packets on all networks.
5. TN1 transmits Report B.
6. Observe the packets on all networks.
7. TN1 transmits Report C.
8. Observe the packets on all networks.

Part B: One Source, payload includes two sources
9. Enable MLDv2 on the RUT.
10. Observe the packets on all networks.
11. TN1 transmits Report A with two Multicast Source Addresses S1 and S2 while the payload set to one.
12. Observe the packets on all networks.
13. TN1 transmits Report B.
14. Observe the packets on all networks.
15. TN1 transmits Report C.
16. Observe the packets on all networks.

Part C: Two Sources, payload includes one source
17. Enable MLDv2 on the RUT.
18. Observe the packets on all networks.
19. TN1 transmits Report A with one Multicast Source Address with the payload set to two.
20. Observe the packets on all networks.
21. TN1 transmits Report B.
22. Observe the packets on all networks.
23. TN1 transmits Report C.
24. Observe the packets on all networks.

Observable Results:

- *Part A*

    Step 2: The RUT must transmit 2 MLDv2 General Queries.
    Step 4: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
    Step 6: The RUT must not transmit Queries other then periodic General Queries.
    Step 8: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2.

- *Part B*

    Step 10: The RUT must transmit 2 MLDv2 General Queries.
    Step 12: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
    Step 14: The RUT must not transmit Queries other then periodic General Queries.

Step 16: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2.

- *Part C*
  Step 18: The RUT must transmit 2 MLDv2 General Queries.
  Step 20: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
  Step 22: The RUT must not transmit Queries other then periodic General Queries.
  Step 24: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2.

Possible Problems:

- None.

Test MLD.2.14: Query ICMPv6 Message Type

Purpose: To verify that an MLDv2 router properly processes ICMPv6 Message type in Query Message.

References:

- [MLD] – 5. Message Formats

  Unrecognized message types MUST be silently ignored. Other message types may be used by newer versions or extensions of MLD, by multicast routing protocols, or for other uses.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Query A

IPv6 Header
Source Address: TR1's Link-local Address
Destination Address: FF02::1
Router Alert
MLD General Query

Query B

IPv6 Header
Source Address: TR1's Link-local Address
Destination Address: M1
Router Alert
MLD MAS Query
Multicast Address: M1
Number of Sources: 1
Source Address: S1

Report A

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record: M1, IS_IN (S1)

Report B

IPv6 Header
Source Address: TN1's Link-

local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record: M1, TO_IN()

Procedure:

1. TR1 has a lower IP address then the RUT.
2. Enable MLDv2 on the RUT.
3. Observe the packets on all networks.
4. TR1 transmits Query A with an ICMPv6 Message Type of 0xff.
5. Observe the packets on all networks.
6. TN1 transmits Report A.
7. Observe the packets on all networks.
8. TR1 transmits Query B with an ICMPv6 Message Type of 0xff.
9. Observe the packets on all networks.
10. TN1 transmits Report B.
11. Observe the packets on all networks.

Observable Results:

Step 3: The RUT must transmit 2 MLDv2 General Queries.
Step 5: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
Step 7: The RUT must not transmit Queries other then periodic General Queries.
Step 9: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
Step 11: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.

Possible Problems:

- None.

Test MLD.2.15: Query ICMPv6 Code

Purpose: To verify that an MLDv2 router properly processes ICMPv6 code in Query Message.

References:

- [MLD] – 5.1.1. Code

  Initialized to zero by the sender; ignored by receivers

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

<div align="center">

Query A

IPv6 Header Source Address: TR1's Link-local Address Destination Address: FF02::1
Router Alert
MLD General Query

</div>

Procedure:

1. TR1 has a lower IP address then the RUT.
2. Enable MLDv2 on the RUT.
3. Observe the packets on all networks.
4. TR1 transmits Query A with an ICMPv6 Code of 0xff.
5. Observe the packets on all networks.
6. Wait [OQPT] seconds.
7. Observe the packets on all networks.

Observable Results:

Step 3: The RUT must transmit 2 MLDv2 General Queries.
Step 5: The RUT must not transmit Queries. The RUT must transmits MLDv2 Reports with Multicast Address Records with IS_EX (FF02::2), IS_EX (FF02::16), IS_EX(RUT Solicited Node Address).
Step 7: The RUT must transmit a General Query.

Possible Problems:

- None.

Test MLD.2.16: Query ICMPv6 Checksum

Purpose: To verify that an MLDv2 router properly processes ICMPv6 Checksum in Query Message.

References:

- [MLD] – 5.1.2. Checksum

  The standard ICMPv6 checksum; it covers the entire MLDv2 message, plus a "pseudo-header" of IPv6 header fields [RFC2463]. For computing the checksum, the Checksum field is set to zero. When a packet is received, the checksum MUST be verified before processing it.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

<table>
<tr><td align="center">Query A</td></tr>
<tr><td align="center">IPv6 Header
Source Address: TR1's Link-local Address
Destination Address: FF02::1</td></tr>
<tr><td align="center">Router Alert</td></tr>
<tr><td align="center">MLD General Query</td></tr>
</table>

<table>
<tr><td align="center">Query B</td></tr>
<tr><td align="center">IPv6 Header
Source Address: TR1's Link-local Address
Destination Address: M1</td></tr>
<tr><td align="center">Router Alert</td></tr>
<tr><td align="center">MLD MAS Query
Multicast Address: M1
Number of Sources: 1
Source Address: S1</td></tr>
</table>

<table>
<tr><td align="center">Report A</td></tr>
<tr><td align="center">IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16</td></tr>
<tr><td align="center">Router Alert</td></tr>
<tr><td align="center">MLDv2 Report
Multicast Address Record:
M1, IS_IN (S1)</td></tr>
</table>

Report B

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN()

Procedure:

1. TR1 has a lower IP address then the RUT.
2. Enable MLDv2 on the RUT.
3. Observe the packets on all networks.
4. TR1 transmits Query A with an invalid checksum.
5. Observe the packets on all networks.
6. TN1 transmits Report A.
7. Observe the packets on all networks.
8. TR1 transmits Query B with an invalid checksum.
9. Observe the packets on all networks.
10. TN1 transmits Report B.
11. Observe the packets on all networks.

Observable Results:

Step 3: The RUT must transmit 2 MLDv2 General Queries.
Step 5: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
Step 7: The RUT must not transmit Queries other then periodic General Queries.
Step 9: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
Step 11: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S1.

Possible Problems:

- None.

Test MLD.2.17: Query ICMPv6 Reserved

Purpose: To verify that an MLDv2 router properly processes ICMPv6 reserve field in Query Message.

References:

- [MLD] – 5.1.4. Reserved

   Initialized to zero by the sender; ignored by receivers.

- [MLD] – 7. Description of the Protocol for Multicast Routers

   This section describes the part of MLDv2 that is performed by multicast routers. Multicast routers may themselves become multicast address listeners, and therefore also perform the multicast listener part of MLDv2, described in section 6.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Query A

IPv6 Header Source Address: TR1's Link-local Address Destination Address: FF02::1
Router Alert
MLD General Query

Procedure:

1. TR1 has a lower IP address then the RUT.
2. Enable MLDv2 on the RUT.
3. Observe the packets on all networks.
4. TR1 transmits Query A with an ICMPv6 Reserved field of 0xff.
5. Observe the packets on all networks.
6. Wait [OPQT] seconds.
7. Observe the packets on all networks.

Observable Results:

Step 3: The RUT must transmit 2 Reports with Multicast Address Records for FF02::16 TO_EX() and Multicast Address Record for RUT Solicited-Node Multicast address TO_EX() one second apart. The RUT must transmit 2 MLDv2 General Queries.
Step 5: The RUT must not transmit Queries. The RUT must transmits MLDv2 Reports with Multicast Address Records with IS_EX (FF02::2), IS_EX (FF02::16), IS_EX(RUT Solicited Node Address).
Step 7: The RUT must transmit a General Query.

Possible Problems:

- None.

Test MLD.2.18: Query Multicast Address Field

Purpose: To verify that an MLDv2 router properly processes Multicast Address Field in Query messages.

References:

- [MLD] – 5.1.5. Multicast Address

  For a General Query, the Multicast Address field is set to zero. For a Multicast Address Specific Query or Multicast Address and Source Specific Query, it is set to the multicast address being queried (see section 5.1.10, below).

- [MLD] – 5.1.7. S Flag (Suppress Router-Side Processing)

  the normal "host-side" processing of a Query that a router may be required to perform as a consequence of itself being a multicast listener.

- [MLD] – 5.1.13. Query Variants

  o A "General Query" is sent by the Querier to learn which multicast addresses have listeners on an attached link. In a General Query, both the Multicast Address field and the Number of Sources (N) field are zero.

  o A "Multicast Address and Source Specific Query" is sent by the Querier to learn if any of the sources from the specified list for the particular multicast address has any listeners on an attached link or not. In a Multicast Address and Source Specific Query the Multicast Address field contains the multicast address of interest, while the Source Address [i] field(s) contain(s) the source address(es) of interest.

  o A "Multicast Address and Source Specific Query" is sent by the Querier to learn if any of the sources from the specified list for the particular multicast address has any listeners on an attached link or not. In a Multicast Address and Source Specific Query the Multicast Address field contains the multicast address of interest, while the Source Address [i] field(s) contain(s) the source address(es) of interest.

- [MLD] – 6. Protocol Description for Multicast Address Listeners

  The link-scope all-nodes multicast address, (FF02::1), is handled as a special case. On all nodes -- that is all hosts and routers, including multicast routers -- listening to packets destined to the all-nodes multicast address, from all sources, is permanently enabled on all interfaces on which multicast listening is supported. No MLD messages are ever sent regarding neither the link-scope all-nodes multicast address, nor any multicast address of scope 0 (reserved) or 1 (node-local).

- [MLD] – 7. Description of the Protocol for Multicast Routers

This section describes the part of MLDv2 that is performed by multicast routers. Multicast routers may themselves become multicast address listeners, and therefore also perform the multicast listener part of MLDv2, described in section 6.

On each interface over which this protocol is being run, the router MUST enable reception of the link-scope "all MLDv2-capable routers" multicast address from all sources, and MUST perform the multicast address listener part of MLDv2 for that address on that interface.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record: M1, IS_IN (S1)

Report B

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record: M1, TO_IN()

Query A

IPv6 Header
Source Address: TR1's Link-local Address
Destination Address: M1
Router Alert
MLD MAS Query
Multicast Address: M1
Number of Sources: 1
Source Address: S1

Procedure:

Part A: All Nodes Multicast Address
1. TR1 has a lower IP address then the RUT.

2. Enable MLDv2 on the RUT.
3. Observe the packets on all networks.
4. TN1 transmits Report A.
5. Observe the packets on all networks.
6. TR1 transmits Query A with a Multicast Address of FF02::1.
7. Observe the packets on all networks.
8. TN1 transmits Report B.
9. Observe the packets on all networks.

Part B: All MLDv2 Routers
10. TR1 has a lower IP address then the RUT.
11. Enable MLDv2 on the RUT.
12. Observe the packets on all networks.
13. TN1 transmits Report A.
14. Observe the packets on all networks.
15. TR1 transmits Query A with a Multicast Address of FF02::16.
16. Observe the packets on all networks.
17. TN1 transmits Report B.
18. Observe the packets on all networks.

Part C: All MLDv2 Routers with S Flag set
19. TR1 has a lower IP address then the RUT.
20. Enable MLDv2 on the RUT.
21. Observe the packets on all networks.
22. TN1 transmits Report A.
23. Observe the packets on all networks.
24. TR1 transmits Query A with a Multicast Address of FF02::16 with the S Flag set.
25. Observe the packets on all networks.
26. TN1 transmits Report B.
27. Observe the packets on all networks.

Part D: No Previous Multicast Address
28. TR1 has a lower IP address then the RUT.
29. Enable MLDv2 on the RUT.
30. Observe the packets on all networks.
31. TN1 transmits Report A.
32. Observe the packets on all networks.
33. TR1 transmits Query A with a Multicast Address of M2.
34. Observe the packets on all networks.
35. TN1 transmits Report B.
36. Observe the packet on all networks.

Part E: Unspecified Address
37. TR1 has a lower IP address then the RUT.
38. Enable MLDv2 on the RUT.
39. Observe the packets on all networks.
40. TN1 transmits Report A.
41. Observe the packets on all networks.
42. TR1 transmits Query A with a Multicast Address of Unspecified Address (::).
43. Observe the packets on all networks.
44. TN1 transmits Report B.
45. Observe the packets on all networks.

Part F: Link Local

46. TR1 has a lower IP address then the RUT.
47. Enable MLDv2 on the RUT.
48. Observe the packets on all networks.
49. TN1 transmits Report A.
50. Observe the packets on all networks.
51. TR1 transmits Query A with a Multicast Address of RUT link-local address.
52. Observe the packets on all networks.
53. TN1 transmits Report B.
54. Observe the packets on all networks.

Part G: RUT Global Address

55. TR1 has a lower IP address then the RUT.
56. Enable MLDv2 on the RUT.
57. Observe the packets on all networks.
58. TN1 transmits Report A.
59. Observe the packets on all networks.
60. TR1 transmits Query A with a Multicast Address of the RUT global address.
61. Observe the packets on all networks.
62. TN1 transmits Report B.
63. Observe the packets on all networks

Observable Results:

- *Part A*
    Step 3: The RUT must transmit 2 MLDv2 General Queries.
    Step 5: The RUT must not transmit Queries other then periodic General Queries.
    Step 7: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
    Step 9: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S1.
- *Part B*
    Step 12: The RUT must transmit 2 MLDv2 General Queries.
    Step 14: The RUT must not transmit Queries other then periodic General Queries.
    Step 16: The RUT must not crash or generate invalid packets. The RUT must transmit Report with Multicast Address Records FF02::16 IS_IN(S1).   The RUT must not transmit Queries.
    Step 18: The RUT must not transmit Queries.
- *Part C*
    Step 21: The RUT must transmit 2 MLDv2 General Queries.
    Step 23: The RUT must not transmit Queries other then periodic General Queries.
    Step 25: The RUT must not crash or generate invalid packets. The RUT must transmit Report with Multicast Address Records FF02::16 IS_IN(S1). The RUT must not transmit Queries.
    Step 27: The RUT must not transmit Queries.
- *Part D*
    Step 30: The RUT must transmit 2 MLDv2 General Queries.
    Step 32: The RUT must not transmit Queries other then periodic General Queries.
    Step 34: The RUT must not transmit Queries.
    Step 36:. The RUT must not transmit Queries
- *Part E*

Step 39: The RUT must transmit 2 MLDv2 General Queries.
Step 41: The RUT must not transmit Queries other then periodic General Queries.
Step 43: The RUT must not transmit Queries other then periodic General Queries.
Step 45: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.

- *Part F*
  Step 48: The RUT must transmit 2 MLDv2 General Queries.
  Step 50: The RUT must not transmit Queries other then periodic General Queries.
  Step 52: The RUT must not transmit Queries other then periodic General Queries.
  Step 54: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S1.

- *Part G*
  Step 57: The RUT must transmit 2 MLDv2 General Queries.
  Step 59: The RUT must not transmit Queries other then periodic General Queries.
  Step 61: The RUT must not transmit Queries other then periodic General Queries.
  Step 63: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S1.

Possible Problems:

- None.

Test MLD.2.19: Query Number of Sources

Purpose: To verify that an MLDv2 router properly processes Number of Source Addresses in Query messages.

References:

- [MLD] – 5.1.10. Number of Sources (N)

  This number is limited by the MTU of the link over which the Query is transmitted. For example, on an Ethernet link with an MTU of 1500 octets, the IPv6 header (40 octets) together with the Hop-By-Hop Extension Header (8 octets) that includes the Router Alert option consume 48 octets; the MLD fields up to the Number of Sources (N) field consume 28 octets; thus, there are 1424 octets left for source addresses, which limits the number of source addresses to 89 (1424/16).

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S1)

Report B

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN()

Report C

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16

Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN(S1,S2)

Query A

IPv6 Header Source Address: TR2's Link- local Address Destination Address: M1
Router Alert
MLD MAS Query Multicast Address: M1 Number of Sources: 1 Source Address: S1

Query B

IPv6 Header Source Address: TR2's Link- local Address Destination Address: M1
Router Alert
MLD MA Query Multicast Address: M1

Query C

IPv6 Header Source Address: TR2's Link- local Address Destination Address: M1
Router Alert
MLD MA Query Multicast Address: M1 Source Address: S1,S2

Query D

IPv6 Header Source Address: TR1's Link- local Address Destination Address: M1
Router Alert
MLD MAS Query Multicast Address: M1 Number of Sources: 1 Source Address: S1

Query E

IPv6 Header Source Address: TR1's Link-local Address Destination Address: M1
Router Alert
MLD MA Query Multicast Address: M1

Procedure:

Part A: Zero
1. TR2 has a higher IP address then the RUT.
2. Enable MLDv2 on the RUT.
3. Observe the packets on all networks.
4. TN1 transmits Report A.
5. Observe the packets on all networks.
6. TR2 transmits Query A with the Number of Sources set to 0.
7. Observe the packets on all networks.
8. TN1 transmits Report B.
9. Observe the packets on all networks.

Part B: One, No sources included
10. TR2 has a higher IP address then the RUT.
11. Enable MLDv2 on the RUT.
12. Observe the packets on all networks.
13. TN1 transmits Report A.
14. Observe the packets on all networks.
15. TR2 transmits Query B with the Number of Sources set to 1.
16. Observe the packets on all networks.
17. TN1 transmits Report B.
18. Observe the packets on all networks.

Part C:
   missing number

Part D: Two, One Source included
28. TR2 has a higher IP address then the RUT.
29. Enable MLDv2 on the RUT.
30. Observe the packets on all networks.
31. TN1 transmits Report C.
32. Observe the packets on all networks.
33. TR2 transmits Query A with the Number of Sources set to 2.
34. Observe the packets on all networks.
35. TN1 transmits Report B.
36. Observe the packet on all networks.

Part E: One, No sources included in querier query
37. TR1 has a higher IP address then the RUT.
38. Enable MLDv2 on the RUT.
39. Observe the packets on all networks.
40. TN1 transmits Report A.
41. Observe the packets on all networks.
42. TR1 transmits Query D with the Number of Sources set to 1.

---

43. Observe the packets on all networks.
44. TN1 transmits Report B.
45. Observe the packets on all networks.

Part F: Two, One Source included in querier query
46. TR1 has a higher IP address then the RUT.
47. Enable MLDv2 on the RUT.
48. Observe the packets on all networks.
49. TN1 transmits Report C.
50. Observe the packets on all networks.
51. TR1 transmits Query E with the Number of Sources set to 2.
52. Observe the packets on all networks.
53. TN1 transmits Report B.
54. Observe the packet on all networks.

Observable Results:

- *Part A*
  Step 3: The RUT must transmit 2 MLDv2 General Queries.
  Step 5: The RUT must not transmit Queries other then periodic General Queries.
  Step 7: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
  Step 9: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S1.
- *Part B*
  Step 12: The RUT must transmit 2 MLDv2 General Queries.
  Step 14: The RUT must not transmit Queries other then periodic General Queries.
  Step 16: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
  Step 18: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S1.
- *Part C*
  missing number
- *Part D*
  Step 30: The RUT must transmit 2 MLDv2 General Queries.
  Step 32: The RUT must not transmit Queries other then periodic General Queries.
  Step 34: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
  Step 36: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and Source Addresses of S1 and S2.
- *Part E*
  Step 39: The RUT must transmit 2 MLDv2 General Queries.
  Step 41: The RUT must not transmit Queries other then periodic General Queries.
  Step 43: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
  Step 45: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S1.
- *Part F*
  Step 48: The RUT must transmit 2 MLDv2 General Queries.
  Step 50: The RUT must not transmit Queries other then periodic General Queries.

Step 52: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
Step 54: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and Source Addresses of S1 and S2.

Possible Problems:

- None.

Test MLD.2.20:

missing number

Test MLD.2.21: Query Additional Data

Purpose: To verify that an MLDv2 router properly processes ICMPv6 Additional Data in Query Message.

References:

- [MLD] – 5.1.12. Additional Data

  If the Payload Length field in the IPv6 header of a received Query indicates that there are additional octets of data present, beyond the fields described here, MLDv2 implementations MUST include those octets in the computation to verify the received MLD Checksum, but MUST otherwise ignore those additional octets.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

<div align="center">

Query A

IPv6 Header Source Address: TR1's Link-local Address Destination Address: FF02::1
Router Alert
MLD General Query

</div>

Procedure:

1. TR1 has a lower IP address then the RUT.
2. Enable MLDv2 on the RUT.
3. Observe the packets on all networks.
4. TR1 transmits Query A with additional data.
5. Observe the packets on all networks.
6. Wait [OQPT] seconds.
7. Observe the packets on all networks.

Observable Results:

Step 3: The RUT must transmit 2 MLDv2 General Queries.
Step 5: The RUT must not transmit Queries. The RUT must transmits MLDv2 Reports with Multicast Address Records with IS_EX (FF02::2), IS_EX (FF02::16), IS_EX(RUT Solicited Node Address).
Step 7: The RUT must transmit a General Query.

Possible Problems:

- None.

Test MLD.2.22: Report Message Type

Purpose: To verify that an MLDv2 router properly processes ICMPv6 Message type in Report messages.

References:

- [MLD] – 5. Message Formats

    Unrecognized message types MUST be silently ignored. Other message types may be used by newer versions or extensions of MLD, by multicast routing protocols, or for other uses.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record: M1, IS_IN (S1)

Report B

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record: M1, IS_IN (S2)

Report C

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record: M1, TO_IN()

Procedure:

1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A with a Message Type of 0xff.
4. Observe the packets on all networks.
5. TN1 transmits Report B.
6. Observe the packets on all networks.
7. TN1 transmits Report C.
8. Observe the packets on all networks.

Observable Results:

Step 2: The RUT must transmit 2 MLDv2 General Queries.
Step 4: The RUT must not transmit Queries other then periodic General Queries.
Step 6: The RUT must not transmit Queries other then periodic General Queries.
Step 8: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2.

Possible Problems:

- None.

Test MLD.2.23: Report Reserved Field

Purpose: To verify that an MLDv2 router properly processes ICMPv6 Reserved field in Report messages.

References:

- [MLD] – 5.2.1. Reserved

    The Reserved fields are set to zero on transmission, and ignored on reception.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A

IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S1)

Report B

IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S2)

Report C

IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN()

Procedure:

1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A with a Reserved field of 0xff.
4. Observe the packets on all networks.
5. TN1 transmits Report B.
6. Observe the packets on all networks.
7. TN1 transmits Report C.
8. Observe the packets on all networks.

Observable Results:

Step 2: The RUT must transmit 2 MLDv2 General Queries.
Step 4: The RUT must not transmit Queries other then periodic General Queries.
Step 6: The RUT must not transmit Queries other then periodic General Queries.
Step 8: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and Source Addresses of S1 and S2.

Possible Problems:

- None.

Test MLD.2.24: Report Checksum

Purpose: To verify that an MLDv2 router properly processes ICMPv6 Checksum in Report messages.

References:

- [MLD] – 5.2.2. Checksum

    The standard ICMPv6 checksum; it covers the entire MLDv2 message, plus a "pseudo-header" of IPv6 header fields [RFC2460, RFC2463]. In order to compute the checksum, the Checksum field is set to zero. When a packet is received, the checksum MUST be verified before processing it.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S1)

Report B

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S2)

Report C

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record:

Procedure:

1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A with a Checksum of all zeroes.
4. Observe the packets on all networks.
5. TN1 transmits Report B.
6. Observe the packets on all networks.
7. TN1 transmits Report C.
8. Observe the packets on all networks.

Observable Results:

Step 2: The RUT must transmit 2 MLDv2 General Queries.
Step 4: The RUT must not transmit Queries other then periodic General Queries.
Step 6: The RUT must not transmit Queries other then periodic General Queries.
Step 8: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2.

Possible Problems:

- None.

Test MLD.2.25: Report Number of Multicast Address Records

Purpose: To verify that an MLDv2 router properly processes Number of Multicast Address Records in Report messages.

References:

- [MLD] – 5.2.3. Nr of Mcast Address Records (M)

   The Nr of Mcast Address Records (M) field specifies how many Multicast Address Records are present in this Report.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record: M1, IS_IN (S1)

Report B

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record: M1, IS_IN (S2)

Report C

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record: M1, TO_IN()

Report D

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record: M2, TO_IN()

Procedure:

Part A: Zero
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A with a M set to 0.
4. Observe the packets on all networks.
5. TN1 transmits Report B.
6. Observe the packets on all networks.
7. TN1 transmits Report C.
8. Observe the packets on all networks.

Part B: No Record
9. Enable MLDv2 on the RUT.
10. Observe the packets on all networks.
11. TN1 transmits Report A without any Multicast Address Records with M set to 1.
12. Observe the packets on all networks.
13. TN1 transmits Report B.
14. Observe the packets on all networks.
15. TN1 transmits Report C.
16. Observe the packets on all networks.

Part C: One
17. Enable MLDv2 on the RUT.
18. Observe the packets on all networks.
19. TN1 transmits Report A with an added Multicast Address Records for M2 IS_IN(S1) with M set to 1.
20. Observe the packets on all networks.
21. TN1 transmits Report B.
22. Observe the packets on all networks.
23. TN1 transmits Report C.
24. Observe the packets on all networks.
25. TN1 transmits Report D.
26. Observe the packets on all networks.

Part D: Two
27. Enable MLDv2 on the RUT.
28. Observe the packets on all networks.
29. TN1 transmits Report A without any Multicast Address Records with M set to 2.
30. Observe the packets on all networks.

31. TN1 transmits Report B.
32. Observe the packets on all networks.
33. TN1 transmits Report C.
34. Observe the packets on all networks.

Observable Results:

- *Part A*
  - **Step 2:** The RUT must transmit 2 MLDv2 General Queries.
  - **Step 4:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 6:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 8:** The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2.
- *Part B*
  - **Step 10:** The RUT must transmit 2 MLDv2 General Queries.
  - **Step 12:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 14:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 16:** The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2.
- *Part C*
  - **Step 18:** The RUT must transmit 2 MLDv2 General Queries.
  - **Step 20:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 22:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 24:** The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and Source Addresses of S1 and S2.
  - **Step 26:** The RUT must not transmit Query other then periodic General Queries.
- *Part D*
  - **Step 28:** The RUT must transmit 2 MLDv2 General Queries.
  - **Step 30:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 32:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 34:** The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2.

Possible Problems:

- None.

Test MLD.2.26: Report Record Type

Purpose: To verify that an MLDv2 router properly processes Record Type in Report messages.

References:

- [MLD] – 5.2.12. Multicast Address Record Types

  Multicast Address Records with an unrecognized Record Type value MUST be silently ignored, with the rest of the report being processed.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S1)

Report B

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S2)

Report C

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN()

Report D

IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M2, TO_IN()

Procedure:

Part A: Unrecognized (0)
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A with a Record Type of zero.
4. Observe the packets on all networks.
5. TN1 transmits Report B.
6. Observe the packets on all networks.
7. TN1 transmits Report C.
8. Observe the packets on all networks.

Part B: Unrecognized (7)
9. Enable MLDv2 on the RUT.
10. Observe the packets on all networks.
11. TN1 transmits Report A with a Record Type of 7.
12. Observe the packets on all networks.
13. TN1 transmits Report B.
14. Observe the packets on all networks.
15. TN1 transmits Report C.
16. Observe the packets on all networks.

Part C: One Recognized and One Unrecognized
17. Enable MLDv2 on the RUT.
18. Observe the packets on all networks.
19. TN1 transmits Report A with a Record Type of 0xff. A Multicast Address Record for M2 IS_IN (S1) has been added.
20. Observe the packets on all networks.
21. TN1 transmits Report B.
22. Observe the packets on all networks.
23. TN1 transmits Report C.
24. Observe the packets on all networks.
25. TN1 transmits Report D.
26. Observe the packets on all networks.

Observable Results:

- *Part A*
    Step 2: The RUT must transmit 2 MLDv2 General Queries.
    Step 4: The RUT must not transmit Queries other then periodic General Queries.

Step 6: The RUT must not transmit Queries other then periodic General Queries.
Step 8: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2.

- *Part B*
    Step 10: The RUT must transmit 2 MLDv2 General Queries.
    Step 12: The RUT must not transmit Queries other then periodic General Queries.
    Step 14: The RUT must not transmit Queries other then periodic General Queries.
    Step 16: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2.

- *Part C*
    Step 18: The RUT must transmit 2 MLDv2 General Queries.
    Step 20: The RUT must not transmit Queries other then periodic General Queries.
    Step 22: The RUT must not transmit Queries other then periodic General Queries.
    Step 24: The RUT must transmit a Source and Multicast Specific Query with Multicast Address of M1 and a Source Address of S2.
    Step 26: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S1.

Possible Problems:

- None.

Test MLD.2.27: Report Aux Data Len

Purpose: To verify that an MLDv2 router properly processes Aux Data Len in Report messages.

References:

- [MLD] – 5.2.6. Aux Data Len

  The Aux Data Len field contains the length of the Auxiliary Data Field in this Multicast Address Record, in units of 32-bit words. It may contain zero, to indicate the absence of any auxiliary data.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S1) Aux Data Len = 0 Auxiliary Data = 0 (16 octets) M2, IS_IN (S1)

Report B

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S2)

Report C

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record:

M1, TO_IN()

Report D

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record: M2, TO_IN()

Report E

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record: M1, IS_IN (S1)

Report F

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record: M1, IS_IN (S1) Aux Data Len = 1 No Auxiliary Data M2, IS_IN (S1)

Procedure:

Part A: Zero
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A with first record including Aux Data but the Aux Data Len set to zero.
4. Observe the packets on all networks.
5. TN1 transmits Report B.
6. Observe the packets on all networks.
7. TN1 transmits Report C.
8. Observe the packets on all networks.
9. TN1 transmits Report D.

10. Observe the packets on all networks.

Part B: One, Last record has no data included
11. Enable MLDv2 on the RUT.
12. Observe the packets on all networks.
13. TN1 transmits Report E with Aux Data Len set to 1, but no Auxiliary Data.
14. Observe the packets on all networks.
15. TN1 transmits Report B.
16. Observe the packets on all networks.
17. TN1 transmits Report C.
18. Observe the packets on all networks.

Part C: One, no data included
19. Enable MLDv2 on the RUT.
20. Observe the packets on all networks.
21. TN1 transmits Report F with first record including no Aux Data but the Aux Data Len set to one.
22. Observe the packets on all networks.
23. TN1 transmits Report B.
24. Observe the packets on all networks.
25. TN1 transmits Report C.
26. Observe the packets on all networks.
27. TN1 transmits Report D.
28. Observe the packets on all networks.

Observable Results:

- *Part A*
    Step 2: The RUT must transmit 2 MLDv2 General Queries.
    Step 4: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
    Step 6: The RUT must not transmit Queries other then periodic General Queries.
    Step 8: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and Source Addresses of S1 and S2.
    Step 10: The RUT must not transmit Queries other then periodic General Queries.
- *Part B*
    Step 12: The RUT must transmit 2 MLDv2 General Queries.
    Step 14: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
    Step 16: The RUT must not transmit Queries other then periodic General Queries.
    Step 18: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2.
- *Part C*
    Step 20: The RUT must transmit 2 MLDv2 General Queries.
    Step 22: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
    Step 24: The RUT must not transmit Queries other then periodic General Queries.
    Step 26: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2.
    Step 28: The RUT must not transmit Queries other then periodic General Queries.

Possible Problems:

- None.

Test MLD.2.28: Report Number of Sources

Purpose: To verify that an MLDv2 router properly processes the number of sources in Report messages.

References:

- [MLD] – 5.2.7. Number of Sources (N)

  The Number of Sources (N) field specifies how many source addresses are present in this Multicast Address Record.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record:
M1, IS_IN (S1)
M2, IS_IN (S1)

Report B

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record:
M1, IS_IN (S2)

Report C

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record:
M1, TO_IN()

Report D

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M2, TO_IN()

Report E

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN ()

Report F

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN () M2, IS_IN (S1)

Procedure:

Part A: Zero
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A with the first record having the Number of Sources set to 0.
4. Observe the packets on all networks.
5. TN1 transmits Report B.
6. Observe the packets on all networks.
7. TN1 transmits Report C.
8. Observe the packets on all networks.
9. TN1 transmits Report D.
10. Observe the packets on all networks.

Part B: One, Last record as no data included
    11. Enable MLDv2 on the RUT.
    12. Observe the packets on all networks.
    13. TN1 transmits Report E with the Number of Sources set to 1.
    14. Observe the packets on all networks.
    15. TN1 transmits Report B.
    16. Observe the packets on all networks.
    17. TN1 transmits Report C.
    18. Observe the packets on all networks.

Part C: One, no data included
    19. Enable MLDv2 on the RUT.
    20. Observe the packets on all networks.
    21. TN1 transmits Report F with the first record having the Number of Sources set to 1.
    22. Observe the packets on all networks.
    23. TN1 transmits Report B.
    24. Observe the packets on all networks.
    25. TN1 transmits Report C.
    26. Observe the packets on all networks.
    27. TN1 transmits Report D.
    28. Observe the packets on all networks.

Observable Results:

- *Part A*
  Step 2: The RUT must transmit 2 MLDv2 General Queries.
  Step 4: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
  Step 6: The RUT must not transmit Queries other then periodic General Queries.
  Step 8: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2.
  Step 10: The RUT must not transmit Queries other then periodic General Queries.
- *Part B*
  Step 12: The RUT must transmit 2 MLDv2 General Queries.
  Step 14: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
  Step 16: The RUT must not transmit Queries other then periodic General Queries.
  Step 18: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2.
- *Part C*
  Step 20: The RUT must transmit 2 MLDv2 General Queries.
  Step 22: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
  Step 24: The RUT must not transmit Queries other then periodic General Queries.
  Step 26: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2.
  Step 28: The RUT must not transmit Queries other then periodic General Queries.

Possible Problems:

- None.

Test MLD.2.29: Report Multicast Address

Purpose: To verify that an MLDv2 router properly processes Multicast Address fields in Report messages.

References:

- [MLD] – 5.2.8. Multicast Address

  The Multicast Address field contains the multicast address to which this Multicast Address Record pertains.

- [MLD] – 6. Protocol Description for Multicast Address Listeners

  The link-scope all-nodes multicast address, (FF02::1), is handled as a special case. On all nodes -- that is all hosts and routers, including multicast routers -- listening to packets destined to the all-nodes multicast address, from all sources, is permanently enabled on all interfaces on which multicast listening is supported. No MLD messages are ever sent regarding neither the link-scope all-nodes multicast address, nor any multicast address of scope 0 (reserved) or 1 (node-local).

- [MLD] - 7. Description of the Protocol for Multicast Routers

  On each interface over which this protocol is being run, the router MUST enable reception of the link-scope "all MLDv2-capable routers" multicast address from all sources, and MUST perform the multicast address listener part of MLDv2 for that address on that interface.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

<div align="center">

Report A

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S1) M2, IS_IN (S1)

Report B

IPv6 Header Source Address: TN1's Link-local Address Destination Address:

</div>

| FF02::16 |
| Router Alert |
| MLDv2 Report
Multicast Address Record:
M1, TO_IN() |

Report C

| IPv6 Header
Source Address: TN1's Link-
local Address
Destination Address:
FF02::16 |
| Router Alert |
| MLDv2 Report
Multicast Address Record:
M2, TO_IN() |

Procedure:

Part A: Unspecified
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A with M1 multicast address set to ::.
4. Observe the packets on all networks.
5. TN1 transmits Report B.
6. Observe the packets on all networks.
7. TN1 transmits Report C.
8. Observe the packets on all networks.

Part B: RUT link-local
9. Enable MLDv2 on the RUT.
10. Observe the packets on all networks.
11. TN1 transmits Report A with M1 multicast address set to the RUT link-local address.
12. Observe the packets on all networks.
13. TN1 transmits Report B.
14. Observe the packets on all networks.
15. TN1 transmits Report C.
16. Observe the packets on all networks.

Part C: RUT global address
17. Enable MLDv2 on the RUT.
18. Observe the packets on all networks.
19. TN1 transmits Report A with M1 multicast address set to the RUT global address.
20. Observe the packets on all networks.
21. TN1 transmits Report B.
22. Observe the packets on all networks.
23. TN1 transmits Report C.
24. Observe the packets on all networks.

Part D: All Nodes multicast Address
25. Enable MLDv2 on the RUT.
26. Observe the packets on all networks.

---

27. TN1 transmits Report A with M1 multicast address set to FF02::1.
28. Observe the packets on all networks.
29. TN1 transmits Report B.
30. Observe the packets on all networks.
31. TN1 transmits Report C.
32. Observe the packets on all networks.

Part E: All MLDv2 Capable Routers
33. Enable MLDv2 on the RUT.
34. Observe the packets on all networks.
35. TN1 transmits Report A with M1 multicast address set to FF02::16.
36. Observe the packets on all networks.
37. TN1 transmits Report B.
38. Observe the packets on all networks.
39. TN1 transmits Report C.
40. Observe the packets on all networks.

Observable Results:

- *Part A*
     Step 2: The RUT must transmit 2 MLDv2 General Queries.
     Step 4: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
     Step 6: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
     Step 8: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M2 and a Source Address of S1.
- *Part B*
     Step 10: The RUT must transmit 2 MLDv2 General Queries.
     Step 12: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
     Step 14: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
     Step 16: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M2 and a Source Address of S1.
- *Part C*
     Step 18: The RUT must transmit 2 MLDv2 General Queries.
     Step 20: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
     Step 22: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
     Step 24: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M2 and a Source Address of S1.
- *Part D*
     Step 26: The RUT must transmit 2 MLDv2 General Queries.
     Step 28: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
     Step 30: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
     Step 32: The RUT must transmit 2 Multicast Address and Source Specific Queries with a

Multicast Address of M2 and a Source Address of S1.

- *Part E*

  Step 34: The RUT must transmit 2 MLDv2 General Queries.

  Step 36: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.

  Step 38: The RUT must transmit a Source and Multicast Specific Query with a Multicast Address of M1 and a Source Address of S1.

  Step 40: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M2 and a Source Address of S1.

Possible Problems:

- None.

Test MLD.2.30: Report Source Address

Purpose: To verify that an MLDv2 router properly processes Source Address fields in Report messages.

References:

- [MLD] – 5.2.9. Source Address [i]

   The Source Address [i] fields are a vector of n unicast addresses, where n is the value in this record's Number of Sources (N) field.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

<table>
<tr><td align="center">Report A</td></tr>
<tr><td align="center">IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16</td></tr>
<tr><td align="center">Router Alert</td></tr>
<tr><td align="center">MLDv2 Report
Multicast Address Record:
M1, IS_IN (S1, S2)</td></tr>
</table>

<table>
<tr><td align="center">Report B</td></tr>
<tr><td align="center">IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16</td></tr>
<tr><td align="center">Router Alert</td></tr>
<tr><td align="center">MLDv2 Report
Multicast Address Record:
M1, TO_IN()</td></tr>
</table>

Procedure:

Part A: Unspecified
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A with S1 address set to ::.
4. Observe the packets on all networks.
5. TN1 transmits Report B.
6. Observe the packets on all networks.

Part B: RUT link-local
7. Enable MLDv2 on the RUT.

8. Observe the packets on all networks.
9. TN1 transmits Report A with S1 address set to RUT link-local address.
10. Observe the packets on all networks.
11. TN1 transmits Report B.
12. Observe the packets on all networks.

Part C: RUT global address
13. Enable MLDv2 on the RUT.
14. Observe the packets on all networks.
15. TN1 transmits Report A with S1 address set to the RUT global address.
16. Observe the packets on all networks.
17. TN1 transmits Report B.
18. Observe the packets on all networks.

Part D: All Nodes multicast Address
19. Enable MLDv2 on the RUT.
20. Observe the packets on all networks.
21. TN1 transmits Report A with S1 address set to FF02::1.
22. Observe the packets on all networks.
23. TN1 transmits Report B.
24. Observe the packets on all networks.

Part E: All MLDv2 Capable Routers
25. Enable MLDv2 on the RUT.
26. Observe the packets on all networks.
27. TN1 transmits Report A with S1 address set to FF02::16.
28. Observe the packets on all networks.
29. TN1 transmits Report B.
30. Observe the packets on all networks.

Observable Results:

- *Part A*
  Step 2: The RUT must transmit 2 MLDv2 General Queries.
  Step 4: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
  Step 6: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2.
- *Part B*
  Step 8: The RUT must transmit 2 MLDv2 General Queries.
  Step 10: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
  Step 12: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2.
- *Part C*
  Step 14: The RUT must transmit 2 MLDv2 General Queries.
  Step 16: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.
  Step 18: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2.
- *Part D*
  Step 20: The RUT must transmit 2 MLDv2 General Queries.

Step 22: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.

Step 24: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2.

- *Part E*

     Step 26: The RUT must transmit 2 MLDv2 General Queries.

     Step 28: The RUT must not crash or generate invalid packets. The RUT must not transmit Queries other then periodic General Queries.

     Step 30: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2.

Possible Problems:

- None.

Test MLD.2.31: Report Auxiliary Data

Purpose: To verify that an MLDv2 router properly processes Auxiliary Data in Report messages.

References:

- [MLD] – 5.2.10. Auxiliary Data

  Therefore, implementations of MLDv2 MUST NOT include any auxiliary data (i.e., MUST set the Aux Data Len field to zero) in any transmitted Multicast Address Record, and MUST ignore any such data present in any received Multicast Address Record. The semantics and the internal encoding of the Auxiliary Data field are to be defined by any future version or extension of MLD that uses this field.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S1) M2, IS_IN (S1)

Report B

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN ()

Report C

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert

Procedure:

1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A with Auxiliary Data included in all records.
4. Observe the packets on all networks.
5. TN1 transmits Report B.
6. Observe the packets on all networks.
7. TN1 transmits Report C.
8. Observe the packets on all networks.

Observable Results:

Step 2: The RUT must transmit 2 MLDv2 General Queries.
Step 4: The RUT must not crash or generate invalid packets.
Step 6: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S1.
Step 8: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M2 and a Source Address of S1.

Possible Problems:

- None.

Test MLD.2.32: Report Additional Data

Purpose: To verify that an MLDv2 router properly processes Additional Data in Report messages.

References:

- [MLD] – 5.2.11. Additional Data

    If the Payload Length field in the IPv6 header of a received Report indicates that there are additional octets of data present, beyond the last Multicast Address Record, MLDv2 implementations MUST include those octets in the computation to verify the received MLD Checksum, but MUST otherwise ignore those additional octets. When sending a Report, an MLDv2 implementation MUST NOT include additional octets beyond the last Multicast Address Record.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S1)

Report B

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN ()

Procedure:

1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A with Additional Data .
4. Observe the packets on all networks.
5. TN1 transmits Report B.

6. Observe the packets on all networks.

Observable Results:

Step 2: The RUT must transmit 2 MLDv2 General Queries.
Step 4: The RUT must not crash or generate invalid packets.
Step 6: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S1.

Possible Problems:

- None.

GROUP 3: Value Adoption and Timers

Scope:

The following tests are designed to verify an MLDv2 Router's value adoption and timer expiration.

Overview:

These tests verify that an MLDv2 Router will adopt the appropriate values for certain timers when non-querier. These values include the Robustness Variable, the Other Querier Present Interval, the Group Membership Interval, Querier's Query Interval Code Adoption, and Older Host Present Interval. These tests also verify that timer expiration is handled correctly.

Test MLD.3.1: Other Querier Present Timeout

Purpose: To verify that an MLDv2 router properly implements Other Querier Present Timeout.

References:

- [MLD] – 5.1.3. Maximum Response Code

  Small values of Maximum Response Delay allow MLDv2 routers to tune the "leave latency" (the time between the moment the last node on a link ceases to listen to a specific multicast address and the moment the routing protocol is notified that there are no more listeners for that address). Larger values, especially in the exponential range, allow the tuning of the burstiness of MLD traffic on a link.

- [MLD] – 5.1.7. S Flag (Suppress Router-Side Processing)

  Nevertheless, it does not suppress the querier election or

- [MLD] – 5.1.8. QRV (Querier's Robustness Variable)

  Routers adopt the QRV value from the most recently received Query as their own [Robustness Variable] value, unless that most recently received QRV was zero, in which case they use the default [Robustness Variable] value specified in section 9.1, or a statically configured value.

- [MLD] – 5.1.9. QQIC (Querier's Query Interval Code)

  Multicast routers that are not the current Querier adopt the QQI value from the most recently received Query as their own [Query Interval] value, unless that most recently received QQI was zero, in which case the receiving routers use the default [Query Interval] value specified in section 9.2.

- [MLD] – 7.6.2. Querier Election

  When a router receives a query with a lower IPv6 address than its own, it sets the Other Querier Present timer to Other Querier Present Timeout; if it was previously in Querier state, it switches to Non- Querier state and ceases to send queries on the link. After the Other Querier Present timer expires, it should re-enter the Querier state and begin sending General Queries.

- [MLD] – 9.5. Other Querier Present Timeout

  The Other Querier Present Timeout is the length of time that must pass before a multicast router decides that there is no longer another multicast router which should be the Querier. This value MUST be ([Robustness Variable] times ([Query Interval]) plus (one half of [Query Response Interval]).

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed

after each test.

Query A
IPv6 Header Source Address: TR1's Link-local Address Destination Address: FF02::1
Router Alert
MLD General Query Max Response Code: 10000 QRV: 2 QQIC: 125

Procedure:

Part A: Max Response Code of 10000
1. Configure a Query Response Interval of 10000 milliseconds.
2. Enable MLDv2 on the RUT.
3. Observe the packets on all networks.
4. TR1 transmits Query A.
5. Observe the packets on all networks.
6. Wait [OQPT] 255 seconds.
7. Observe the packets on all networks.

Part B: Max Response Code of zero
8. Enable MLDv2 on the RUT.
9. Observe the packets on all networks.
10. TR1 transmits Query A with a Max Response Code of 0.
11. Observe the packets on all networks.
12. Wait [OQPT] seconds.
13. Observe the packets on all networks.

Part C: Max Response Code of 5000
14. Enable MLDv2 on the RUT.
15. Observe the packets on all networks.
16. TR1 transmits Query A with a Max Response Code of 5000.
17. Observe the packets on all networks.
18. Wait [OQPT] seconds.
19. Observe the packets on all networks.

Part D: Max Response Code of 20000
20. Enable MLDv2 on the RUT.
21. Observe the packets on all networks.
22. TR1 transmits Query A with a Max Response Code of 20000.
23. Observe the packets on all networks.
24. Wait [OQPT] seconds.
25. Observe the packets on all networks.

Part E: QRV of 0
26. Enable MLDv2 on the RUT.
27. Observe the packets on all networks.
28. TR1 transmits Query A with a QRV set to 0.
29. Observe the packets on all networks.

30. Wait Other Querier Present Timeout (255 seconds).
31. Observe the packets on all networks.

Part F: QQIC of 0

32. Enable MLDv2 on the RUT.
33. Observe the packets on all networks.
34. TR1 transmits Query A with a QQIC of 0.
35. Observe the packets on all networks.
36. Wait [OQPT] seconds.
37. Observe the packets on all networks.

Part G: QRV of 0 and QQIC 0

38. Configure a Robustness Variable of 2 and Query Interval of 60 on the RUT.
39. Enable MLDv2 on the RUT.
40. Observe the packets on all networks.
41. TR1 transmits Query A with a QRV set to 0 and QQIC set to 0.
42. Observe the packets on all networks.
43. Wait [OQPT] seconds.
44. Observe the packets on all networks.

Part H: QRV of 7 and QQIC of 60

45. Enable MLDv2 on the RUT.
46. Observe the packets on all networks.
47. TR1 transmits Query A with a QRV set to 7 and QQIC set to 60.
48. Observe the packets on all networks.
49. Wait [OQPT] seconds.
50. Observe the packets on all networks.

Part I: QQIC of 127

51. Enable MLDv2 on the RUT.
52. Observe the packets on all networks.
53. TR1 transmits Query A with a QQIC of 127.
54. Observe the packets on all networks.
55. Wait [OQPT] seconds.
56. Observe the packets on all networks.

Part J: QQIC of 128

57. Enable MLDv2 on the RUT.
58. Observe the packets on all networks.
59. TR1 transmits Query A with a QQIC of 128.
60. Observe the packets on all networks.
61. Wait [OQPT] seconds.
62. Observe the packets on all networks.

Part K: QQIC of 132

63. Enable MLDv2 on the RUT.
64. Observe the packets on all networks.
65. TR1 transmits Query A with a QQIC of 132.
66. Observe the packets on all networks.
67. Wait [OQPT] seconds.
68. Observe the packets on all networks.

Part L: S Flag

69. Enable MLDv2 on the RUT.
70. Observe the packets on all networks.
71. TR1 transmits Query A with S Flag set to 1.

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72. Observe the packets on all networks.
73. Wait [OQPT] seconds.
74. Observe the packets on all networks.

Observable Results:

- *Part A*
  Step 2: The RUT must transmit 2 MLDv2 General Queries.
  Step 4: The RUT must transmit a Report. The RUT must not transmit Queries.
  Step 6: The RUT must transmit a General Queries.
- *Part B*
  Step 8: The RUT must transmit 2 MLDv2 General Queries.
  Step 10: The RUT must transmit a Report. The RUT must not transmit Queries.
  Step 12: The RUT must transmit a General Queries.
- *Part C*
  Step 14: The RUT must transmit 2 MLDv2 General Queries.
  Step 16: The RUT must transmit a Report. The RUT must not transmit Queries.
  Step 18: The RUT must transmit a General Queries.
- *Part D*
  Step 20: The RUT must transmit 2 MLDv2 General Queries.
  Step 22: The RUT must transmit a Report. The RUT must not transmit Queries.
  Step 24: The RUT must transmit a General Queries.
- *Part E*
  Step 26: The RUT must transmit 2 MLDv2 General Queries.
  Step 28: The RUT must transmit a Report. The RUT must not transmit Queries.
  Step 30: The RUT must transmit a General Queries.
- *Part F*
  Step 32: The RUT must transmit 2 MLDv2 General Queries.
  Step 34: The RUT must transmit a Report. The RUT must not transmit Queries.
  Step 36: The RUT must transmit a General Queries.
- *Part G*
  Step 40: The RUT must transmit 2 MLDv2 General Queries.
  Step 42: The RUT must transmit a Report. The RUT must not transmit Queries.
  Step 44: The RUT must transmit a General Queries.
- *Part H*
  Step 46: The RUT must transmit 2 MLDv2 General Queries.
  Step 48: The RUT must transmit a Report. The RUT must not transmit Queries.
  Step 50: The RUT must transmit a General Queries.
- *Part I*
  Step 52: The RUT must transmit 2 MLDv2 General Queries.
  Step 54: The RUT must transmit a Report. The RUT must not transmit Queries.
  Step 56: The RUT must transmit a General Queries.
- *Part J*
  Step 58: The RUT must transmit 2 MLDv2 General Queries.
  Step 60: The RUT must transmit a Report. The RUT must not transmit Queries.
  Step 62: The RUT must transmit a General Queries.
- *Part K*
  Step 64: The RUT must transmit 2 MLDv2 General Queries.

Step 66: The RUT must transmit a Report. The RUT must not transmit Queries.
Step 68: The RUT must transmit a General Queries.

- *Part L*
  Step 70: The RUT must transmit 2 MLDv2 General Queries.
  Step 72: The RUT must transmit a Report. The RUT must not transmit Queries.
  Step 74: The RUT must transmit a General Queries.

Possible Problems:

- None.

Test MLD.3.2: Other Querier Specific Query

Purpose: To verify that an MLDv2 router properly processes Other Querier Specific Queries.

References:

- [MLD] – 5.1.7. S Flag (Suppress Router-Side Processing)

  the normal "host-side" processing of a Query that a router may be required to perform as a consequence of itself being a multicast listener.

- [MLD] – 5.1.8. QRV (Querier's Robustness Variable)

  Routers adopt the QRV value from the most recently received Query as their own [Robustness Variable] value, unless that most recently received QRV was zero, in which case they use the default [Robustness Variable] value specified in section 9.1, or a statically configured value.

- [MLD] – 5.1.9. QQIC (Querier's Query Interval Code)

  Multicast routers that are not the current Querier adopt the QQI value from the most recently received Query as their own [Query Interval] value, unless that most recently received QQI was zero, in which case the receiving routers use the default [Query Interval] value specified in section 9.2.

- [MLD] – 7.6.2. Querier Election

  When a router receives a query with a lower IPv6 address than its own, it sets the Other Querier Present timer to Other Querier Present Timeout; if it was previously in Querier state, it switches to Non- Querier state and ceases to send queries on the link. After the Other Querier Present timer expires, it should re-enter the Querier state and begin sending General Queries.

- [MLD] – 9.5. Other Querier Present Timeout

  The Other Querier Present Timeout is the length of time that must pass before a multicast router decides that there is no longer another multicast router which should be the Querier. This value MUST be ([Robustness Variable] times ([Query Interval]) plus (one half of [Query Response Interval]).

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Query A
IPv6 Header
Source Address: TR1's Link-local Address

Destination Address: M1
Router Alert
MLD MA Query Max Response Code: 10000 Multicast Address: M1 QRV: 2 QQIC: 125

Query B

IPv6 Header Source Address: TR1's Link- local Address Destination Address: M1
Router Alert
MLD MAS Query Max Response Code: 10000 Multicast Address: M1 QRV: 2 QQIC: 125 Number of Sources: 1 Source Address: S1

Procedure:

Part A: Other Querier MA Query
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TR1 transmits Query A.
4. Observe the packets on all networks.
5. Wait [OQPT] seconds.
6. Observe the packets on all networks.

Part B: Other Querier MAS Query
7. Enable MLDv2 on the RUT.
8. Observe the packets on all networks.
9. TR1 transmits Query B.
10. Observe the packets on all networks.
11. Wait [OQPT] seconds.
12. Observe the packets on all networks.

Part C: Other Querier MA Query with S Flag set
13. Enable MLDv2 on the RUT.
14. Observe the packets on all networks.
15. TR1 transmits Query A with the S Flag set.
16. Observe the packets on all networks.
17. Wait [OQPT] seconds.
18. Observe the packets on all networks.

Part D: Other Querier MAS Query with S Flag set
19. Enable MLDv2 on the RUT.
20. Observe the packets on all networks.
21. TR1 transmits Query A with the S Flag set.

22. Observe the packets on all networks.
23. Wait [OQPT] seconds.
24. Observe the packets on all networks.

Observable Results:

- *Part A*
    Step 2: The RUT must transmit 2 MLDv2 General Queries.
    Step 4: The RUT must not transmit Queries.
    Step 6: The RUT must transmit a General Queries.
- *Part B*
    Step 8: The RUT must transmit 2 MLDv2 General Queries.
    Step 10: The RUT must not transmit Queries.
    Step 12: The RUT must transmit a General Queries.
- *Part C*
    Step 14: The RUT must transmit 2 MLDv2 General Queries.
    Step 16: The RUT must not transmit Queries.
    Step 18: The RUT must transmit a General Queries.
- *Part D*
    Step 20: The RUT must transmit 2 MLDv2 General Queries.
    Step 22: The RUT must not transmit Queries.
    Step 24: The RUT must transmit a General Queries.

Possible Problems:

- None.

Test MLD.3.3: Other Non-Querier Query

Purpose: To verify that an MLDv2 router properly processes Other Non-Querier Queries.

References:

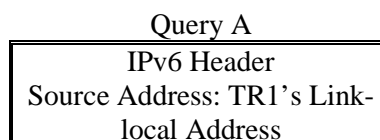- [MLD] – 5.1.8. QRV (Querier's Robustness Variable)

  Routers adopt the QRV value from the most recently received Query as their own [Robustness Variable] value, unless that most recently received QRV was zero, in which case they use the default [Robustness Variable] value specified in section 9.1, or a statically configured value.

- [MLD] – 5.1.9. QQIC (Querier's Query Interval Code)

  Multicast routers that are not the current Querier adopt the QQI value from the most recently received Query as their own [Query Interval] value, unless that most recently received QQI was zero, in which case the receiving routers use the default [Query Interval] value specified in section 9.2.

- [MLD] – 7.6. Action on Reception of Queries

  Upon reception of an MLD message that contains a Query, the router checks if the source address of the message is a valid link-local address, if the Hop Limit is set to 1, and if the Router Alert option is present in the Hop-By-Hop Options header of the IPv6 packet. If any of these checks fails, the packet is dropped.

- [MLD] – 7.6.1. Timer Updates

  When a router sends or receives a query with a clear Suppress Router-Side Processing flag, it must update its timers to reflect the correct timeout values for the multicast address or sources being queried. The following table describes the timer actions when sending or receiving a Multicast Address Specific or Multicast Address and Source Specific Query with the Suppress Router-Side Processing flag not set.

  ```
  Query      Action
  -----      ------
  Q(MA,A)    Source Timers for sources in A are lowered to LLQT
  Q(MA)      Filter Timer is lowered to LLQT
  ```

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Query A
IPv6 Header
Source Address: TR2's Link-local Address
Destination Address: FF02::1

Router Alert
MLD General Query Max Response Code: 10000 QRV: 2 QQIC: 125

Query B

IPv6 Header Source Address: TR2's Link-local Address Destination Address: M1
Router Alert
MLD MA Query Max Response Code: 1000 Multicast Address: M1 QRV: 2 QQIC: 125

Query C

IPv6 Header Source Address: TR2's Link-local Address Destination Address: M1
Router Alert
MLD MAS Query Max Response Code: 1000 Multicast Address: M1 QRV: 2 QQIC: 125 Number of Sources: 1 Source Address: S1

Report A

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S1)

Report B

IPv6 Header Source Address: TN1's Link-local Address Destination Address:

FF02::16

Router Alert
MLDv2 Report Multicast Address Record: M1, IS_EX ()

Report C

IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN()

Procedure:

Part A: Non-Querier General Query
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TR2 transmits Query A.
4. Observe the packets on all networks.
5. Wait [QI] seconds.
6. Observe the packets on all networks.

Part B: Non-Querier MA Query
7. Enable MLDv2 on the RUT.
8. Observe the packets on all networks.
9. TR2 transmits Query B.
10. Observe the packets on all networks.
11. Wait [QI] seconds.
12. Observe the packets on all networks.

Part C: Non-Querier MAS Query
13. Enable MLDv2 on the RUT.
14. Observe the packets on all networks.
15. TR2 transmits Query C.
16. Observe the packets on all networks.
17. Wait [QI] seconds.
18. Observe the packets on all networks.

Part D:
   missing number

Part E:
   missing number

Observable Results:

- *Part A*
  - **Step 2:** The RUT must transmit 2 MLDv2 General Queries.
  - **Step 4:** The RUT must transmit a Report. The RUT must not transmit Queries.
  - **Step 6:** The RUT must transmit a General Query.
- *Part B*
  - **Step 8:** The RUT must transmit 2 MLDv2 General Queries.
  - **Step 10:** The RUT must not transmit Queries.
  - **Step 12:** The RUT must transmit a General Query.
- *Part C*
  - **Step 14:** The RUT must transmit 2 MLDv2 General Queries.
  - **Step 16:** The RUT must not transmit Queries.
  - **Step 18:** The RUT must transmit a General Query.
- *Part D*
  - *missing number*
- *Part E*
  - *missing number*

Possible Problems:

- None.

Test MLD.3.4: Query Adoption Filter Timer

Purpose: To verify that an MLDv2 router properly updates Filter Timer.

References:

- [MLD] – 5.1.3. Maximum Response Code

  Small values of Maximum Response Delay allow MLDv2 routers to tune the "leave latency" (the time between the moment the last node on a link ceases to listen to a specific multicast address and the moment the routing protocol is notified that there are no more listeners for that address). Larger values, especially in the exponential range, allow the tuning of the burstiness of MLD traffic on a link.

- [MLD] – 5.1.8. QRV (Querier's Robustness Variable)

  Routers adopt the QRV value from the most recently received Query as their own [Robustness Variable] value, unless that most recently received QRV was zero, in which case they use the default [Robustness Variable] value specified in section 9.1, or a statically configured value.

- [MLD] – 5.1.9. QQIC (Querier's Query Interval Code)

  Multicast routers that are not the current Querier adopt the QQI value from the most recently received Query as their own [Query Interval] value, unless that most recently received QQI was zero, in which case the receiving routers use the default [Query Interval] value specified in section 9.2.

- [MLD] – 7.4.2. Reception of Filter Mode Change and Source List Change Records

  When a router queries or receives a query for a specific set of sources, it lowers its source timers for those sources to a small interval of Last Listener Query Time milliseconds.

- [MLD] – 7.6.1. Timer Updates

  When a router sends or receives a query with the Suppress Router-Side Processing flag set, it will not update its timers.

- [MLD] – 10.1. Query Message

  A forged Query message from a machine with a lower IPv6 address than the current Querier will cause Querier duties to be assigned to the forger. If the forger then sends no more Query messages, other routers' Other Querier Present timer will time out and one will resume the role of Querier. During this time, if the forger ignores Multicast Listener Done Messages, traffic might flow to multicast addresses with no listeners for up to [Multicast Address Listener Interval].

Test Setup: The is performed on the RUT. The is performed after each test.

Query A

IPv6 Header
Source Address: TR1's Link-local Address
Destination Address: FF02::1
Router Alert
MLD General Query
Max Response Code: 10000
QRV: 2
QQIC: 125

Report A

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record: M1, IS_EX ()

Report B

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record: M1, TO_IN()

Procedure:

Part A: Default MALI before Filter Timer expires
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TR1 transmits Query A.
4. Observe the packets on all networks.
5. Wait [QI] seconds from Step 3. TN1 transmits Report A.
6. Observe the packets on all networks.
7. Wait [OQPT] seconds from Step 3.
8. Observe the packets on all networks.
9. Wait [MALI] from Step 5. TN1 transmits Report B.

---

10. Observe the packets on all networks.

Part B: Default MALI after Filter Timer expires

11. Enable MLDv2 on the RUT.
12. Observe the packets on all networks.
13. TR1 transmits Query A.
14. Observe the packets on all networks.
15. Wait [QI] seconds from Step 13. TN1 transmits Report A.
16. Observe the packets on all networks.
17. Wait [OQPT] from Step 13.
18. Observe the packets on all networks.
19. Wait [MALI] seconds from Step 15. TN1 transmits Report B.
20. Observe the packets on all networks.

Part C: Adoption RV and QI before Filter Timer expires

21. Enable MLDv2 on the RUT.
22. Observe the packets on all networks.
23. TR1 transmits Query A with a QRV of 0, QQIC of 0, and Max Response Code of 5000.
24. Observe the packets on all networks.
25. Wait [QI] seconds from Step 23. TN1 transmits Report A.
26. Observe the packets on all networks.
27. Wait [OQPT] seconds from Step 23.
28. Observe the packets on all networks.
29. Wait [MALI-LLQT-∝] seconds from Step 25. TN1 transmits Report B.
30. Observe the packets on all networks.

Part D: Adoption RV and QI after Filter Timer expires

31. Enable MLDv2 on the RUT.
32. Observe the packets on all networks.
33. TR1 transmits Query A with a QRV of 0, QQIC of 0, and Max Response Code of 5000.
34. Observe the packets on all networks.
35. Wait [QI] seconds from Step 33. TN1 transmits Report A.
36. Observe the packets on all networks.
37. Wait [OQPT] seconds from Step 33.
38. Observe the packets on all networks.
39. Wait [MALI] seconds from Step 35. TN1 transmits Report B.
40. Observe the packets on all networks.

Part E: Small QQIC before Filter Timer expires

41. Enable MLDv2 on the RUT.
42. Observe the packets on all networks.
43. TR1 transmits Query A with a QRV of 2, QQIC of 60, and Max Response Code of 10000.
44. Observe the packets on all networks.
45. Wait [QI] seconds from Step 43. TN1 transmits Report A.
46. Observe the packets on all networks.
47. Wait [OQPT] seconds from Step 43.
48. Observe the packets on all networks.
49. Wait [MALI-LLQT-∝] seconds from Step 45. TN1 transmits Report B.
50. Observe the packets on all networks.

Part F: Small QQIC after Filter Timer expires

51. Enable MLDv2 on the RUT.
52. Observe the packets on all networks.
53. TR1 transmits Query A with a QRV of 2, QQIC of 60, and Max Response Code of 10000.

54. Observe the packets on all networks.
55. Wait [QI] seconds from Step 53. TN1 transmits Report A.
56. Observe the packets on all networks.
57. Wait [OQPT] seconds from Step 53.
58. Observe the packets on all networks.
59. Wait [MALI] seconds from Step 55. TN1 transmits Report B.
60. Observe the packets on all networks.

Part G: QRV before Filter Timer expires
61. Enable MLDv2 on the RUT.
62. Observe the packets on all networks.
63. TR1 transmits Query A with a QRV of 3, QQIC of 80, and Max Response Code of 20000.
64. Observe the packets on all networks.
65. Wait [QI] seconds from Step 63. TN1 transmits Report A.
66. Observe the packets on all networks.
67. Wait [OQPT] seconds from Step 63.
68. Observe the packets on all networks.
69. Wait [MALI-LLQT-∝] from Step 65. TN1 transmits Report B.
70. Observe the packets on all networks.

Part H: QRV after Filter Timer expires
71. Enable MLDv2 on the RUT.
72. Observe the packets on all networks.
73. TR1 transmits Query A with a QRV of 3, QQIC of 80, and Max Response Code of 20000.
74. Observe the packets on all networks.
75. Wait [QI] seconds from Step 73. TN1 transmits Report A.
76. Observe the packets on all networks.
77. Wait [OQPT] seconds from Step 73.
78. Observe the packets on all networks.
79. Wait [MALI] seconds from Step 75. TN1 transmits Report B.
80. Observe the packets on all networks.

Part I: QQIC before Filter Timer expires
81. Enable MLDv2 on the RUT.
82. Observe the packets on all networks.
83. TR1 transmits Query A with a QRV of 2, QQIC of 132, and Max Response Code of 33672 (0x8388).
84. Observe the packets on all networks.
85. Wait [QI] seconds from Step 83. TN1 transmits Report A.
86. Observe the packets on all networks.
87. Wait [OQPT] seconds from Step 85.
88. Observe the packets on all networks.
89. Wait [MALI-LLQT-∝] seconds from Step 85. TN1 transmits Report B.
90. Observe the packets on all networks.

Part J: QQIC after Filter Timer expires
91. Enable MLDv2 on the RUT.
92. Observe the packets on all networks.
93. TR1 transmits Query A with a QRV of 2, QQIC of 132, and Max Response Code of 33672 (0x8388).
94. Observe the packets on all networks.
95. Wait [QI] seconds from Step 93. TN1 transmits Report A.
96. Observe the packets on all networks.

97. Wait [OQPT] seconds from Step 93.

98. Observe the packets on all networks.

99. Wait [MALI] seconds from Step 95. TN1 transmits Report B.

100. Observe the packets on all networks.

Part K: Last Listener Timer

101. Configure RUT to have a Robustness Variable of 3.

102. Enable MLDv2 on the RUT.

103. Observe the packets on all networks.

104. TR1 transmits Query A with a QRV of 2, QQIC of 60, and Max Response Code of 10000.

105. Observe the packets on all networks.

106. Wait [QI] seconds from Step 104. TN1 transmits Report A.

107. Observe the packets on all networks.

108. Wait [OQPT] seconds from Step 104.

109. Observe the packets on all networks.

110. Wait [MALI-LLQT-∝] seconds from Step 106. TN1 transmits Report B.

111. Observe the packets on all networks.

Part L: Change Filter Mode before Filter Timer expires

112. Enable MLDv2 on the RUT.

113. Observe the packets on all networks.

114. TR1 transmits Query A with a QRV of 3, QQIC of 60, and Max Response Code of 10000.

115. Observe the packets on all networks.

116. Wait [QI] seconds from Step 114. TN1 transmits Report A.

117. Observe the packets on all networks.

118. Wait [QI] seconds from Step 116. TN1 transmits Report B.

119. Observe the packets on all networks.

120. Wait [OQPT] seconds from Step 114.

121. Observe the packets on all networks.

122. Wait [MALI-LLQT-∝] seconds from Step 116. TN1 transmits Report B.

123. Observe the packets on all networks.

Part M: Change Filter Mode after Filter Timer expires

124. Enable MLDv2 on the RUT.

125. Observe the packets on all networks.

126. TR1 transmits Query A with a QRV of 3, QQIC of 60, and Max Response Code of 10000.

127. Observe the packets on all networks.

128. Wait [QI] seconds from Step 126. TN1 transmits Report A.

129. Observe the packets on all networks.

130. Wait [QI] seconds from Step 128. TN1 transmits Report B.

131. Observe the packets on all networks.

132. Wait [OQPT] seconds from Step 126.

133. Observe the packets on all networks.

134. Wait [MALI] seconds from Step 128. TN1 transmits Report B.

135. Observe the packets on all networks.

Part N: S Flag

136. Enable MLDv2 on the RUT.

137. Observe the packets on all networks.

138. TR1 transmits Query A.

139. Observe the packets on all networks.

140. Wait [QI] seconds from Step 138. TN1 transmits Report A.

141. Observe the packets on all networks.

142. Wait [QI*2] seconds from Step 138. TR2 transmits a MA Query for M1 with the S Flag set.
143. Observe the packets on all networks.
144. Wait [OQPT] seconds from Step 138.
145. Observe the packets on all networks.
146. TN1 transmits Report B.
147. Observe the packets on all networks.

Observable Results:

- *Part A*
    Step 2: The RUT must transmit 2 MLDv2 General Queries.
    Step 4: The RUT must transmit a Report. The RUT must not transmit Queries.
    Step 6: The RUT must not transmit Queries.
    Step 8: The RUT must transmit a General Queries.
    Step 10: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part B*
    Step 12: The RUT must transmit 2 MLDv2 General Queries.
    Step 14: The RUT must transmit a Report. The RUT must not transmit Queries.
    Step 16: The RUT must not transmit Queries.
    Step 18: The RUT must transmit a General Queries.
    Step 20: The RUT must not transmit Queries other then periodic General Queries.
- *Part C*
    Step 22: The RUT must transmit 2 MLDv2 General Queries.
    Step 24: The RUT must not transmit Queries.
    Step 26: The RUT must not transmit Queries.
    Step 28: The RUT must transmit a General Queries.
    Step 30: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part D*
    Step 32: The RUT must transmit 2 MLDv2 General Queries.
    Step 34: The RUT must transmit a Report. The RUT must not transmit Queries.
    Step 36: The RUT must not transmit Queries.
    Step 38: The RUT must transmit a General Queries.
    Step 40: The RUT must not transmit Queries other then periodic General Queries.
- *Part E*
    Step 42: The RUT must transmit 2 MLDv2 General Queries.
    Step 44: The RUT must transmit a Report. The RUT must not transmit Queries.
    Step 46: The RUT must not transmit Queries.
    Step 48: The RUT must transmit a General Queries.
    Step 50: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part F*
    Step 52: The RUT must transmit 2 MLDv2 General Queries.
    Step 54: The RUT must transmit a Report. The RUT must not transmit Queries.
    Step 56: The RUT must not transmit Queries.
    Step 58: The RUT must transmit a General Queries.
    Step 60: The RUT must not transmit Queries other then periodic General Queries.
- *Part G*

Step 62: The RUT must transmit 2 MLDv2 General Queries.

Step 64: The RUT must transmit a Report. The RUT must not transmit Queries.

Step 66: The RUT must not transmit Queries.

Step 68: The RUT must transmit a General Queries.

Step 70: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

- *Part H*

    Step 72: The RUT must transmit 2 MLDv2 General Queries.

    Step 74: The RUT must transmit a Report. The RUT must not transmit Queries.

    Step 76: The RUT must not transmit Queries.

    Step 78: The RUT must transmit a General Queries.

    Step 80: The RUT must not transmit Queries other then periodic General Queries.

- *Part I*

    Step 82: The RUT must transmit 2 MLDv2 General Queries.

    Step 84: The RUT must transmit a Report. The RUT must not transmit Queries.

    Step 86: The RUT must not transmit Queries.

    Step 88: The RUT must transmit a General Queries.

    Step 90: The RUT must transmit 2 Multicast Specific Query with a Multicast Address of M1.

- *Part J*

    Step 92: The RUT must transmit 2 MLDv2 General Queries.

    Step 94: The RUT must transmit a Report. The RUT must not transmit Queries.

    Step 96: The RUT must not transmit Queries.

    Step 98: The RUT must transmit a General Queries.

    Step 100: The RUT must not transmit Queries other then periodic General Queries.

- *Part K*

    Step 103: The RUT must transmit 2 MLDv2 General Queries.

    Step 105: The RUT must transmit a Report. The RUT must not transmit Queries.

    Step 107: The RUT must not transmit Queries.

    Step 109: The RUT must transmit a General Queries.

    Step 111: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

- *Part L*

    Step 113: The RUT must transmit 2 MLDv2 General Queries.

    Step 115: The RUT must transmit a Report. The RUT must not transmit Queries.

    Step 117: The RUT must not transmit Queries.

    Step 119: The RUT must not transmit Queries.

    Step 121: The RUT must transmit a General Queries.

    Step 123: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

- *Part M*

    Step 125: The RUT must transmit 2 MLDv2 General Queries.

    Step 127: The RUT must transmit a Report. The RUT must not transmit Queries.

    Step 129: The RUT must not transmit Queries.

    Step 131: The RUT must not transmit Queries.

    Step 133: The RUT must transmit a General Queries.

    Step 135: The RUT must not transmit Queries other then periodic General Queries.

- *Part N*

    Step 137: The RUT must transmit 2 MLDv2 General Queries.

Step 139: The RUT must transmit a Report. The RUT must not transmit Queries.
Step 141: The RUT must not transmit Queries.
Step 143: The RUT must not transmit Queries.
Step 145: The RUT must transmit a General Queries.
Step 147: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

Possible Problems:

- None.

Test MLD.3.5: Query Adoption Source Timer

Purpose: To verify that an MLDv2 router properly updates Source Timer.

References:

- [MLD] – 5.1.3. Maximum Response Code

  Small values of Maximum Response Delay allow MLDv2 routers to tune the "leave latency" (the time between the moment the last node on a link ceases to listen to a specific multicast address and the moment the routing protocol is notified that there are no more listeners for that address). Larger values, especially in the exponential range, allow the tuning of the burstiness of MLD traffic on a link.

- [MLD] – 5.1.8. QRV (Querier's Robustness Variable)

  Routers adopt the QRV value from the most recently received Query as their own [Robustness Variable] value, unless that most recently received QRV was zero, in which case they use the default [Robustness Variable] value specified in section 9.1, or a statically configured value.

- [MLD] – 5.1.9. QQIC (Querier's Query Interval Code)

  Multicast routers that are not the current Querier adopt the QQI value from the most recently received Query as their own [Query Interval] value, unless that most recently received QQI was zero, in which case the receiving routers use the default [Query Interval] value specified in section 9.2.

- [MLD] – 7.4.2. Reception of Filter Mode Change and Source List Change Records

  When a router queries or receives a query for a specific set of sources, it lowers its source timers for those sources to a small interval of Last Listener Query Time milliseconds.

- [MLD] – 7.6.1. Timer Updates

  When a router sends or receives a query with the Suppress Router-Side Processing flag set, it will not update its timers.

- [MLD] – 10.1. Query Message

  A forged Query message from a machine with a lower IPv6 address than the current Querier will cause Querier duties to be assigned to the forger. If the forger then sends no more Query messages, other routers' Other Querier Present timer will time out and one will resume the role of Querier. During this time, if the forger ignores Multicast Listener Done Messages, traffic might flow to multicast addresses with no listeners for up to [Multicast Address Listener Interval].

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed

after each test.

Query A

IPv6 Header
Source Address: TR1's Link-local Address
Destination Address: FF02::1
Router Alert
MLD General Query
Max Response Code: 10000
QRV: 2
QQIC: 125

Report A

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record: M1, TO_EX ()

Report B

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record: M1, TO_IN()

Procedure:

Part A: Default MALI before Source Timer expires
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TR1 transmits Query A.
4. Observe the packets on all networks.
5. Wait [QI] seconds from Step 3. TN1 transmits Report A.
6. Observe the packets on all networks.
7. Wait [OQPT] seconds from Step 3.
8. Observe the packets on all networks.
9. Wait [MALI-LLQT-∝] seconds from Step 5. TN1 transmits Report B.
10. Observe the packets on all networks.

Part B: Default MALI after Source Timer expires
    11. Enable MLDv2 on the RUT.
    12. Observe the packets on all networks.
    13. TR1 transmits Query A.
    14. Observe the packets on all networks.
    15. Wait [QI] seconds from Step 13. TN1 transmits Report A.
    16. Observe the packets on all networks.
    17. Wait [OQPT] seconds form Step 13.
    18. Observe the packets on all networks.
    19. Wait [MALI] seconds from Step 15. TN1 transmits Report B.
    20. Observe the packets on all networks.

Part C: Adoption RV and QI before Source Timer expires
    21. Enable MLDv2 on the RUT.
    22. Observe the packets on all networks.
    23. TR1 transmits Query A with a QRV of 0, QQIC of 0, and Max Response Code of 5000.
    24. Observe the packets on all networks.
    25. Wait [QI] seconds from Step 23. TN1 transmits Report A.
    26. Observe the packets on all networks.
    27. Wait [OQPT] seconds from Step 23.
    28. Observe the packets on all networks.
    29. Wait [MALI-LLQT-∞] seconds from Step 25. TN1 transmits Report B.
    30. Observe the packets on all networks.

Part D: Adoption RV and QI after Source Timer expires
    31. Enable MLDv2 on the RUT.
    32. Observe the packets on all networks.
    33. TR1 transmits Query A with a QRV of 0, QQIC of 0, and Max Response Code of 5000.
    34. Observe the packets on all networks.
    35. Wait [QI] seconds. TN1 transmits Report A.
    36. Observe the packets on all networks.
    37. Wait [OQPT] from Step 33.
    38. Observe the packets on all networks.
    39. Wait [MALI] seconds from Step 35. TN1 transmits Report B.
    40. Observe the packets on all networks.

Part E: Small QQIC before Source Timer expires
    41. Enable MLDv2 on the RUT.
    42. Observe the packets on all networks.
    43. TR1 transmits Query A with a QRV of 2, QQIC of 60, and Max Response Code of 10000.
    44. Observe the packets on all networks.
    45. Wait [QI] seconds from Step 43. TN1 transmits Report A.
    46. Observe the packets on all networks.
    47. Wait [OQPT] seconds from 43.
    48. Observe the packets on all networks.
    49. Wait [MALI-LLQT-∞] seconds from Step 45. TN1 transmits Report B.
    50. Observe the packets on all networks.

Part F: Small QQIC after Source Timer expires
    51. Enable MLDv2 on the RUT.
    52. Observe the packets on all networks.
    53. TR1 transmits Query A with a QRV of 2, QQIC of 60, and Max Response Code of 10000.
    54. Observe the packets on all networks.

55. Wait [QI] seconds. TN1 transmits Report A.
56. Observe the packets on all networks.
57. Wait [OQPT] seconds from Step 53.
58. Observe the packets on all networks.
59. Wait [MALI] seconds from Step 55. TN1 transmits Report B.
60. Observe the packets on all networks.

Part G: QRV before Source Timer expires
61. Enable MLDv2 on the RUT.
62. Observe the packets on all networks.
63. TR1 transmits Query A with a QRV of 3, QQIC of 80, and Max Response Code of 20000.
64. Observe the packets on all networks.
65. Wait [QI] seconds from Step 63. TN1 transmits Report A.
66. Observe the packets on all networks.
67. Wait [OQPT] from Step 63.
68. Observe the packets on all networks.
69. Wait [MALI-LLQT-∝] seconds from Step 65. TN1 transmits Report B.
70. Observe the packets on all networks.

Part H: QRV after Source Timer expires
71. Enable MLDv2 on the RUT.
72. Observe the packets on all networks.
73. TR1 transmits Query A with a QRV of 3, QQIC of 80, and Max Response Code of 20000.
74. Observe the packets on all networks.
75. Wait [QI] seconds from Step 73. TN1 transmits Report A.
76. Observe the packets on all networks.
77. Wait [OQPT] seconds from Step 73.
78. Observe the packets on all networks.
79. Wait [MALI] seconds from Step 75. TN1 transmits Report B.
80. Observe the packets on all networks.

Part I: QQIC before Source Timer expires
81. Enable MLDv2 on the RUT.
82. Observe the packets on all networks.
83. TR1 transmits Query A with a QRV of 2, QQIC of 132, and Max Response Code of 33672 (0x8388).
84. Observe the packets on all networks.
85. Wait [QI] seconds from Step 83. TN1 transmits Report A.
86. Observe the packets on all networks.
87. Wait [OQPT] seconds from Step 83.
88. Observe the packets on all networks.
89. Wait [MALI-LLQT-∝] seconds from Step 85. TN1 transmits Report B.
90. Observe the packets on all networks.

Part J: QQIC after Source Timer expires
91. Enable MLDv2 on the RUT.
92. Observe the packets on all networks.
93. TR1 transmits Query A with a QRV of 2, QQIC of 132, and Max Response Code of 33672 (0x8388).
94. Observe the packets on all networks.
95. Wait [QI] seconds from Step 93. TN1 transmits Report A.
96. Observe the packets on all networks.
97. Wait [OQPT] seconds from Step 93.

98. Observe the packets on all networks.
99. Wait [MALI-LLQT-∝] seconds from Step 95. TN1 transmits Report B.
100. Observe the packets on all networks.

Part K: Last Listener Timer
101. Configure RUT to have a Robustness Variable of 3.
102. Enable MLDv2 on the RUT.
103. Observe the packets on all networks.
104. TR1 transmits Query A with a QRV of 2, QQIC of 60, and Max Response Code of 10000.
105. Observe the packets on all networks.
106. Wait [QI] seconds from Step 104. TN1 transmits Report A.
107. Observe the packets on all networks.
108. Wait [OQPT] seconds from Step 104.
109. Observe the packets on all networks.
110. Wait [MALI-LLQT-∝] seconds from Step 106. TN1 transmits Report B.
111. Observe the packets on all networks.

Part L: Change Source Mode before Source Timer expires
112. Enable MLDv2 on the RUT.
113. Observe the packets on all networks.
114. TR1 transmits Query A with a QRV of 3, QQIC of 60, and Max Response Code of 10000.
115. Observe the packets on all networks.
116. Wait [QI] seconds from 114. TN1 transmits Report A.
117. Observe the packets on all networks.
118. Wait [QI] seconds from 116. TN1 transmits Report B.
119. Observe the packets on all networks.
120. Wait [OQPT] seconds from Step 114.
121. Observe the packets on all networks.
122. Wait [MALI-LLQT-∝] seconds from Step 116. TN1 transmits Report B.
123. Observe the packets on all networks.

Part M: Change Filter Mode after Source Timer expires
124. Enable MLDv2 on the RUT.
125. Observe the packets on all networks.
126. TR1 transmits Query A with a QRV of 3, QQIC of 60, and Max Response Code of 10000.
127. Observe the packets on all networks.
128. Wait [QI] seconds from Step 126. TN1 transmits Report A.
129. Observe the packets on all networks.
130. Wait [QI] seconds from Step 128. TN1 transmits Report B.
131. Observe the packets on all networks.
132. Wait [OQPT] seconds from Step 126.
133. Observe the packets on all networks.
134. Wait [MALI] seconds from Step 128. TN1 transmits Report B.
135. Observe the packets on all networks.

Part N: S Flag
136. Enable MLDv2 on the RUT.
137. Observe the packets on all networks.
138. TR1 transmits Query A.
139. Observe the packets on all networks.
140. Wait [QI] seconds from Step 138. TN1 transmits Report A.
141. Observe the packets on all networks.
142. Wait [QI*2] seconds from Step 138. TR2 transmits a MA Query for M1 with the S Flag set.

143. Observe the packets on all networks.
144. Wait [OQPT] seconds from Step 138.
145. Observe the packets on all networks.
146. TN1 transmits Report B.
147. Observe the packets on all networks.

Observable Results:

- *Part A*
  Step 2: The RUT must transmit 2 MLDv2 General Queries.
  Step 4: The RUT must transmit a Report. The RUT must not transmit Queries.
  Step 6: The RUT must not transmit Queries.
  Step 8: The RUT must transmit a General Queries.
  Step 10: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
- *Part B*
  Step 12: The RUT must transmit 2 MLDv2 General Queries.
  Step 14: The RUT must transmit a Report. The RUT must not transmit Queries.
  Step 16: The RUT must not transmit Queries.
  Step 18: The RUT must transmit a General Queries.
  Step 20: The RUT must not transmit Queries other then periodic General Queries.
- *Part C*
  Step 22: The RUT must transmit 2 MLDv2 General Queries.
  Step 24: The RUT must transmit a Report. The RUT must not transmit Queries.
  Step 26: The RUT must not transmit Queries.
  Step 28: The RUT must transmit a General Queries.
  Step 30: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
- *Part D*
  Step 32: The RUT must transmit 2 MLDv2 General Queries.
  Step 34: The RUT must transmit a Report. The RUT must not transmit Queries.
  Step 36: The RUT must not transmit Queries.
  Step 38: The RUT must transmit a General Queries.
  Step 40: The RUT must not transmit Queries other then periodic General Queries.
- *Part E*
  Step 42: The RUT must transmit 2 MLDv2 General Queries.
  Step 44: The RUT must transmit a Report. The RUT must transmit a Report. The RUT must not transmit Queries.
  Step 46: The RUT must not transmit Queries.
  Step 48: The RUT must transmit a General Queries.
  Step 50: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
- *Part F*
  Step 52: The RUT must transmit 2 MLDv2 General Queries.
  Step 54: The RUT must transmit a Report. The RUT must not transmit Queries.
  Step 56: The RUT must not transmit Queries.
  Step 58: The RUT must transmit a General Queries.
  Step 60: The RUT must not transmit Queries other then periodic General Queries.
- *Part G*

Step 62: The RUT must transmit 2 MLDv2 General Queries.
Step 64: The RUT must transmit a Report. The RUT must not transmit Queries.
Step 66: The RUT must not transmit Queries.
Step 68: The RUT must transmit a General Queries.
Step 70: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.

- *Part H*
    Step 72: The RUT must transmit 2 MLDv2 General Queries.
    Step 74: The RUT must transmit a Report. The RUT must not transmit Queries.
    Step 76: The RUT must not transmit Queries.
    Step 78: The RUT must transmit a General Queries.
    Step 80: The RUT must not transmit Queries other then periodic General Queries.
- *Part I*
    Step 82: The RUT must transmit 2 MLDv2 General Queries.
    Step 84: The RUT must transmit a Report. The RUT must not transmit Queries.
    Step 86: The RUT must not transmit Queries.
    Step 88: The RUT must transmit a General Queries.
    Step 90: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
- *Part J*
    Step 92: The RUT must transmit 2 MLDv2 General Queries.
    Step 94: The RUT must transmit a Report. The RUT must not transmit Queries.
    Step 96: The RUT must not transmit Queries.
    Step 98: The RUT must transmit a General Queries.
    Step 100: The RUT must not transmit Queries other then periodic General Queries.
- *Part K*
    Step 103: The RUT must transmit 2 MLDv2 General Queries.
    Step 105: The RUT must transmit a Report. The RUT must not transmit Queries.
    Step 107: The RUT must not transmit Queries.
    Step 109: The RUT must transmit a General Queries.
    Step 111: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
- *Part L*
    Step 113: The RUT must transmit 2 MLDv2 General Queries.
    Step 115: The RUT must transmit a Report. The RUT must not transmit Queries.
    Step 117: The RUT must not transmit Queries.
    Step 119: The RUT must not transmit Queries.
    Step 121: The RUT must transmit a General Queries.
    Step 123: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
- *Part M*
    Step 125: The RUT must transmit 2 MLDv2 General Queries.
    Step 127: The RUT must transmit a Report. The RUT must not transmit Queries.
    Step 129: The RUT must not transmit Queries.
    Step 131: The RUT must not transmit Queries.
    Step 133: The RUT must transmit a General Queries.
    Step 135: The RUT must not transmit Queries other then periodic General Queries.
- *Part N*
    Step 137: The RUT must transmit 2 MLDv2 General Queries.

Step 139: The RUT must transmits a Report. The RUT must not transmit Queries.
Step 141: The RUT must not transmit Queries.
Step 143: The RUT must not transmit Queries.
Step 145: The RUT must transmit a General Queries.
Step 147: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.

Possible Problems:

- None.

GROUP 4: Report Reception

Scope:

The following tests are designed to verify an MLDv2 Router executes the proper actions upon the reception of an MLDv2 Report.

Overview:

These tests verify that when and MLDv2 Router receives a MLDv2 Report the router switches to the appropriate state, updates times, and transmits queries as required. These specifically test the charts found in RFC 3376 Sections 6.4.1 and 6.4.2 reproduced below for convenience.

Router State	Report Rec'd	New Router State	Action(s)
INCLUDE (A)	IS_IN (B)	INCLUDE (A+B)	(B)=GMI
INCLUDE (A)	IS_EX (B)	EXCLUDE (A*B,B-A)	(B-A)=0 Delete (A-B) Group Timer=GMI
EXCLUDE (X,Y)	IS_IN (A)	EXCLUDE (X+A,Y-A)	(A)=GMI
EXCLUDE (X,Y)	IS_EX (A)	EXCLUDE (A-Y,Y*A)	(A-X-Y)=GMI Delete (X-A) Delete (Y-A) Group Timer=GMI

Router State	Report Rec'd	New Router State	Action(s)
INCLUDE (A)	ALLOW (B)	INCLUDE (A+B)	(B)=GMI
INCLUDE (A)	BLOCK (B)	INCLUDE (A)	Send Q(G,A*B)
INCLUDE (A)	TO_EX (B)	EXCLUDE (A*B,B-A)	(B-A)=0 Delete (A-B) Send Q(G,A*B) Group Timer=GMI
INCLUDE (A)	TO_IN (B)	INCLUDE (A+B)	(B)=GMI Send Q(G,A-B)
EXCLUDE (X,Y)	ALLOW (A)	EXCLUDE (X+A,Y-A)	(A)=GMI
EXCLUDE (X,Y)	BLOCK (A)	EXCLUDE (X+(A-Y),Y)	(A-X-Y)=Group Timer Send Q(G,A-Y)
EXCLUDE (X,Y)	TO_EX (A)	EXCLUDE (A-Y,Y*A)	(A-X-Y)=Group Timer Delete (X-A) Delete (Y-A) Send Q(G,A-Y) Group Timer=GMI
EXCLUDE (X,Y)	TO_IN (A)	EXCLUDE (X+A,Y-A)	(A)=GMI Send Q(G,X-A) Send Q(G)

Test MLD.4.1: Including – Receives Is Include

Purpose: To verify that an MLDv2 router properly processes Is Include reports.

References:

- [MLD] – 5.2.12. Multicast Address Record Types

  A "Current State Record" is sent by a node in response to a Query received on an interface. It reports the current listening state of that interface, with respect to a single multicast address. The Record Type of a Current State Record may be one of the following two values:

  ```
  Value  Name and Meaning
  -----  ----------------
   1   MODE_IS_INCLUDE - indicates that the interface has a filter
       mode of INCLUDE for the specified multicast address.  The
       Source Address [i] fields in this Multicast Address Record
       contain the interface's source list for the specified
       multicast address.  A MODE_IS_INCLUDE Record is never sent
       with an empty source list.
  ```

- [MLD] – 7.4.1. Reception of Current State Records

  When receiving Current State Records, a router updates both its Filter Timer and its source timers. In some circumstances, the reception of a type of multicast address record will cause the Router Filter Mode for that multicast address to change. The table below describes the actions, with respect to state and timers, that occur to a router's state upon reception of Current State Records.

  If the router is in INCLUDE filter mode for a multicast address, we will use the notation INCLUDE (A), where A denotes the associated Include List.

  …

  ```
  Router State        Report Received  New Router State   Actions
  ------------        ---------------  ----------------   -------
  INCLUDE (A)     IS_IN (B)        INCLUDE (A+B)  (B)=MALI
  ```

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A	Report B
IPv6 Header	IPv6 Header
Source Address: TN1's Link-local Address	Source Address: TN1's Link-local Address
Destination Address: FF02::16	Destination Address: FF02::16

Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN ()	MLDv2 Report Multicast Address Record: M1, IS_IN () and IS_IN (S1)

Report C	Report D
IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S1)	MLDv2 Report Multicast Address Record: M1, IS_IN(S1,S3)

Report E	Report F
IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN(S2,S3)	MLDv2 Report Multicast Address Record: M1, TO_IN()

Procedure:

Part A: Including Nothing, Receives Is Include nothing
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A.
4. Observe the packets on all networks.
5. TN1 transmits Report F.
6. Observe the packets on all networks.

Part B: Including Nothing, Receives Is Include nothing an Is Include Source
7. Enable MLDv2 on the RUT.
8. Observe the packets on all networks.
9. TN1 transmits Report B.
10. Observe the packets on all networks.
11. TN1 transmits Report F.
12. Observe the packets on all networks.

Part C: Including A, Receives Is Include nothing
13. Enable MLDv2 on the RUT.
14. Observe the packets on all networks.
15. TN1 transmits Report C.
16. Observe the packets on all networks.
17. TN1 transmits Report A.
18. Observe the packets on all networks.

19. TN1 transmits Report F.
20. Observe the packets on all networks.

Part D: Including A, Receives Is Include Source

21. Enable MLDv2 on the RUT.
22. Observe the packets on all networks.
23. TN1 transmits Report D.
24. Observe the packets on all networks.
25. TN1 transmits Report E.
26. Observe the packets on all networks.
27. TN1 transmits Report F.
28. Observe the packets on all networks.

Observable Results:

- *Part A*
    - **Step 2:** The RUT must transmit 2 MLDv2 General Queries.
    - **Step 4:** The RUT must not transmit Queries other then periodic General Queries.
    - **Step 6:** The RUT must not transmit Queries other then periodic General Queries.
- *Part B*
    - **Step 8:** The RUT must transmit 2 MLDv2 General Queries.
    - **Step 10:** The RUT must not transmit Queries other then periodic General Queries.
    - **Step 12:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
- *Part C*
    - **Step 14:** The RUT must transmit 2 MLDv2 General Queries.
    - **Step 16:** The RUT must not transmit Queries other then periodic General Queries.
    - **Step 18:** The RUT must not transmit Queries other then periodic General Queries.
    - **Step 20:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
- *Part D*
    - **Step 22:** The RUT must transmit 2 MLDv2 General Queries.
    - **Step 24:** The RUT must not transmit Queries other then periodic General Queries.
    - **Step 26:** The RUT must not transmit Queries other then periodic General Queries.
    - **Step 28:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S2, and S3.

Possible Problems:

- None.

Test MLD.4.2: Including – Receives Is Include and updates timer

Purpose: To verify that an MLDv2 router properly processes Is Include reports and updates timers.

References:

- [MLD] – 7.2.3. Definition of Source Timers

  If the timer of a source from the Include List expires, the source is deleted from the Include List. If there are no more source records left, the multicast address record is deleted from the router.

- [MLD] – 7.4.1. Reception of Current State Records

Router State	Report Received	New Router State	Actions
INCLUDE (A)	IS_IN (B)	INCLUDE (A+B)	(B)=MALI

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A	Report B
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN(S1, S3)	MLDv2 Report Multicast Address Record: M1, IS_IN() and IS_IN(S2,S3)

Report C
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN()

Procedure:

Part A: Before first Source Timer expires
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A.

---

4. Observe the packets on all networks.
5. Wait [QI] seconds from Step 3. TN1 transmits Report B.
6. Observe the packets on all networks.
7. Wait [MALI-LLQT-∝] seconds from Step 3. TN1 transmits Report C.
8. Observe the packets on all networks.

Part B: After first Source Timer expires
9. Enable MLDv2 on the RUT.
10. Observe the packets on all networks.
11. TN1 transmits Report A.
12. Observe the packets on all networks.
13. Wait [QI] seconds from Step 11. TN1 transmits Report B.
14. Observe the packets on all networks.
15. Wait [MALI-LLQT-∝] seconds from Step 11. TN1 transmits Report C.
16. Observe the packets on all networks.

Part C: Before second Source Timer expires
17. Enable MLDv2 on the RUT.
18. Observe the packets on all networks.
19. TN1 transmits Report A.
20. Observe the packets on all networks.
21. Wait [QI] seconds from Step 19. TN1 transmits Report B.
22. Observe the packets on all networks.
23. Wait [MALI-LLQT-∝] seconds from Step 21. TN1 transmits Report C.
24. Observe the packets on all networks.

Part D: After second Source Timer expires
25. Enable MLDv2 on the RUT.
26. Observe the packets on all networks.
27. TN1 transmits Report A.
28. Observe the packets on all networks.
29. Wait [QI] seconds from Step 27. TN1 transmits Report B.
30. Observe the packets on all networks.
31. Wait [MALI-LLQT-∝] seconds from Step 29. TN1 transmits Report C.
32. Observe the packets on all networks.

Observable Results:

- *Part A*
    Step 2: The RUT must transmit 2 MLDv2 General Queries.
    Step 4: The RUT must not transmit Queries other then periodic General Queries.
    Step 6: The RUT must not transmit Queries other then periodic General Queries.
    Step 8: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S2, and S3.
- *Part B*
    Step 10: The RUT must transmit 2 MLDv2 General Queries.
    Step 12: The RUT must not transmit Queries other then periodic General Queries.
    Step 14: The RUT must not transmit Queries other then periodic General Queries.
    Step 16: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S2 and S3.
- *Part C*
    Step 18: The RUT must transmit 2 MLDv2 General Queries.

Step 20: The RUT must not transmit Queries other then periodic General Queries.
Step 22: The RUT must not transmit Queries other then periodic General Queries.
Step 24: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S2 and S3.

- *Part D*
   Step 26: The RUT must transmit 2 MLDv2 General Queries.
   Step 28: The RUT must not transmit Queries other then periodic General Queries.
   Step 30: The RUT must not transmit Queries other then periodic General Queries.
   Step 32: The RUT must not transmit Queries other then periodic General Queries.

Possible Problems:

- None.

Test MLD.4.3: Including – Receives Is Exclude

Purpose: To verify that an MLDv2 router properly processes Is Exclude while in Is Include.

References:

- [MLD] – 5.2.12. Multicast Address Record Types

  Value   Name and Meaning

   -----   ----------------
  2   MODE_IS_EXCLUDE - indicates that the interface has a filter mode of
                EXCLUDE for the specified multicast address. The Source Address [i] fields in
                this Multicast Address Record contain the interface's source list for the specified
                multicast address, if it is non-empty.

- [MLD] – 7.4.1. Reception of Current State Records

Router State	Report Received	New Router State	Actions
INCLUDE (A)	IS_EX (B)	EXCLUDE (A*B, B-A)	(B-A)=0
			Delete (A-B)
			Filter Timer=MALI

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A
IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record:
M1, IS_EX ()

Report B
IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record:
M1, BLOCK (S1)

Report C
IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record:
M1, IS_EX (S1)

Report D
IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record:
M1, IS_IN (S1)

Report E	Report F
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S1, S3)	MLDv2 Report Multicast Address Record: M1, IS_EX (S2, S3)

Report G	Report H
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, BLOCK (S1, S2, S3)	MLDv2 Report Multicast Address Record: M1, TO_IN()

Procedure:

Part A: Including Nothing, Receives Is Exclude nothing, Check Request List
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A.
4. Observe the packets on all networks.
5. TN1 transmits Report H.
6. Observe the packets on all networks.

Part B: Including Nothing, Receives Is Exclude nothing, Check Exclude List
7. Enable MLDv2 on the RUT.
8. Observe the packets on all networks.
9. TN1 transmits Report A.
10. Observe the packets on all networks.
11. TN1 transmits Report B.
12. Observe the packets on all networks.
13. Wait [LLQI] seconds. TN1 transmits Report H.
14. Observe the packets on all networks.

Part C: Including Nothing, Receives Is Exclude Source, Check Request List
15. Enable MLDv2 on the RUT.
16. Observe the packets on all networks.
17. TN1 transmits Report C.
18. Observe the packets on all networks.
19. TN1 transmits Report H.
20. Observe the packets on all networks.

Part D: Including Nothing, Receives Is Exclude Source, Check Exclude List
21. Enable MLDv2 on the RUT.
22. Observe the packets on all networks.

23. TN1 transmits Report C.
24. Observe the packets on all networks.
25. TN1 transmits Report B.
26. Observe the packets on all networks.
27. TN1 transmits Report H.
28. Observe the packets on all networks.

Part E: Including Source, Receives Is Exclude nothing, Check Request List
29. Enable MLDv2 on the RUT.
30. Observe the packets on all networks.
31. TN1 transmits Report D.
32. Observe the packets on all networks.
33. TN1 transmits Report A.
34. Observe the packets on all networks.
35. TN1 transmits Report H.
36. Observe the packets on all networks.

Part F: Including Source, Receives Is Exclude nothing, Check Exclude List
37. Enable MLDv2 on the RUT.
38. Observe the packets on all networks.
39. TN1 transmits Report D.
40. Observe the packets on all networks.
41. TN1 transmits Report A.
42. Observe the packets on all networks.
43. TN1 transmits Report B.
44. Observe the packets on all networks.
45. Wait [LLQI] seconds. TN1 transmits Report H.
46. Observe the packets on all networks.

Part G: Including Source, Receives Is Exclude Source, Check Request List
47. Enable MLDv2 on the RUT.
48. Observe the packets on all networks.
49. TN1 transmits Report E.
50. Observe the packets on all networks.
51. TN1 transmits Report F.
52. Observe the packets on all networks.
53. TN1 transmits Report H.
54. Observe the packets on all networks.

Part H: Including Source, Receives Is Exclude Source, Check Exclude List
55. Enable MLDv2 on the RUT.
56. Observe the packets on all networks.
57. TN1 transmits Report E.
58. Observe the packets on all networks.
59. Wait [QI] seconds from Step 57. TN1 transmits Report F.
60. Observe the packets on all networks.
61. TN1 transmits Report G.
62. Observe the packets on all networks.
63. Wait [LLQI] seconds. TN1 transmits Report H.
64. Observe the packets on all networks.

Observable Results:

- *Part A*
  Step 2: The RUT must transmit 2 MLDv2 General Queries.
  Step 4: The RUT must not transmit Queries other then periodic General Queries.
  Step 6: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part B*
  Step 8: The RUT must transmit 2 MLDv2 General Queries.
  Step 10: The RUT must not transmit Queries other then periodic General Queries.
  Step 12: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
  Step 14: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part C*
  Step 16: The RUT must transmit 2 MLDv2 General Queries.
  Step 18: The RUT must not transmit Queries other then periodic General Queries.
  Step 20: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part D*
  Step 22: The RUT must transmit 2 MLDv2 General Queries.
  Step 24: The RUT must not transmit Queries other then periodic General Queries.
  Step 26: The RUT must not transmit Queries other then periodic General Queries.
  Step 28: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part E*
  Step 30: The RUT must transmit 2 MLDv2 General Queries.
  Step 32: The RUT must not transmit Queries other then periodic General Queries.
  Step 34: The RUT must not transmit Queries other then periodic General Queries.
  Step 36: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part F*
  Step 38: The RUT must transmit 2 MLDv2 General Queries.
  Step 40: The RUT must not transmit Queries other then periodic General Queries.
  Step 42: The RUT must not transmit Queries other then periodic General Queries.
  Step 44: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
  Step 46: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part G*
  Step 48: The RUT must transmit 2 MLDv2 General Queries.
  Step 50: The RUT must not transmit Queries other then periodic General Queries.
  Step 52: The RUT must not transmit Queries other then periodic General Queries.
  Step 54: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S3. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part H*
  Step 56: The RUT must transmit 2 MLDv2 General Queries.
  Step 58: The RUT must not transmit Queries other then periodic General Queries.
  Step 60: The RUT must not transmit Queries other then periodic General Queries.
  Step 62: The RUT must transmit 2 Multicast Address and Source Specific Query with a

Multicast Address of M1 and a Source Address of S1 and S3.
Step 64: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

Possible Problems:

- None.

Test MLD.4.4: Including – Receives Is Exclude and Updates Timer

Purpose: To verify that an MLDv2 router properly processes Is Exclude while in Is Include and updates the timer.

References:

- [MLD] – 7.2.3. Definition of Source Timers

  If the timer of a source from the Requested List expires, the source is moved to the Exclude List.

- [MLD] – 7.4.1. Reception of Current State Records

  ```
  Router State         Report Received  New Router State         Actions
  ------------         ---------------  ----------------         -------
  INCLUDE (A)          IS_EX (B)        EXCLUDE (A*B, B-A)       (B-A)=0
                                                                 Delete (A-B)
                                                                 Filter Timer=MALI
  ```

- [MLD] – 7.5. Switching Router Filter Modes

  If at the moment of the switch the Requested List (X) is empty, the multicast address record is deleted from the router.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN(S1, S3)

Report B
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_EX(S2, S3)

Report C
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, BLOCKS(S1,S2,S3)

Report D
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN()

Procedure:

Part A: Before First source timer expires, Check Request List
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A.
4. Observe the packets on all networks.
5. Wait [QI] seconds after Step 3. TN1 transmits Report B.
6. Observe the packets on all networks.
7. Wait [MALI-LLQT-∝] seconds after Step 3. TN1 transmits Report D.
8. Observe the packets on all networks.

Part B: Before first source timer expires, Check Exclude List
9. Enable MLDv2 on the RUT.
10. Observe the packets on all networks.
11. TN1 transmits Report A.
12. Observe the packets on all networks.
13. TN1 transmits Report B.
14. Observe the packets on all networks.
15. Wait [MALI –LLQT-∝] seconds after Step 11. TN1 transmits Report C.
16. Observe the packets on all networks.
17. Wait [LLQI] seconds. TN1 transmits Report D.
18. Observe the packets on all networks.

Part C: After first source timer expires, Check Request List
19. Enable MLDv2 on the RUT.
20. Observe the packets on all networks.
21. TN1 transmits Report A.
22. Observe the packets on all networks.
23. Wait [QI] seconds after Step 21. TN1 transmits Report B.
24. Observe the packets on all networks.
25. Wait [MALI] seconds after Step 21. TN1 transmits Report D.
26. Observe the packets on all networks.

Part D: After first source timer expires, Check Exclude List
27. Enable MLDv2 on the RUT.
28. Observe the packets on all networks.
29. TN1 transmits Report A.
30. Observe the packets on all networks.
31. Wait [QI] seconds after Step 29. TN1 transmits Report B.
32. Observe the packets on all networks.
33. Wait [MALI] seconds after Step 29. TN1 transmits Report C.
34. Observe the packets on all networks.
35. Wait [LLQI] seconds. TN1 transmits Report D.
36. Observe the packets on all networks.

Part E: Before filter timer expires, Check Request List
37. Enable MLDv2 on the RUT.
38. Observe the packets on all networks.
39. TN1 transmits Report A.
40. Observe the packets on all networks.
41. Wait [QI] seconds after Step 39. TN1 transmits Report B.

---

42. Observe the packets on all networks.
43. Wait [MALI-LLAT-∝] seconds after Step 41. TN1 transmits Report D.
44. Observe the packets on all networks.

Part F: Before filter timer expires, Check Exclude List
45. Enable MLDv2 on the RUT.
46. Observe the packets on all networks.
47. TN1 transmits Report A.
48. Observe the packets on all networks.
49. Wait [QI] seconds after Step 47. TN1 transmits Report B.
50. Observe the packets on all networks.
51. Wait [MALI-LLQT-∝] seconds after Step 49. TN1 transmit Report C.
52. Observe the packets on all networks.
53. Wait [LLQI] seconds. TN1 transmits Report D.
54. Observe the packets on all networks.

Part G: Before filter timer expires, Check Include List
55. Enable MLDv2 on the RUT.
56. Observe the packets on all networks.
57. TN1 transmits Report A.
58. Observe the packets on all networks.
59. Wait [QI] seconds after Step 57. TN1 transmits Report B.
60. Observe the packets on all networks.
61. Wait [MALI] seconds after Step 59. TN1 transmits Report D.
62. Observe the packets on all networks.

Observable Results:

- *Part A*
    Step 2: The RUT must transmit 2 MLDv2 General Queries.
    Step 4: The RUT must not transmit Queries other then periodic General Queries.
    Step 6: The RUT must not transmit Queries other then periodic General Queries.
    Step 8: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S3. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part B*
    Step 10: The RUT must transmit 2 MLDv2 General Queries.
    Step 12: The RUT must not transmit Queries other then periodic General Queries.
    Step 14: The RUT must not transmit Queries other then periodic General Queries.
    Step 16: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S3.
    Step 18: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part C*
    Step 20: The RUT must transmit 2 MLDv2 General Queries.
    Step 22: The RUT must not transmit Queries other then periodic General Queries.
    Step 24: The RUT must not transmit Queries other then periodic General Queries.
    Step 26: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part D*
    Step 28: The RUT must transmit 2 MLDv2 General Queries.

Step 30: The RUT must not transmit Queries other then periodic General Queries.
Step 32: The RUT must not transmit Queries other then periodic General Queries.
Step 34: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
Step 36: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

- *Part E*
  Step 38: The RUT must transmit 2 MLDv2 General Queries.
  Step 40: The RUT must not transmit Queries other then periodic General Queries.
  Step 42: The RUT must not transmit Queries other then periodic General Queries.
  Step 44: The RUT must transmit 2 Multicast Specific Query with a Multicast Address of M1.

- *Part F*
  Step 46: The RUT must transmit 2 MLDv2 General Queries.
  Step 48: The RUT must not transmit Queries other then periodic General Queries.
  Step 50: The RUT must not transmit Queries other then periodic General Queries.
  Step 52: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
  Step 54: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

- *Part G*
  Step 56: The RUT must transmit 2 MLDv2 General Queries.
  Step 58: The RUT must not transmit Queries other then periodic General Queries.
  Step 60: The RUT must not transmit Queries other then periodic General Queries.
  Step 62: The RUT must not transmit Queries other then periodic General Queries.

Possible Problems:

- None.

Test MLD.4.5: Excluding – Receives Is Include

Purpose: To verify that an MLDv2 router properly processes Is Exclude while in Is Include.

References:

- [MLD] – 5.2.12. Multicast Address Record Types

  Value   Name and Meaning
  -----   ----------------
  1   MODE_IS_INCLUDE - indicates that the interface has a filter
            mode of INCLUDE for the specified multicast address. The
            Source Address [i] fields in this Multicast Address Record
            contain the interface's source list for the specified
            multicast address. A MODE_IS_INCLUDE Record is never sent
            with an empty source list. "

- [MLD] – 7.4.1. Reception of Current State Records

  Router State   Report Received   New Router State   Actions
  ------------   ---------------   ----------------   -------
  EXCLUDE (X,Y)   IS_IN (A)   EXCLUDE (X+A, Y-A)   (A)=MALI

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A	Report B
IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_EX ()	MLDv2 Report Multicast Address Record: M1, IS_IN ()

Report C	Report D
IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, BLOCKS (S1)	MLDv2 Report Multicast Address Record: M1, IS_IN () and IS_IN (S1)

Report E	Report F

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_EX (S4)	MLDv2 Report Multicast Address Record: M1, IS_IN (S5)

Report G	Report H
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, BLOCK (S4, S5)	MLDv2 Report Multicast Address Record: M1, IS_EX (S3,S4)

Report I	Report J
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S2, S5)	MLDv2 Report Multicast Address Record: M1, IS_IN(S1, S2, S3)

Report K	Report L
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, BLOCK (S1, S2, S3, S4, S5)	MLDv2 Report Multicast Address Record: M1, TO_IN()

Procedure:

Part A: Exclude nothing, Report Is Include nothing, Check Request List
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A.
4. Observe the packets on all networks.
5. TN1 transmits Report B.
6. Observe the packets on all networks.

7. TN1 transmits Report L.
8. Observe the packets on all networks.

Part B: Exclude nothing, Report Is Include nothing, Check Exclude List
9. Enable MLDv2 on the RUT.
10. Observe the packets on all networks.
11. TN1 transmits Report A.
12. Observe the packets on all networks.
13. TN1 transmits Report B.
14. Observe the packets on all networks.
15. TN1 transmits Report C.
16. Observe the packets on all networks.
17. Wait [LLQI] seconds. TN1 transmits Report L.
18. Observe the packets on all networks.

Part C: Excluding Nothing, Report Is Include nothing and a source, Check Request List
19. Enable MLDv2 on the RUT.
20. Observe the packets on all networks.
21. TN1 transmits Report A.
22. Observe the packets on all networks.
23. TN1 transmits Report D.
24. Observe the packets on all networks.
25. TN1 transmits Report L.
26. Observe the packets on all networks.

Part D: Excluding Nothing, Report Is Include nothing and a source, Check Exclude List
27. Enable MLDv2 on the RUT.
28. Observe the packets on all networks.
29. TN1 transmits Report A.
30. Observe the packets on all networks.
31. TN1 transmits Report D.
32. Observe the packets on all networks.
33. TN1 transmits Report C.
34. Observe the packets on all networks.
35. Wait [LLQI] seconds. TN1 transmits Report L.
36. Observe the packets on all networks.

Part E: Excluding Source, Report Is Include nothing, Check Request List
37. Enable MLDv2 on the RUT.
38. Observe the packets on all networks.
39. TN1 transmits Report E.
40. Observe the packets on all networks.
41. TN1 transmits Report F.
42. Observe the packets on all networks.
43. TN1 transmits Report B.
44. Observe the packets on all networks.
45. TN1 transmits Report L.
46. Observe the packets on all networks.

Part F: Excluding Source, Report Is Include nothing, Check Exclude List
47. Enable MLDv2 on the RUT.
48. Observe the packets on all networks.
49. TN1 transmits Report E.
50. Observe the packets on all networks.

51. TN1 transmits Report F.
52. Observe the packets on all networks.
53. TN1 transmit Report B.
54. Observe the packets on all networks.
55. TN1 transmits Report G.
56. Observe the packets on all networks.
57. Wait [LLQI] seconds. TN1 transmits Report L.
58. Observe the packets on all networks.

Part G: Excluding Source, Report Is Include Source, Check Request List
59. Enable MLDv2 on the RUT.
60. Observe the packets on all networks.
61. TN1 transmits Report H.
62. Observe the packets on all networks.
63. TN1 transmits Report I.
64. Observe the packets on all networks.
65. TN1 transmits Report J.
66. Observe the packets on all networks.
67. TN1 transmits Report L.
68. Observe the packets on all networks.

Part H: Excluding Source, Report Is Include Source, Check Request List
69. Enable MLDv2 on the RUT.
70. Observe the packets on all networks.
71. TN1 transmits Report H.
72. Observe the packets on all networks.
73. TN1 transmits Report I.
74. Observe the packets on all networks.
75. TN1 transmit Report J.
76. Observe the packets on all networks.
77. TN1 transmits Report K.
78. Observe the packets on all networks.
79. Wait [LLQI] seconds. TN1 transmits Report L.
80. Observe the packets on all networks.

Observable Results:

- *Part A*
    Step 2: The RUT must transmit 2 MLDv2 General Queries.
    Step 4: The RUT must not transmit Queries other then periodic General Queries.
    Step 6: The RUT must not transmit Queries other then periodic General Queries.
    Step 8: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part B*
    Step 10: The RUT must transmit 2 MLDv2 General Queries.
    Step 12: The RUT must not transmit Queries other then periodic General Queries.
    Step 14: The RUT must not transmit Queries other then periodic General Queries.
    Step 16: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
    Step 18: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

- *Part C*
    - **Step 20:** The RUT must transmit 2 MLDv2 General Queries.
    - **Step 22:** The RUT must not transmit Queries other then periodic General Queries.
    - **Step 24:** The RUT must not transmit Queries other then periodic General Queries.
    - **Step 26:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part D*
    - **Step 28:** The RUT must transmit 2 MLDv2 General Queries.
    - **Step 30:** The RUT must not transmit Queries other then periodic General Queries.
    - **Step 32:** The RUT must not transmit Queries other then periodic General Queries.
    - **Step 34:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
    - **Step 36:** The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part E*
    - **Step 38:** The RUT must transmit 2 MLDv2 General Queries.
    - **Step 40:** The RUT must not transmit Queries other then periodic General Queries.
    - **Step 42:** The RUT must not transmit Queries other then periodic General Queries.
    - **Step 44:** The RUT must not transmit Queries other then periodic General Queries.
    - **Step 46:** The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S5. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part F*
    - **Step 48:** The RUT must transmit 2 MLDv2 General Queries.
    - **Step 50:** The RUT must not transmit Queries other then periodic General Queries.
    - **Step 52:** The RUT must not transmit Queries other then periodic General Queries.
    - **Step 54:** The RUT must not transmit Queries other then periodic General Queries.
    - **Step 56:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S5.
    - **Step 58:** The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part G*
    - **Step 60:** The RUT must transmit 2 MLDv2 General Queries.
    - **Step 62:** The RUT must not transmit Queries other then periodic General Queries.
    - **Step 64:** The RUT must not transmit Queries other then periodic General Queries.
    - **Step 66:** The RUT must not transmit Queries other then periodic General Queries.
    - **Step 68:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S2, S3, and S5. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part H*
    - **Step 70:** The RUT must transmit 2 MLDv2 General Queries.
    - **Step 72:** The RUT must not transmit Queries other then periodic General Queries.
    - **Step 74:** The RUT must not transmit Queries other then periodic General Queries.
    - **Step 76:** The RUT must not transmit Queries other then periodic General Queries.
    - **Step 78:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S2, S3, and S5.
    - **Step 80:** The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

Possible Problems:

- None.

Test MLD.4.6: Excluding – Receives Is Include and Updates Timer

Purpose: To verify that an MLDv2 router properly processes Is Exclude while in Is Include and updates the timer.

References:

- [MLD] – 7.4.1. Reception of Current State Records

Router State	Report Received	New Router State	Actions
------------	---------------	----------------	-------
EXCLUDE (X,Y)	IS_IN (A)	EXCLUDE (X+A, Y-A)	(A)=MALI

- [MLD] – 7.5. Switching Router Filter Modes

  A router uses the sources from the Requested List as its state for the switch to a filter mode of INCLUDE. Sources from the Requested List are moved in the Include List, while sources from the Exclude List are deleted. For example, if a router's state for a multicast address is EXCLUDE(X,Y) and the Filter Timer expires for that multicast address, the router switches to filter mode of INCLUDE with state INCLUDE(X). If at the moment of the switch the Requested List (X) is empty, the multicast address record is deleted from the router.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A	Report B
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_EX (S3, S4)	MLDv2 Report Multicast Address Record: M1, IS_IN (S2, S5)

Report C	Report D
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S1,S2,S3)	MLDv2 Report Multicast Address Record: M1, BLOCK (S1, S2, S3, S4, S5)

Report E
IPv6 Header

Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN ()

Procedure:

Part A: Before filter timer expires, Check Request List
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A.
4. Observe the packets on all networks.
5. Wait [QI / 2] seconds after Step 3. TN1 transmits Report B.
6. Observe the packets on all networks.
7. Wait [QI] seconds after Step 3. TN1 transmits Report C.
8. Observe the packets on all networks.
9. Wait [MALI - LLQT-∝] seconds after Step 3. TN1 transmits Report E.
10. Observe the packets on all networks.

Part B: After filter timer expires, Check Exclude List
11. Enable MLDv2 on the RUT.
12. Observe the packets on all networks.
13. TN1 transmits Report A.
14. Observe the packets on all networks.
15. Wait [QI / 2] seconds after Step 13. TN1 transmits Report B.
16. Observe the packets on all networks.
17. Wait [QI] seconds after Step 13. TN1 transmits Report C.
18. Observe the packets on all networks.
19. Wait [MALI-LLQT-∝] seconds after Step 13. TN1 transmits Report D.
20. Observe the packets on all networks.
21. Wait [LLQI] seconds. TN1 transmits Report E.
22. Observe the packets on all networks.

Part C: After filter timer expires, Check Include List
23. Enable MLDv2 on the RUT.
24. Observe the packets on all networks.
25. TN1 transmits Report A.
26. Observe the packets on all networks.
27. Wait [QI / 2] seconds after Step 25. TN1 transmits Report B.
28. Observe the packets on all networks.
29. Wait [QI] seconds after Step 25. TN1 transmits Report C.
30. Observe the packets on all networks.
31. Wait [MALI] seconds after Step 25. TN1 transmits Report E.
32. Observe the packets on all networks.

Part D: Before second source timer expires, Check Include List
33. Enable MLDv2 on the RUT.
34. Observe the packets on all networks.
35. TN1 transmits Report A.

36. Observe the packets on all networks.
37. Wait [QI / 2] seconds after Step 35. TN1 transmits Report B.
38. Observe the packets on all networks.
39. Wait [QI] seconds after Step 35. TN1 transmits Report C.
40. Observe the packets on all networks.
41. Wait [MALI-LLQT-∝] seconds after Step 37. TN1 transmits Report E.
42. Observe the packets on all networks.

Part E: After second source timer expires, Check Include List
43. Enable MLDv2 on the RUT.
44. Observe the packets on all networks.
45. TN1 transmits Report A.
46. Observe the packets on all networks.
47. Wait [QI / 2] seconds after Step 45. TN1 transmits Report B.
48. Observe the packets on all networks.
49. Wait [QI] seconds after Step 45. TN1 transmits Report C.
50. Observe the packets on all networks.
51. Wait [MALI] seconds after Step 47. TN1 transmits Report E.
52. Observe the packets on all networks.

Part F: Before third source timer expires, Check Include List
53. Enable MLDv2 on the RUT.
54. Observe the packets on all networks.
55. TN1 transmits Report A.
56. Observe the packets on all networks.
57. Wait [QI / 2] seconds after Step 55. TN1 transmits Report B.
58. Observe the packets on all networks.
59. Wait [QI] seconds after Step 55. TN1 transmits Report C.
60. Observe the packets on all networks.
61. Wait [MALI-LLQT-∝] seconds after Step 59. TN1 transmits Report E.
62. Observe the packets on all networks.

Part G: After third source timer expires, Check Include List
63. Enable MLDv2 on the RUT.
64. Observe the packets on all networks.
65. TN1 transmits Report A.
66. Observe the packets on all networks.
67. Wait [QI / 2] seconds after Step 65. TN1 transmits Report B.
68. Observe the packets on all networks.
69. Wait [QI] seconds after Step 65. TN1 transmits Report C.
70. Observe the packets on all networks.
71. Wait [MALI] seconds after Step 69. TN1 transmits Report E.
72. Observe the packets on all networks.

Observable Results:

- *Part A*
  Step 2: The RUT must transmit 2 MLDv2 General Queries.
  Step 4: The RUT must not transmit Queries other then periodic General Queries.
  Step 6: The RUT must not transmit Queries other then periodic General Queries.
  Step 8: The RUT must not transmit Queries other then periodic General Queries.
  Step 10: The RUT must transmit 2 Multicast Address and Source Specific Query with a

Multicast Address of M1 and Source Addresses of S1, S2, S3, and S5. The RUT must transmit 2 Multicast Specific Query with a Multicast Address of M1.

- *Part B*

   Step 12: The RUT must transmit 2 MLDv2 General Queries.
   Step 14: The RUT must not transmit Queries other then periodic General Queries.
   Step 16: The RUT must not transmit Queries other then periodic General Queries.
   Step 18: The RUT must not transmit Queries other then periodic General Queries.
   Step 20: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S2, S3, and S5.
   Step 22: The RUT must transmit 2 Multicast Specific Query with a Multicast Address of M1.

- *Part C*

   Step 24: The RUT must transmit 2 MLDv2 General Queries.
   Step 26: The RUT must not transmit Queries other then periodic General Queries.
   Step 28: The RUT must not transmit Queries other then periodic General Queries.
   Step 30: The RUT must not transmit Queries other then periodic General Queries.
   Step 32: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S2, S3, and-S5.

- *Part D*

   Step 34: The RUT must transmit 2 MLDv2 General Queries.
   Step 36: The RUT must not transmit Queries other then periodic General Queries.
   Step 38: The RUT must not transmit Queries other then periodic General Queries.
   Step 40: The RUT must not transmit Queries other then periodic General Queries.
   Step 42: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S2, S3, and-S5.

- *Part E*

   Step 44: The RUT must transmit 2 MLDv2 General Queries.
   Step 46: The RUT must not transmit Queries other then periodic General Queries.
   Step 48: The RUT must not transmit Queries other then periodic General Queries.
   Step 50: The RUT must not transmit Queries other then periodic General Queries.
   Step 52: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S2, and S3.

- *Part F*

   Step 54: The RUT must transmit 2 MLDv2 General Queries.
   Step 56: The RUT must not transmit Queries other then periodic General Queries.
   Step 58: The RUT must not transmit Queries other then periodic General Queries.
   Step 60: The RUT must not transmit Queries other then periodic General Queries.
   Step 62: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S2, and S3.

- *Part G*

   Step 64: The RUT must transmit 2 MLDv2 General Queries.
   Step 66: The RUT must not transmit Queries other then periodic General Queries.
   Step 68: The RUT must not transmit Queries other then periodic General Queries.
   Step 70: The RUT must not transmit Queries other then periodic General Queries.
   Step 72: The RUT must not transmit Queries other then periodic General Queries.

Possible Problems:

- None.

Test MLD.4.7: Excluding – Receives Is Exclude

Purpose: To verify that an MLDv2 router properly processes Is Exclude while in Is Exclude.

References:

- [MLD] – 7.4.1. Reception of Current State Records

Router State	Report Received	New Router State	Actions
------------	---------------	----------------	-------
EXCLUDE (X,Y)	IS_EX (A)	EXCLUDE (A-Y, Y*A)	(A-X-Y)=MALI
			Delete (X-A)
			Delete (Y-A)
			Filter Timer=MALI

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A	Report B
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_EX ()	MLDv2 Report Multicast Address Record: M1, BLOCK (S1)

Report C	Report D
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_EX (S1)	MLDv2 Report Multicast Address Record: M1, IS_EX(S4)

Report E	Report F
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S5)	MLDv2 Report Multicast Address Record: M1, BLOCK(S4, S5)

Report G	Report H
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_EX(S3, S4)	MLDv2 Report Multicast Address Record: M1, IS_IN (S2, S5)

Report I	Report J
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_EX (S1, S2, S3)	MLDv2 Report Multicast Address Record: M1, BLOCK (S1, S2, S3, S4, S5)

Report K
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN()

Procedure:

Part A: Exclude nothing, Report Is Exclude nothing, Check Request List
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A.
4. Observe the packets on all networks.
5. TN1 transmits Report A.
6. Observe the packets on all networks.
7. TN1 transmits Report K.
8. Observe the packets on all networks.

Part B: Exclude nothing, Report Is Exclude nothing, Check Exclude List
9. Enable MLDv2 on the RUT.
10. Observe the packets on all networks.
11. TN1 transmits Report A.
12. Observe the packets on all networks.
13. TN1 transmits Report A.

14. Observe the packets on all networks.
15. TN1 transmits Report B.
16. Observe the packets on all networks.
17. Wait [LLQI] seconds. TN1 transmits Report K.
18. Observe the packets on all networks.

Part C: Excluding Nothing, Report Is Exclude nothing and a source, Check Request List
19. Enable MLDv2 on the RUT.
20. Observe the packets on all networks.
21. TN1 transmits Report A.
22. Observe the packets on all networks.
23. TN1 transmits Report C.
24. Observe the packets on all networks.
25. TN1 transmits Report K.
26. Observe the packets on all networks.

Part D: Excluding Nothing, Report Is Exclude nothings and a source, Check Exclude List
27. Enable MLDv2 on the RUT.
28. Observe the packets on all networks.
29. TN1 transmits Report A.
30. Observe the packets on all networks.
31. TN1 transmits Report C.
32. Observe the packets on all networks.
33. TN1 transmits Report B.
34. Observe the packets on all networks.
35. Wait [LLQI] seconds. TN1 transmits Report K.
36. Observe the packets on all networks.

Part E: Excluding Source, Report Is Exclude nothing, Check Request List
37. Enable MLDv2 on the RUT.
38. Observe the packets on all networks.
39. TN1 transmits Report D.
40. Observe the packets on all networks.
41. TN1 transmits Report E.
42. Observe the packets on all networks.
43. TN1 transmits Report A.
44. Observe the packets on all networks.
45. TN1 transmits Report K.
46. Observe the packets on all networks.

Part F: Excluding Source, Report Is Exclude nothing, Check Exclude List
47. Enable MLDv2 on the RUT.
48. Observe the packets on all networks.
49. TN1 transmits Report D.
50. Observe the packets on all networks.
51. TN1 transmits Report E.
52. Observe the packets on all networks.
53. TN1 transmit Report A.
54. Observe the packets on all networks.
55. TN1 transmits Report F.
56. Observe the packets on all networks.
57. Wait [LLQI] seconds. TN1 transmits Report K.
58. Observe the packets on all networks.

Part G: Excluding Source, Report Is Exclude Source, Check Request List
    59. Enable MLDv2 on the RUT.
    60. Observe the packets on all networks.
    61. TN1 transmits Report G.
    62. Observe the packets on all networks.
    63. TN1 transmits Report H.
    64. Observe the packets on all networks.
    65. TN1 transmits Report I.
    66. Observe the packets on all networks.
    67. TN1 transmits Report K.
    68. Observe the packets on all networks.

Part H: Excluding Source, Report Is Exclude Source, Check Request List
    69. Enable MLDv2 on the RUT.
    70. Observe the packets on all networks.
    71. TN1 transmits Report G.
    72. Observe the packets on all networks.
    73. TN1 transmits Report H.
    74. Observe the packets on all networks.
    75. TN1 transmit Report I.
    76. Observe the packets on all networks.
    77. TN1 transmits Report J.
    78. Observe the packets on all networks.
    79. Wait [LLQI] seconds. TN1 transmits Report K.
    80. Observe the packets on all networks.

Observable Results:

- *Part A*
  - **Step 2:** The RUT must transmit 2 MLDv2 General Queries.
  - **Step 4:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 6:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 8:** The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part B*
  - **Step 10:** The RUT must transmit 2 MLDv2 General Queries.
  - **Step 12:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 14:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 16:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
  - **Step 18:** The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part C*
  - **Step 20:** The RUT must transmit 2 MLDv2 General Queries.
  - **Step 22:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 24:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 26:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part D*

Step 28: The RUT must transmit 2 MLDv2 General Queries.
Step 30: The RUT must not transmit Queries other then periodic General Queries.
Step 32: The RUT must not transmit Queries other then periodic General Queries.
Step 34: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
Step 36: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

- *Part E*

    Step 38: The RUT must transmit 2 MLDv2 General Queries.
    Step 40: The RUT must not transmit Queries other then periodic General Queries.
    Step 42: The RUT must not transmit Queries other then periodic General Queries.
    Step 44: The RUT must not transmit Queries other then periodic General Queries.
    Step 46: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

- *Part F*

    Step 48: The RUT must transmit 2 MLDv2 General Queries.
    Step 50: The RUT must not transmit Queries other then periodic General Queries.
    Step 52: The RUT must not transmit Queries other then periodic General Queries.
    Step 54: The RUT must not transmit Queries other then periodic General Queries.
    Step 56: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S4 and S5.
    Step 58: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

- *Part G*

    Step 60: The RUT must transmit 2 MLDv2 General Queries.
    Step 62: The RUT must not transmit Queries other then periodic General Queries.
    Step 64: The RUT must not transmit Queries other then periodic General Queries.
    Step 66: The RUT must not transmit Queries other then periodic General Queries.
    Step 68: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

- *Part H*

    Step 70: The RUT must transmit 2 MLDv2 General Queries.
    Step 72: The RUT must not transmit Queries other then periodic General Queries.
    Step 74: The RUT must not transmit Queries other then periodic General Queries.
    Step 76: The RUT must not transmit Queries other then periodic General Queries.
    Step 78: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S2, S4 and S5.
    Step 80: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

Possible Problems:

- None.

Test MLD.4.8: Excluding – Receives Is Exclude and Updates Timer

Purpose: To verify that an MLDv2 router properly processes Is Exclude while in Is Exclude and updates the timer.

References:

- [MLD] – 7.2.3. Definition of Source Timers

  If the timer of a source from the Requested List expires, the source is moved to the Exclude List.

- [MLD] – 7.4.1. Reception of Current State Records

Router State	Report Received	New Router State	Actions
EXCLUDE (X,Y)	IS_EX (A)	EXCLUDE (A-Y, Y*A)	(A-X-Y)=MALI
			Delete (X-A)
			Delete (Y-A)
			Filter Timer=MALI

- [MLD] – 7.5. Switching Router Filter Modes

  If at the moment of the switch the Requested List (X) is empty, the multicast address record is deleted from the router.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_EX (S3, S4)

Report B
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S2, S5)

Report C
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record:

Report D
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record:

M1, IS_EX (S1,S2,S3)	M1, BLOCK (S1, S2, S3, S4, S5)

Report E

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN ()

Procedure:

Part A: Before second source timer expires, Check Request List
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A.
4. Observe the packets on all networks.
5. Wait [QI/ 2] seconds after Step 3. TN1 transmits Report B.
6. Observe the packets on all networks.
7. Wait [QI] seconds after Step 3. TN1 transmits Report C.
8. Observe the packets on all networks.
9. Wait [MALI-LLQT-∝] seconds after Step 5. TN1 transmits Report E.
10. Observe the packets on all networks.

Part B: Before second timer expires, Check Exclude List
11. Enable MLDv2 on the RUT.
12. Observe the packets on all networks.
13. TN1 transmits Report A.
14. Observe the packets on all networks.
15. Wait [QI / 2] seconds after Step 13. TN1 transmits Report B.
16. Observe the packets on all networks.
17. Wait [QI] seconds after Step 13. TN1 transmits Report C.
18. Observe the packets on all networks.
19. Wait [MALI-LLQT-∝] seconds after Step 15. TN1 transmits Report D.
20. Observe the packets on all networks.
21. Wait [LLQI] seconds. TN1 transmits Report E.
22. Observe the packets on all networks.

Part C: After second source timer expires, Check Request List
23. Enable MLDv2 on the RUT.
24. Observe the packets on all networks.
25. TN1 transmits Report A.
26. Observe the packets on all networks.
27. Wait [QI/2] seconds after Step 25. TN1 transmits Report B.
28. Observe the packets on all networks.
29. Wait [QI] seconds after Step 25. TN1 transmits Report C.
30. Observe the packets on all networks.
31. Wait [MALI] seconds after Step 27. TN1 transmits Report E.
32. Observe the packets on all networks.

Part D: After second source timer expires, Check Exclude List
33. Enable MLDv2 on the RUT.
34. Observe the packets on all networks.
35. TN1 transmits Report A.
36. Observe the packets on all networks.
37. Wait [QI / 2] seconds after Step 35. TN1 transmits Report B.
38. Observe the packets on all networks.
39. Wait [QI] seconds after Step 35. TN1 transmits Report C.
40. Observe the packets on all networks.
41. Wait [MALI] seconds after Step 37. TN1 transmits Report D.
42. Observe the packets on all networks.
43. Wait [LLQI] seconds. TN1 transmits Report E.
44. Observe the packets on all networks.
Part E: Before filter timer expires, Check Exclude List
45. Enable MLDv2 on the RUT.
46. Observe the packets on all networks.
47. TN1 transmits Report A.
48. Observe the packets on all networks.
49. Wait [QI / 2] seconds after Step 47. TN1 transmits Report B.
50. Observe the packets on all networks.
51. Wait [QI] seconds after Step 47. TN1 transmits Report C.
52. Observe the packets on all networks.
53. Wait [MALI-LLQT-∝] seconds after Step 51. TN1 transmits Report E.
54. Observe the packets on all networks.
Part F: After filter timer expires, Check Include List
55. Enable MLDv2 on the RUT.
56. Observe the packets on all networks.
57. TN1 transmits Report A.
58. Observe the packets on all networks.
59. Wait [QI / 2] seconds after Step 57. TN1 transmits Report B.
60. Observe the packets on all networks.
61. Wait [QI] seconds after Step 57. TN1 transmits Report C.
62. Observe the packets on all networks.
63. Wait [MALI-LLQT-∝] seconds after Step 61. TN1 transmits Report D.
64. Observe the packets on all networks.
65. Wait [LLQI] seconds. TN1 transmits Report E.
66. Observe the packets on all networks.
Part G: After third source timer expires, Check Include List
67. Enable MLDv2 on the RUT.
68. Observe the packets on all networks.
69. TN1 transmits Report A.
70. Observe the packets on all networks.
71. Wait [QI / 2] seconds after Step 69. TN1 transmits Report B.
72. Observe the packets on all networks.
73. Wait [QI] seconds after Step 69. TN1 transmits Report C.
74. Observe the packets on all networks.
75. Wait [MALI] seconds after Step 73. TN1 transmits Report E.
76. Observe the packets on all networks.

Observable Results:

- *Part A*
  Step 2: The RUT must transmit 2 MLDv2 General Queries.
  Step 4: The RUT must not transmit Queries other then periodic General Queries.
  Step 6: The RUT must not transmit Queries other then periodic General Queries.
  Step 8: The RUT must not transmit Queries other then periodic General Queries.
  Step 10: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part B*
  Step 12: The RUT must transmit 2 MLDv2 General Queries.
  Step 14: The RUT must not transmit Queries other then periodic General Queries.
  Step 16: The RUT must not transmit Queries other then periodic General Queries.
  Step 18: The RUT must not transmit Queries other then periodic General Queries.
  Step 20: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S2, S4, and S5.
  Step 22: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part C*
  Step 24: The RUT must transmit 2 MLDv2 General Queries.
  Step 26: The RUT must not transmit Queries other then periodic General Queries.
  Step 28: The RUT must not transmit Queries other then periodic General Queries.
  Step 30: The RUT must not transmit Queries other then periodic General Queries.
  Step 32: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part D*
  Step 34: The RUT must transmit 2 MLDv2 General Queries.
  Step 36: The RUT must not transmit Queries other then periodic General Queries.
  Step 38: The RUT must not transmit Queries other then periodic General Queries.
  Step 40: The RUT must not transmit Queries other then periodic General Queries.
  Step 42: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S4, and S5.
  Step 44: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part E*
  Step 46: The RUT must transmit 2 MLDv2 General Queries.
  Step 48: The RUT must not transmit Queries other then periodic General Queries.
  Step 50: The RUT must not transmit Queries other then periodic General Queries.
  Step 52: The RUT must not transmit Queries other then periodic General Queries.
  Step 54: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part F*
  Step 56: The RUT must transmit 2 MLDv2 General Queries.
  Step 58: The RUT must not transmit Queries other then periodic General Queries.
  Step 60: The RUT must not transmit Queries other then periodic General Queries.
  Step 62: The RUT must not transmit Queries other then periodic General Queries.

Step 64: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S4, and S5.
Step 66: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

- *Part G*
  Step 68: The RUT must transmit 2 MLDv2 General Queries.
  Step 70: The RUT must not transmit Queries other then periodic General Queries.
  Step 72: The RUT must not transmit Queries other then periodic General Queries.
  Step 74: The RUT must not transmit Queries other then periodic General Queries.
  Step 76: The RUT must not transmit Queries other then periodic General Queries.

Possible Problems:

- None.

Test MLD.4.9: Including – Receives Allow

Purpose: To verify that an MLDv2 router properly processes Allow while in Is Including.

References:

- [MLD] – 5.2.12. Multicast Address Record Types

  Value Name and Meaning
  -----   ----------------
  5   ALLOW_NEW_SOURCES - indicates that the Source Address [i]
                    fields in this Multicast Address Record contain a list of
                    the additional sources that the node wishes to listen to,
                    for packets sent to the specified multicast address. If
                    the change was to an INCLUDE source list, these are the
                    addresses that were added to the list; if the change was to
                    an EXCLUDE source list, these are the addresses that were
                    deleted from the list.

- [MLD] – 7.4.2. Reception of Filter Mode Change and Source List Change Records

  Router State   Report Received New Router State   Actions
  ---------------   ---------------   ----------------   -------
  INCLUDE (A)   ALLOW (B)   INCLUDE (A+B)   (B)=MALI

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, ALLOW ()

Report B
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, ALLOW() and ALLOW(S1)

Report C
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN(S1)

Report D
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1,ALLOW (S1, S3)

Report E	Report F
IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, ALLOW (S2, S3)	MLDv2 Report Multicast Address Record: M1, TO_IN ()

Procedure:

Part A: Including nothing, receives Allow
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A.
4. Observe the packets on all networks.
5. TN1 transmits Report F.
6. Observe the packets on all networks.

Part B: Including nothing, receives Allow with second source
7. Enable MLDv2 on the RUT.
8. Observe the packets on all networks.
9. TN1 transmits Report B.
10. Observe the packets on all networks.
11. TN1 transmits Report F.
12. Observe the packets on all networks.

Part C: Including Source, receives Allow
13. Enable MLDv2 on the RUT.
14. Observe the packets on all networks.
15. TN1 transmits Report C.
16. Observe the packets on all networks.
17. TN1 transmits Report A.
18. Observe the packets on all networks.
19. TN1 transmits Report F.
20. Observe the packets on all networks.

Part D: Including Source, Receives Allow with second source
21. Enable MLDv2 on the RUT.
22. Observe the packets on all networks.
23. TN1 transmits Report D.
24. Observe the packets on all networks.
25. TN1 transmits Report E.
26. Observe the packets on all networks.
27. TN1 transmits Report F.
28. Observe the packets on all networks

Observable Results:

- *Part A*

Step 2: The RUT must transmit 2 MLDv2 General Queries.
Step 4: The RUT must not transmit Queries other then periodic General Queries.
Step 6: The RUT must not transmit Queries other then periodic General Queries.

- *Part B*
  Step 8: The RUT must transmit 2 MLDv2 General Queries.
  Step 10: The RUT must not transmit Queries other then periodic General Queries.
  Step 12: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.

- *Part C*
  Step 14: The RUT must transmit 2 MLDv2 General Queries.
  Step 16: The RUT must not transmit Queries other then periodic General Queries.
  Step 18: The RUT must not transmit Queries other then periodic General Queries.
  Step 20: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.

- *Part D*
  Step 22: The RUT must transmit 2 MLDv2 General Queries.
  Step 24: The RUT must not transmit Queries other then periodic General Queries.
  Step 26: The RUT must not transmit Queries other then periodic General Queries.
  Step 28: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S2, and S3.

Possible Problems:

- None.

Test MLD.4.10: Including – Receives Allow and Updates Timer

Purpose: To verify that an MLDv2 router properly processes Allow while in Is Include and updates the timer.

References:

- [MLD] – 7.2.3. Definition of Source Timers

  If the timer of a source from the Include List expires, the source is deleted from the Include List. If there are no more source records left, the multicast address record is deleted from the router.

- [MLD] – 7.4.2. Reception of Filter Mode Change and Source List Change Records

Router State	Report Received	New Router State	Actions
INCLUDE (A)	ALLOW (B)	INCLUDE (A+B)	(B)=MALI

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A	Report B
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S1, S3)	MLDv2 Report Multicast Address Record: M1, ALLOW (S2, S3)

Report C
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN ()

Procedure:

Part A: Before source timer expires, Check Include List
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.

---

3. TN1 transmits Report A.
4. Observe the packets on all networks.
5. Wait [QI] seconds after Step 3. TN1 transmits Report B.
6. Observe the packets on all networks.
7. Wait [MALI-LLQT-∝] seconds after Step 3. TN1 transmits Report C.
8. Observe the packets on all networks.

Part B: After source timer expires, Check Include List
9. Enable MLDv2 on the RUT.
10. Observe the packets on all networks.
11. TN1 transmits Report A.
12. Observe the packets on all networks.
13. Wait [QI] seconds after Step 11. TN1 transmits Report B.
14. Observe the packets on all networks.
15. Wait [MALI] seconds after Step 11. TN1 transmits Report C.
16. Observe the packets on all networks.

Part C: Before second source timer expires, Check Include List
17. Enable MLDv2 on the RUT.
18. Observe the packets on all networks.
19. TN1 transmits Report A.
20. Observe the packets on all networks.
21. Wait [QI] seconds after Step 19. TN1 transmits Report B.
22. Observe the packets on all networks.
23. Wait [MALI-LLQT-∝] seconds after Step 21. TN1 transmits Report C.
24. Observe the packets on all networks.

Part D: After second source timer expires, Check Include List
25. Enable MLDv2 on the RUT.
26. Observe the packets on all networks.
27. TN1 transmits Report A.
28. Observe the packets on all networks.
29. Wait [QI] seconds after Step 27. TN1 transmits Report B.
30. Observe the packets on all networks.
31. Wait [MALI] seconds after Step 29. TN1 transmits Report C.
32. Observe the packets on all networks.

Observable Results:

- *Part A*
  Step 2: The RUT must transmit 2 MLDv2 General Queries.
  Step 4: The RUT must not transmit Queries other then periodic General Queries.
  Step 6: The RUT must not transmit Queries other then periodic General Queries.
  Step 8: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S2, and S3.
- *Part B*
  Step 10: The RUT must transmit 2 MLDv2 General Queries.
  Step 12: The RUT must not transmit Queries other then periodic General Queries.
  Step 14: The RUT must not transmit Queries other then periodic General Queries.
  Step 16: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S2 and S3.
- *Part C*

Step 18: The RUT must transmit 2 MLDv2 General Queries.
Step 20: The RUT must not transmit Queries other then periodic General Queries.
Step 22: The RUT must not transmit Queries other then periodic General Queries.
Step 24: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S2 and S3.

- *Part D*
  Step 26: The RUT must transmit 2 MLDv2 General Queries.
  Step 28: The RUT must not transmit Queries other then periodic General Queries.
  Step 30: The RUT must not transmit Queries other then periodic General Queries.
  Step 32: The RUT must not transmit Queries other then periodic General Queries.

Possible Problems:

- None.

Test MLD.4.11: Including – Receives Block

Purpose: To verify that an MLDv2 router properly processes Block while in Is Include.

References:

- [MLD] – 5.2.12. Multicast Address Record Types

  Value   Name and Meaning
  -----   ----------------
  6   BLOCK_OLD_SOURCES - indicates that the Source Address [i]
                  fields in this Multicast Address Record contain a list of
                  the sources that the node no longer wishes to listen to,
                  for packets sent to the specified multicast address. If the
                  change was to an INCLUDE source list, these are the
                  addresses that were deleted from the list; if the change
                  was to an EXCLUDE source list, these are the addresses that
                  were added to the list.

  If a change of source list results in both allowing new sources and blocking old sources, then two Multicast Address Records are sent for the same multicast address, one of type ALLOW_NEW_SOURCES and one of type BLOCK_OLD_SOURCES.

- [MLD] – 7.4.2. Reception of Filter Mode Change and Source List Change Records

  Router State   Report Received New Router State   Actions
  ---------------- ---------------   ----------------   -------
  INCLUDE (A) ALLOW (B)   INCLUDE (A+B)   (B)=MALI
  INCLUDE (A) BLOCK (B)   INCLUDE (A)   Send Q (MA, A*B)

- [MLD] – 7.6.1. Timer Updates

  Query   Action
  -----   ------
  Q(MA,A)   Source Timers for sources in A are lowered to LLQT

- [MLD] – 7.6.3.2. Building and Sending Multicast Address and Source Specific

  o Lower source timer to LLQT;
  o Add the sources to the Retransmission List;
  o Set the Source Retransmission Counter for each source to [Last Listener Query Count].

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A	Report B
IPv6 Header	IPv6 Header
Source Address: TN1's Link-	Source Address: TN1's Link-

local Address Destination Address: FF02::16	local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, BLOCK ()	MLDv2 Report Multicast Address Record: M1, BLOCK () and ALLOW (S1)

Report C	Report D
IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, BLOCK (S1)	MLDv2 Report Multicast Address Record: M1, BLOCK (S1) and ALLOW (S2)

Report E	Report F
IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S1)	MLDv2 Report Multicast Address Record: M1, IS_IN (S1, S3)

Report G	Report H
IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, BLOCK (S2, S3)	MLDv2 Report Multicast Address Record: M1, TO_IN ()

Procedure:

Part A: Including nothing, receive BLOCK nothing
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A.
4. Observe the packets on all networks.
5. TN1 transmits Report H.
6. Observe the packets on all networks.

Part B: Include nothing, Report BLOCK nothing and ALLOW source

7. Enable MLDv2 on the RUT.
8. Observe the packets on all networks.
9. TN1 transmits Report B.
10. Observe the packets on all networks.
11. TN1 transmits Report H.
12. Observe the packets on all networks.

Part C: Include nothing, Report BLOCK Source
13. Enable MLDv2 on the RUT.
14. Observe the packets on all networks.
15. TN1 transmits Report C.
16. Observe the packets on all networks.
17. TN1 transmits Report H.
18. Observe the packets on all networks.

Part D: Include nothing, Report BLOCK Source and ALLOW different source
19. Enable MLDv2 on the RUT.
20. Observe the packets on all networks.
21. TN1 transmits Report D.
22. Observe the packets on all networks.
23. TN1 transmits Report H.
24. Observe the packets on all networks.

Part E: Including Source, receives BLOCK nothing
25. Enable MLDv2 on the RUT.
26. Observe the packets on all networks.
27. TN1 transmits Report E.
28. Observe the packets on all networks.
29. TN1 transmits Report A.
30. Observe the packets on all networks.
31. TN1 transmits Report H.
32. Observe the packets on all networks.

Part F: Including Source, Report BLOCK different source
33. Enable MLDv2 on the RUT.
34. Observe the packets on all networks.
35. TN1 transmits Report F.
36. Observe the packets on all networks.
37. TN1 transmits Report G.
38. Observe the packets on all networks.
39. TN1 transmit Report H.
40. Observe the packets on all networks.

Part G: Including Source, Report BLOCK different source and ALLOW third source
41. Enable MLDv2 on the RUT.
42. Observe the packets on all networks.
43. TN1 transmits Report F.
44. Observe the packets on all networks.
45. TN1 transmits Report D.
46. Observe the packets on all networks.
47. TN1 transmits Report H.
48. Observe the packets on all networks.

Observable Results:

- *Part A*
  - **Step 2:** The RUT must transmit 2 MLDv2 General Queries.
  - **Step 4:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 6:** The RUT must not transmit Queries other then periodic General Queries.
- *Part B*
  - **Step 8:** The RUT must transmit 2 MLDv2 General Queries.
  - **Step 10:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 12:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
- *Part C*
  - **Step 14:** The RUT must transmit 2 MLDv2 General Queries.
  - **Step 16:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 18:** The RUT must not transmit Queries other then periodic General Queries.
- *Part D*
  - **Step 20:** The RUT must transmit 2 MLDv2 General Queries.
  - **Step 22:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 24:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S2.
- *Part E*
  - **Step 26:** The RUT must transmit 2 MLDv2 General Queries.
  - **Step 28:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 30:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 32:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
- *Part F*
  - **Step 34:** The RUT must transmit 2 MLDv2 General Queries.
  - **Step 36:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 38:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S3.
  - **Step 40:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
- *Part G*
  - **Step 42:** The RUT must transmit 2 MLDv2 General Queries.
  - **Step 44:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 46:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1.
  - **Step 48:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S2 and S3.

Possible Problems:

- None.

Test MLD.4.12: Including – Receives BLOCK and Updates Timer

Purpose: To verify that an MLDv2 router properly processes Block while in Is Include and updates the timer.

References:

- [MLD] – 7.2.3. Definition of Source Timers

  If the timer of a source from the Include List expires, the source is deleted from the Include List. If there are no more source records left, the multicast address record is deleted from the router.

- [MLD] – 7.4.2. Reception of Filter Mode Change and Source List Change Records

Router State	Report Received	New Router State	Actions
INCLUDE (A)	BLOCK (B)	INCLUDE (A)	Send Q(MA, A*B)

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A	Report B
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S1, S3)	MLDv2 Report Multicast Address Record: M1, BLOCK (S2, S3)

Report C
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN ()

Procedure:

Part A: Before source timer expires, Check Include List
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.

3. TN1 transmits Report A.
4. Observe the packets on all networks.
5. Wait [QI] seconds after Step 3. TN1 transmits Report B.
6. Observe the packets on all networks.
7. Wait [MALI-LLQT-∝] seconds after Step 3. TN1 transmits Report C.
8. Observe the packets on all networks.

Part B: After source timer expires, Check Include List
9. Enable MLDv2 on the RUT.
10. Observe the packets on all networks.
11. TN1 transmits Report A.
12. Observe the packets on all networks.
13. Wait [QI] seconds after Step 11. TN1 transmits Report B.
14. Observe the packets on all networks.
15. Wait [MALI] seconds after Step 11. TN1 transmits Report C.
16. Observe the packets on all networks.

Observable Results:

- *Part A*
    Step 2: The RUT must transmit 2 MLDv2 General Queries.
    Step 4: The RUT must not transmit Queries other then periodic General Queries.
    Step 6: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S3.
    Step 8: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
- *Part B*
    Step 10: The RUT must transmit 2 MLDv2 General Queries.
    Step 12: The RUT must not transmit Queries other then periodic General Queries.
    Step 14: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S3.
    Step 16: The RUT must not transmit Queries other then periodic General Queries.

Possible Problems:

- None.

Test MLD.4.13: Including – Receives To Exclude

Purpose: To verify that an MLDv2 router properly processes To Exclude while in Is Include.

References:

- [MLD] – 7.4.2. Reception of Filter Mode Change and Source List Change Records

Router State	Report Received	New Router State	Actions
INCLUDE (A)	TO_EX (B)	EXCLUDE (A*B,B-A)	(B-A)=0
			Delete (A-B)
			Send Q(MA,A*B)
			Filter Timer=MALI

- [MLD] – 7.6.1. Timer Updates

Query	Action
Q(MA,A)	Source Timers for sources in A are lowered to LLQT

- [MLD] – 7.6.3.2. Building and Sending Multicast Address and Source Specific

    o Lower source timer to LLQT;
    o Add the sources to the Retransmission List;
    o Set the Source Retransmission Counter for each source to [Last Listener Query Count].

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A
IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record:
M1, TO_EX()

Report B
IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record:
M1, BLOCK(S1)

Report C
IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report

Report D
IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report

Multicast Address Record:	Multicast Address Record:
M1, TO_EX (S1)	M1, IS_IN (S1)

Report E	Report F
IPv6 Header	IPv6 Header
Source Address: TN1's Link-local Address	Source Address: TN1's Link-local Address
Destination Address: FF02::16	Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report	MLDv2 Report
Multicast Address Record:	Multicast Address Record:
M1, IS_IN (S1, S3)	M1, TO_EX (S2, S3)

Report G	Report H
IPv6 Header	IPv6 Header
Source Address: TN1's Link-local Address	Source Address: TN1's Link-local Address
Destination Address: FF02::16	Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report	MLDv2 Report
Multicast Address Record:	Multicast Address Record:
M1, BLOCK (S1, S2, S3)	M1, TO_IN()

Procedure:

Part A: Including nothing, receives To Exclude nothing, Check Requested List
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A.
4. Observe the packets on all networks.
5. TN1 transmits Report H.
6. Observe the packets on all networks.

Part B: Including nothing, receives To Exclude nothing, Check Exclude List
7. Enable MLDv2 on the RUT.
8. Observe the packets on all networks.
9. TN1 transmits Report A.
10. Observe the packets on all networks.
11. TN1 transmits Report B.
12. Observe the packets on all networks.
13. Wait [LLQI] seconds. TN1 transmits Report H.
14. Observe the packets on all networks.

Part C: Including nothing, receives To Exclude source, Check Requested List
15. Enable MLDv2 on the RUT.
16. Observe the packets on all networks.
17. TN1 transmits Report C.
18. Observe the packets on all networks.
19. TN1 transmits Report H.
20. Observe the packets on all networks.

Part D: Including nothing, receives To Exclude source, Check Exclude List
    21. Enable MLDv2 on the RUT.
    22. Observe the packets on all networks.
    23. TN1 transmits Report C.
    24. Observe the packets on all networks.
    25. TN1 transmits Report B.
    26. Observe the packets on all networks.
    27. TN1 transmits Report H.
    28. Observe the packets on all networks.

Part E: Including source, receives To Exclude nothing, Check Requested List
    29. Enable MLDv2 on the RUT.
    30. Observe the packets on all networks.
    31. TN1 transmits Report D.
    32. Observe the packets on all networks.
    33. TN1 transmits Report A.
    34. Observe the packets on all networks.
    35. TN1 transmits Report H.
    36. Observe the packets on all networks.

Part F: Including source, receives To Exclude nothing, Check Exclude List
    37. Enable MLDv2 on the RUT.
    38. Observe the packets on all networks.
    39. TN1 transmits Report D.
    40. Observe the packets on all networks.
    41. TN1 transmits Report A.
    42. Observe the packets on all networks.
    43. TN1 transmits Report B.
    44. Observe the packets on all networks.
    45. Wait [LLQI] seconds. TN1 transmits Report H.
    46. Observe the packets on all networks.

Part G: Including source, receives To Exclude different source, Check Requested List
    47. Enable MLDv2 on the RUT.
    48. Observe the packets on all networks.
    49. TN1 transmits Report E.
    50. Observe the packets on all networks.
    51. TN1 transmits Report F.
    52. Observe the packets on all networks.
    53. Wait [LLQI] seconds. TN1 transmits Report H.
    54. Observe the packets on all networks.

Part H: Including source, receives To Exclude different source, Check Exclude List
    55. Enable MLDv2 on the RUT.
    56. Observe the packets on all networks.
    57. TN1 transmits Report E.
    58. Observe the packets on all networks.
    59. TN1 transmits Report F.
    60. Observe the packets on all networks.
    61. Wait [LLQI] seconds. TN1 transmits Report G.
    62. Observe the packets on all networks.
    63. Wait [LLQI] seconds. TN1 transmits Report H.
    64. Observe the packets on all networks.

Observable Results:

- *Part A*
  Step 2: The RUT must transmit 2 MLDv2 General Queries.
  Step 4: The RUT must not transmit Queries other then periodic General Queries.
  Step 6: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part B*
  Step 8: The RUT must transmit 2 MLDv2 General Queries.
  Step 10: The RUT must not transmit Queries other then periodic General Queries.
  Step 12: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
  Step 14: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part C*
  Step 16: The RUT must transmit 2 MLDv2 General Queries.
  Step 18: The RUT must not transmit Queries other then periodic General Queries.
  Step 20: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part D*
  Step 22: The RUT must transmit 2 MLDv2 General Queries.
  Step 24: The RUT must not transmit Queries other then periodic General Queries.
  Step 26: The RUT must not transmit Queries other then periodic General Queries.
  Step 28: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part E*
  Step 30: The RUT must transmit 2 MLDv2 General Queries.
  Step 32: The RUT must not transmit Queries other then periodic General Queries.
  Step 34: The RUT must not transmit Queries other then periodic General Queries.
  Step 36: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part F*
  Step 38: The RUT must transmit 2 MLDv2 General Queries.
  Step 40: The RUT must not transmit Queries other then periodic General Queries.
  Step 42: The RUT must not transmit Queries other then periodic General Queries.
  Step 44: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
  Step 46: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part G*
  Step 48: The RUT must transmit 2 MLDv2 General Queries.
  Step 50: The RUT must not transmit Queries other then periodic General Queries.
  Step 52: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S3.
  Step 54: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part H*
  Step 56: The RUT must transmit 2 MLDv2 General Queries.

Step 58: The RUT must not transmit Queries other then periodic General Queries.
Step 60: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S3.
Step 62: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
Step 64: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

Possible Problems:

- None.

Test MLD.4.14: Including – Receives To Exclude and Updates Timer

Purpose: To verify that an MLDv2 router properly processes To Exclude while in Is Include and updates the timer.

References:

- [MLD] – 7.2.3. Definition of Source Timers

  If the timer of a source from the Requested List expires, the source is moved to the Exclude List.

- [MLD] – 7.4.2. Reception of Filter Mode Change and Source List Change Records

  INCLUDE (A)   TO_EX (B)   EXCLUDE (A*B,B-A)   (B-A)=0
                                            Delete (A-B)
                                            Send Q(MA,A*B)
                                            Filter Timer=MALI

- [MLD] – 7.5. Switching Router Filter Modes

  If at the moment of the switch the Requested List (X) is empty, the multicast address record is deleted from the router.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S1, S3)

Report B
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_EX (S2, S3)

Report C
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, BLOCK (S1, S2, S3)

Report D
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN()

Procedure:

Part A: Before filter timer expires, Check Requested List
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A.
4. Observe the packets on all networks.
5. Wait [QI] seconds after Step 3. TN1 transmits Report B.
6. Observe the packets on all networks.
7. Wait [MALI-LLQT-∝] seconds after Step 5. TN1 transmits Report D.
8. Observe the packets on all networks.

Part B: Before filter timer expires, Check Exclude List
9. Enable MLDv2 on the RUT.
10. Observe the packets on all networks.
11. TN1 transmits Report A.
12. Observe the packets on all networks.
13. Wait [QI] seconds after Step 11. TN1 transmits Report B.
14. Observe the packets on all networks.
15. Wait [MALI – LLQT - ∝] seconds after Step 13. TN1 transmits Report C.
16. Observe the packets on all networks.
17. Wait [LLQI] seconds. TN1 transmits Report D.
18. Observe the packets on all networks.

Part C: After filter timer expires, Check Include List
19. Enable MLDv2 on the RUT.
20. Observe the packets on all networks.
21. TN1 transmits Report A.
22. Observe the packets on all networks.
23. Wait [QI] seconds after Step 21. TN1 transmits Report B.
24. Observe the packets on all networks.
25. Wait [MALI] seconds after Step 23. TN1 transmits Report D.
26. Observe the packets on all networks.

Observable Results:

- *Part A*

  Step 2: The RUT must transmit 2 MLDv2 General Queries.
  Step 4: The RUT must not transmit Queries other then periodic General Queries.
  Step 6: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S3.
  Step 8: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

- *Part B*

  Step 10: The RUT must transmit 2 MLDv2 General Queries.
  Step 12: The RUT must not transmit Queries other then periodic General Queries.
  Step 14: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S3.
  Step 16: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
  Step 18: The RUT must transmit 2 Multicast Address Specific Query with a Multicast

Address of M1.
- *Part C*

  Step 20: The RUT must transmit 2 MLDv2 General Queries.
  Step 22: The RUT must not transmit Queries other then periodic General Queries.
  Step 24: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S3.
  Step 26: The RUT must not transmit Queries other then periodic General Queries.

Possible Problems:

- None.

Test MLD.4.15: Including – Receives To Include

Purpose: To verify that an MLDv2 router properly processes To Include while in Is Including.

References:

- [MLD] – 7.4.2. Reception of Filter Mode Change and Source List Change Records

Router State	Report Received	New Router State	Actions
INCLUDE (A)	TO_IN (B)	INCLUDE (A+B)	(B)=MALI Send Q(MA,A-B)

- [MLD] – 7.6.1. Timer Updates

Query	Action
Q(MA,A)	Source Timers for sources in A are lowered to LLQT

- [MLD] – 7.6.3.2. Building and Sending Multicast Address and Source Specific

  o Lower source timer to LLQT;
  o Add the sources to the Retransmission List;
  o Set the Source Retransmission Counter for each source to [Last Listener Query Count].

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A	Report B
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN ()	MLDv2 Report Multicast Address Record: M1, TO_IN() and TO_IN (S1)

Report C	Report D
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN (S1)	MLDv2 Report Multicast Address Record: M1, TO_IN (S1, S3)

IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN (S2, S3)

Procedure:

Part A: Including nothing, receives To Include nothing
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A.
4. Observe the packets on all networks.
5. TN1 transmits Report A.
6. Observe the packets on all networks.

Part B: Including nothing, receives To Include with second source
7. Enable MLDv2 on the RUT.
8. Observe the packets on all networks.
9. TN1 transmits Report B.
10. Observe the packets on all networks.
11. TN1 transmits Report A.
12. Observe the packets on all networks.

Part C: Including Source, receives To Include nothing
13. Enable MLDv2 on the RUT.
14. Observe the packets on all networks.
15. TN1 transmits Report C.
16. Observe the packets on all networks.
17. TN1 transmits Report A.
18. Observe the packets on all networks.
19. Wait [LLQI] seconds. TN1 transmits Report A.
20. Observe the packets on all networks.

Part D: Including Source, Receives To Include with second source
21. Enable MLDv2 on the RUT.
22. Observe the packets on all networks.
23. TN1 transmits Report D.
24. Observe the packets on all networks.
25. TN1 transmits Report E.
26. Observe the packets on all networks.
27. Wait [LLQI] seconds. TN1 transmits Report A.
28. Observe the packets on all networks

Observable Results:

- *Part A*

Step 2: The RUT must transmit 2 MLDv2 General Queries.

Step 4: The RUT must not transmit Queries other then periodic General Queries.

Step 6: The RUT must not transmit Queries other then periodic General Queries.

- *Part B*

  Step 8: The RUT must transmit 2 MLDv2 General Queries.

  Step 10: The RUT must not transmit Queries other then periodic General Queries.

  Step 12: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.

- *Part C*

  Step 14: The RUT must transmit 2 MLDv2 General Queries.

  Step 16: The RUT must not transmit Queries other then periodic General Queries.

  Step 18: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.

  Step 20: The RUT must not transmit Queries other then periodic General Queries.

- *Part D*

  Step 22: The RUT must transmit 2 MLDv2 General Queries.

  Step 24: The RUT must not transmit Queries other then periodic General Queries.

  Step 26: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.

  Step 28: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S2 and S3.

Possible Problems:

- None.

Test MLD.4.16: Including – Receives To Include and Updates Timer

Purpose: To verify that an MLDv2 router properly processes To Include while in Is Include and updates the timer.

References:

- [MLD] – 7.2.3. Definition of Source Timers

  If the timer of a source from the Include List expires, the source is deleted from the Include List. If there are no more source records left, the multicast address record is deleted from the router.

- [MLD] – 7.4.2. Reception of Filter Mode Change and Source List Change Records

Router State	Report Received	New Router State	Actions
INCLUDE (A)	TO_IN (B)	INCLUDE (A+B)	(B)=MALI Send Q(MA, A-B)

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A	Report B
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN (S1, S3)	MLDv2 Report Multicast Address Record: M1, TO_IN (S2, S3)

Report C
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN ()

Procedure:

Part A: Before second source timer expires, Check Include List
1. Enable MLDv2 on the RUT.

---

2. Observe the packets on all networks.
3. TN1 transmits Report A.
4. Observe the packets on all networks.
5. Wait [QI] seconds after Step 3. TN1 transmits Report B.
6. Observe the packets on all networks.
7. Wait [MALI-LLQT-∝] seconds after Step 5. TN1 transmits Report C.
8. Observe the packets on all networks.

Part B: After second source timer expires, Check Include List
9. Enable MLDv2 on the RUT.
10. Observe the packets on all networks.
11. TN1 transmits Report A.
12. Observe the packets on all networks.
13. Wait [QI] seconds after Step 11. TN1 transmits Report B.
14. Observe the packets on all networks.
15. Wait [MALI] seconds after Step 13. TN1 transmits Report C.
16. Observe the packets on all networks.

Observable Results:

- *Part A*
  Step 2: The RUT must transmit 2 MLDv2 General Queries.
  Step 4: The RUT must not transmit Queries other then periodic General Queries.
  Step 6: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
  Step 8: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S2 and S3.
- *Part B*
  Step 10: The RUT must transmit 2 MLDv2 General Queries.
  Step 12: The RUT must not transmit Queries other then periodic General Queries.
  Step 14: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
  Step 16: The RUT must not transmit Queries other then periodic General Queries.

Possible Problems:

- None.

Test MLD.4.17: Excluding – Receives Allow

Purpose: To verify that an MLDv2 router properly processes ALLOW while in Is Exclude.

References:

- [MLD] – 5.2.12. Multicast Address Record Types

  Value Name and Meaning
  ----- ----------------
  5   ALLOW_NEW_SOURCES - indicates that the Source Address [i]
              fields in this Multicast Address Record contain a list of
              the additional sources that the node wishes to listen to,
              for packets sent to the specified multicast address. If
              the change was to an INCLUDE source list, these are the
              addresses that were added to the list; if the change was to
              an EXCLUDE source list, these are the addresses that were
              deleted from the list.

- [MLD] – 7.4.2. Reception of Filter Mode Change and Source List Change Records

  Router State   Report Received New Router State   Actions
  ------------   --------------- ----------------   -------
  EXCLUDE (X,Y) ALLOW (A)   EXCLUDE (X+A, Y-A) (A)=MALI

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A	Report B
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_EX ()	MLDv2 Report Multicast Address Record: M1, ALLOW ()

Report C	Report D
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, BLOCK (S1)	MLDv2 Report Multicast Address Record: M1,

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Report E	Report F
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_EX (S3, S4)	MLDv2 Report Multicast Address Record: M1, IS_IN (S2, S5)

Report G	Report H
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, BLOCK (S1, S2, S3, S4, S5)	MLDv2 Report Multicast Address Record: M1, ALLOW (S1, S2, S3)

Report I
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN ()

Procedure:

Part A: Excluding nothing, receives Allow nothing, Check Requested List
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A.
4. Observe the packets on all networks.
5. TN1 transmits Report B.
6. Observe the packets on all networks.
7. TN1 transmits Report I.
8. Observe the packets on all networks.

Part B: Excluding nothing, receives Allow nothing, Check Exclude List
9. Enable MLDv2 on the RUT.
10. Observe the packets on all networks.
11. TN1 transmits Report A.
12. Observe the packets on all networks.

13. TN1 transmits Report B.
14. Observe the packets on all networks.
15. TN1 transmits Report C.
16. Observe the packets on all networks.
17. Wait [LLQI] seconds. TN1 transmits Report I.
18. Observe the packets on all networks.

Part C: Excluding nothing, receives Allow nothing and Allow source, Check Requested List
19. Enable MLDv2 on the RUT.
20. Observe the packets on all networks.
21. TN1 transmits Report A.
22. Observe the packets on all networks.
23. TN1 transmits Report D.
24. Observe the packets on all networks.
25. TN1 transmits Report I.
26. Observe the packets on all networks.

Part D: Excluding nothing, receives Allow nothing and Allow source, Check Exclude List
27. Enable MLDv2 on the RUT.
28. Observe the packets on all networks.
29. TN1 transmits Report A.
30. Observe the packets on all networks.
31. TN1 transmits Report D.
32. Observe the packets on all networks.
33. TN1 transmits Report C.
34. Observe the packets on all networks.
35. Wait [LLQI] seconds. TN1 transmits Report I.
36. Observe the packets on all networks.

Part E: Excluding source and request different source, receives Allow nothing, Check Requested List
37. Enable MLDv2 on the RUT.
38. Observe the packets on all networks.
39. TN1 transmits Report E.
40. Observe the packets on all networks.
41. TN1 transmits Report F.
42. Observe the packets on all networks.
43. TN1 transmits Report B.
44. Observe the packets on all networks.
45. TN1 transmits Report I.
46. Observe the packets on all networks.

Part F: Excluding source and request different source, receives Allow nothing, Check Exclude List
47. Enable MLDv2 on the RUT.
48. Observe the packets on all networks.
49. TN1 transmits Report E.
50. Observe the packets on all networks.
51. TN1 transmits Report F.
52. Observe the packets on all networks.
53. TN1 transmits Report B.
54. Observe the packets on all networks.
55. TN1 transmits Report G.
56. Observe the packets on all networks.
57. Wait [LLQI] seconds. TN1 transmits Report I.

58. Observe the packets on all networks.
Part G Excluding source and request different source, receives Allow source, Check Requested List
59. Enable MLDv2 on the RUT.
60. Observe the packets on all networks.
61. TN1 transmits Report E.
62. Observe the packets on all networks.
63. TN1 transmits Report F.
64. Observe the packets on all networks.
65. TN1 transmits Report H.
66. Observe the packets on all networks.
67. TN1 transmits Report I.
68. Observe the packets on all networks.
Part H: Excluding source and request different source, receives Allow source, Check Exclude List
69. Enable MLDv2 on the RUT.
70. Observe the packets on all networks.
71. TN1 transmits Report E.
72. Observe the packets on all networks.
73. TN1 transmits Report F.
74. Observe the packets on all networks.
75. TN1 transmits Report H.
76. Observe the packets on all networks.
77. TN1 transmits Report G.
78. Observe the packets on all networks.
79. Wait [LLQI] seconds. TN1 transmits Report I.
80. Observe the packets on all networks.

Observable Results:

- *Part A*
    Step 2: The RUT must transmit 2 MLDv2 General Queries.
    Step 4: The RUT must not transmit Queries other then periodic General Queries.
    Step 6: The RUT must not transmit Queries other then periodic General Queries
    Step 8: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part B*
    Step 10: The RUT must transmit 2 MLDv2 General Queries.
    Step 12: The RUT must not transmit Queries other then periodic General Queries.
    Step 14: The RUT must not transmit Queries other then periodic General Queries.
    Step 16: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
    Step 18: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part C*
    Step 20: The RUT must transmit 2 MLDv2 General Queries.
    Step 22: The RUT must not transmit Queries other then periodic General Queries.
    Step 24: The RUT must not transmit Queries other then periodic General Queries.
    Step 26: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

- *Part D*
  - **Step 28:** The RUT must transmit 2 MLDv2 General Queries.
  - **Step 30:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 32:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 34:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
  - **Step 36:** The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part E*
  - **Step 38:** The RUT must transmit 2 MLDv2 General Queries.
  - **Step 40:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 42:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 44:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 46:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S5. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part F*
  - **Step 48:** The RUT must transmit 2 MLDv2 General Queries.
  - **Step 50:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 52:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 54:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 56:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S2, and S5.
  - **Step 58:** The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part G*
  - **Step 60:** The RUT must transmit 2 MLDv2 General Queries.
  - **Step 62:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 64:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 66:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 68:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S2, S3 and S5. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part H*
  - **Step 70:** The RUT must transmit 2 MLDv2 General Queries.
  - **Step 72:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 74:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 76:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 78:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S2, S3, and S5.
  - **Step 80:** The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

Possible Problems:

- None.

Test MLD.4.18: Excluding – Receives Allow and Updates Timer

Purpose: To verify that an MLDv2 router properly processes Allow while in Is Excluding and updates timer.

References:

- [MLD] – 7.4.2. Reception of Filter Mode Change and Source List Change Records

Router State	Report Received	New Router State	Actions
EXCLUDE (X,Y)	ALLOW (A)	EXCLUDE (X+A,Y-A)	(A)=MALI

- [MLD] – 7.5. Switching Router Filter Modes

  A router uses the sources from the Requested List as its state for the switch to a filter mode of INCLUDE. Sources from the Requested List are moved in the Include List, while sources from the Exclude List are deleted. For example, if a router's state for a multicast address is EXCLUDE(X,Y) and the Filter Timer expires for that multicast address, the router switches to filter mode of INCLUDE with state INCLUDE(X). If at the moment of the switch the Requested List (X) is empty, the multicast address record is deleted from the router.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A	Report B
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_EX (S3,S4)	MLDv2 Report Multicast Address Record: M1, IS_IN (S2, S5)

Report C	Report D
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, ALLOW (S1, S2, S3)	MLDv2 Report Multicast Address Record: M1, BLOCK (S1, S2, S3, S4, S5)

Report E
IPv6 Header

Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN ()

Procedure:

Part A: Before filter timer expires, Check Requested List
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A.
4. Observe the packets on all networks.
5. Wait [QI/2] seconds after step 3. TN1 transmits Report B.
6. Observe the packets on all networks.
7. Wait [QI] seconds after Step 3. TN1 transmits Report C.
8. Observe the packets on all networks.
9. Wait [MALI - LLQT - ∝] seconds after Step 3. TN1 transmits Report E.
10. Observe the packets on all networks.

Part B: After filter timer expires, Check Exclude List
11. Enable MLDv2 on the RUT.
12. Observe the packets on all networks.
13. TN1 transmits Report A.
14. Observe the packets on all networks.
15. Wait [QI/2] seconds after step 13. TN1 transmits Report B.
16. Observe the packets on all networks.
17. Wait [QI] seconds after Step 13. TN1 transmits Report C.
18. Observe the packets on all networks.
19. Wait [MALI – LLQT - ∝] seconds after Step 13. TN1 transmits Report D.
20. Observe the packets on all networks.
21. Wait [LLQI] seconds. TN1 transmits Report E.
22. Observe the packets on all networks.

Part C: After filter expire, Check Include List
23. Enable MLDv2 on the RUT.
24. Observe the packets on all networks.
25. TN1 transmits Report A.
26. Observe the packets on all networks.
27. Wait [QI/2] seconds after step 25. TN1 transmits Report B.
28. Observe the packets on all networks.
29. Wait [QI] seconds after Step 25. TN1 transmits Report C.
30. Observe the packets on all networks.
31. Wait [MALI] seconds after Step 25. TN1 transmits Report E.
32. Observe the packets on all networks.

Part D: Before second timer expire, Check Include List
33. Enable MLDv2 on the RUT.
34. Observe the packets on all networks.
35. TN1 transmits Report A.

36. Observe the packets on all networks.
37. Wait [QI/2] seconds after step 35. TN1 transmits Report B.
38. Observe the packets on all networks.
39. Wait [QI] seconds after Step 35. TN1 transmits Report C.
40. Observe the packets on all networks.
41. Wait [MALI – LLQT - ∝] seconds after Step 37. TN1 transmits Report E.
42. Observe the packets on all networks.

Part E: After expiring second source timer, Check Include List
43. Enable MLDv2 on the RUT.
44. Observe the packets on all networks.
45. TN1 transmits Report A.
46. Observe the packets on all networks.
47. Wait [QI/2] seconds after step 45. TN1 transmits Report B.
48. Observe the packets on all networks.
49. Wait [QI] seconds after Step 45. TN1 transmits Report C.
50. Observe the packets on all networks.
51. Wait [MALI] seconds after Step 47. TN1 transmits Report E.
52. Observe the packets on all networks.

Part F: Before expiring third source timer, Check Include List
53. Enable MLDv2 on the RUT.
54. Observe the packets on all networks.
55. TN1 transmits Report A.
56. Observe the packets on all networks.
57. Wait [QI/2] seconds after step 55. TN1 transmits Report B.
58. Observe the packets on all networks.
59. Wait [QI] seconds after Step 55. TN1 transmits Report C.
60. Observe the packets on all networks.
61. Wait [MALI – LLQT- ∝] seconds after Step 59. TN1 transmits Report E.
62. Observe the packets on all networks.

Part G: After expiring third source timer, Check Include List
63. Enable MLDv2 on the RUT.
64. Observe the packets on all networks.
65. TN1 transmits Report A.
66. Observe the packets on all networks.
67. Wait [QI/2] seconds after step 65. TN1 transmits Report B.
68. Observe the packets on all networks.
69. Wait [QI] seconds after Step 65. TN1 transmits Report C.
70. Observe the packets on all networks.
71. Wait [MALI] seconds after Step 69. TN1 transmits Report E.
72. Observe the packets on all networks.

Observable Results:

- *Part A*
    Step 2: The RUT must transmit 2 MLDv2 General Queries.
    Step 4: The RUT must not transmit Queries other then periodic General Queries.
    Step 6: The RUT must not transmit Queries other then periodic General Queries.
    Step 8: The RUT must not transmit Queries other then periodic General Queries.
    Step 10: The RUT must transmit 2 Multicast Address and Source Specific Query with a

Multicast Address of M1 and Source Addresses of S1, S2, S3 and S5. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

- *Part B*
    Step 12: The RUT must transmit 2 MLDv2 General Queries.
    Step 14: The RUT must not transmit Queries other then periodic General Queries.
    Step 16: The RUT must not transmit Queries other then periodic General Queries.
    Step 18: The RUT must not transmit Queries other then periodic General Queries.
    Step 20: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S2, S3, and S5.
    Step 22: The RUT must transmit 2 Multicast Address Specific Query with Multicast Address of M1.

- *Part C*
    Step 24: The RUT must transmit 2 MLDv2 General Queries.
    Step 26: The RUT must not transmit Queries other then periodic General Queries.
    Step 28: The RUT must not transmit Queries other then periodic General Queries.
    Step 30: The RUT must not transmit Queries other then periodic General Queries.
    Step 32: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S2, S3 and S5.

- *Part D*
    Step 34: The RUT must transmit 2 MLDv2 General Queries.
    Step 36: The RUT must not transmit Queries other then periodic General Queries.
    Step 38: The RUT must not transmit Queries other then periodic General Queries.
    Step 40: The RUT must not transmit Queries other then periodic General Queries.
    Step 42: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S2, S3 and S5.

- *Part E*
    Step 44: The RUT must transmit 2 MLDv2 General Queries.
    Step 46: The RUT must not transmit Queries other then periodic General Queries.
    Step 48: The RUT must not transmit Queries other then periodic General Queries.
    Step 50: The RUT must not transmit Queries other then periodic General Queries.
    Step 52: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S2 and S3.

- *Part F*
    Step 54: The RUT must transmit 2 MLDv2 General Queries.
    Step 56: The RUT must not transmit Queries other then periodic General Queries.
    Step 58: The RUT must not transmit Queries other then periodic General Queries.
    Step 60: The RUT must not transmit Queries other then periodic General Queries.
    Step 62: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S2 and S3.

- *Part G*
    Step 64: The RUT must transmit 2 MLDv2 General Queries.
    Step 66: The RUT must not transmit Queries other then periodic General Queries.
    Step 68: The RUT must not transmit Queries other then periodic General Queries.
    Step 70: The RUT must not transmit Queries other then periodic General Queries.
    Step 72: The RUT must not transmit Queries other then periodic General Queries.

Possible Problems:

- None.

Test MLD.4.19: Excluding – Receives Block

Purpose: To verify that an MLDv2 router properly processes BLOCK while in Is Excluding.

References:

- [MLD] – 5.2.12. Multicast Address Record Types

  Value Name and Meaning
  -----   ----------------
  6   BLOCK_OLD_SOURCES - indicates that the Source Address [i]
                    fields in this Multicast Address Record contain a list of
                    the sources that the node no longer wishes to listen to,
                    for packets sent to the specified multicast address. If the
                  change was to an INCLUDE source list, these are the
                  addresses that were deleted from the list; if the change
                  was to an EXCLUDE source list, these are the addresses that
                  were added to the list.

  If a change of source list results in both allowing new sources and blocking old sources, then two Multicast Address Records are sent for the same multicast address, one of type ALLOW_NEW_SOURCES and one of type BLOCK_OLD_SOURCES.

- [MLD] – 7.4.2. Reception of Filter Mode Change and Source List Change Records

  Router State   Report Received New Router State   Actions
  ------------   --------------- ----------------   -------
  EXCLUDE (X,Y) ALLOW (A)   EXCLUDE (X+A,Y-A) (A)=MALI

  EXCLUDE (X,Y) BLOCK (A)   EXCLUDE (X+(A-Y),Y) (A-X-Y) = Filter Timer
                                                          Send Q(MA,A-Y)

- [MLD] – 7.6.1. Timer Updates

  Query   Action
  -----   ------
  Q(MA,A)   Source Timers for sources in A are lowered to LLQT

- [MLD] – 7.6.3.2. Building and Sending Multicast Address and Source Specific

  o Lower source timer to LLQT;
  o Add the sources to the Retransmission List;
  o Set the Source Retransmission Counter for each source to [Last Listener Query Count].

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A	Report B

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_EX ()	MLDv2 Report Multicast Address Record: M1, BLOCK ()

Report C	Report D
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, BLOCK (S1)	MLDv2 Report Multicast Address Record: M1, BLOCK () and ALLOW (S1)

Report E	Report F
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_EX (S3, S4)	MLDv2 Report Multicast Address Record: M1, IS_IN (S2, S5)

Report G	Report H
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, BLOCK (S1, S2, S3, S4, S5)	MLDv2 Report Multicast Address Record: M1, BLOCK (S1, S2, S3)

Report I	Report J
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report	MLDv2 Report

Multicast Address Record: M1, BLOCK (S1) and ALLOW (S2)	Multicast Address Record: M1, BLOCK (S1, S2)

Report K	Report L
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_EX (S3, S4, S8)	MLDv2 Report Multicast Address Record: M1, IS_EX (S2, S5, S7)

Report M	Report N
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, BLOCK (S1, S2, S3) and ALLOW (S6, S7, S8)	MLDv2 Report Multicast Address Record: M1, BLOCK (S1, S2, S3, S4, S5, S6, S7, S8)

Report O
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN ()

Procedure:

Part A: Excluding nothing, receives Block nothing, Check Requested List
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A.
4. Observe the packets on all networks.
5. TN1 transmits Report B.
6. Observe the packets on all networks.
7. TN1 transmits Report O.
8. Observe the packets on all networks.

Part B: Excluding nothing, receives Block nothing, Check Exclude List
9. Enable MLDv2 on the RUT.

10. Observe the packets on all networks.
11. TN1 transmits Report A.
12. Observe the packets on all networks.
13. TN1 transmits Report B.
14. Observe the packets on all networks.
15. TN1 transmits Report C.
16. Observe the packets on all networks.
17. Wait [LLQI] seconds. TN1 transmits Report O.
18. Observe the packets on all networks.

Part C: Excluding nothing, receives Block nothing and Allow source, Check Requested List
19. Enable MLDv2 on the RUT.
20. Observe the packets on all networks.
21. TN1 transmits Report A.
22. Observe the packets on all networks.
23. TN1 transmits Report D.
24. Observe the packets on all networks.
25. TN1 transmits Report O.
26. Observe the packets on all networks.

Part D: Excluding nothing, receives Block nothing and Allow source, Check Exclude List
27. Enable MLDv2 on the RUT.
28. Observe the packets on all networks.
29. TN1 transmits Report A.
30. Observe the packets on all networks.
31. TN1 transmits Report D.
32. Observe the packets on all networks.
33. TN1 transmits Report C.
34. Observe the packets on all networks.
35. Wait [LLQI] seconds. TN1 transmits Report O.
36. Observe the packets on all networks.

Part E: Excluding source and request different source, receives Block nothing, Check Requested List
37. Enable MLDv2 on the RUT.
38. Observe the packets on all networks.
39. TN1 transmits Report E.
40. Observe the packets on all networks.
41. TN1 transmits Report F.
42. Observe the packets on all networks.
43. TN1 transmits Report B.
44. Observe the packets on all networks.
45. TN1 transmits Report O.
46. Observe the packets on all networks.

Part F: Excluding source and request different source, receives Block nothing, Check Exclude List
47. Enable MLDv2 on the RUT.
48. Observe the packets on all networks.
49. TN1 transmits Report E.
50. Observe the packets on all networks.
51. TN1 transmits Report F.
52. Observe the packets on all networks.
53. TN1 transmits Report B.
54. Observe the packets on all networks.

55. TN1 transmits Report G.
56. Observe the packets on all networks.
57. Wait [LLQI] seconds. TN1 transmits Report O.
58. Observe the packets on all networks.

Part G: Excluding source and request different source, receives Block source, Check Requested List
59. Enable MLDv2 on the RUT.
60. Observe the packets on all networks.
61. TN1 transmits Report E.
62. Observe the packets on all networks.
63. TN1 transmits Report F.
64. Observe the packets on all networks.
65. TN1 transmits Report H.
66. Observe the packets on all networks.
67. Wait [LLQI] seconds. TN1 transmits Report O.
68. Observe the packets on all networks.

Part H: Excluding source and request different source, receives Block source, Check Exclude List
69. Enable MLDv2 on the RUT.
70. Observe the packets on all networks.
71. TN1 transmits Report E.
72. Observe the packets on all networks.
73. TN1 transmits Report F.
74. Observe the packets on all networks.
75. TN1 transmits Report H.
76. Observe the packets on all networks.
77. Wait [LLQI] seconds. TN1 transmits Report G.
78. Observe the packets on all networks.
79. Wait [LLQI] seconds. TN1 transmits Report O.
80. Observe the packets on all networks.

Part I: Excluding nothing, receives Block source and Allow different source, Check Requested List
81. Enable MLDv2 on the RUT.
82. Observe the packets on all networks.
83. TN1 transmits Report A.
84. Observe the packets on all networks.
85. TN1 transmits Report I.
86. Observe the packets on all networks.
87. Wait [LLQI] seconds after Step TN1 transmits Report O.
88. Observe the packets on all networks.

Part J: Excluding nothing, receives Block source and Allow different source, Check Exclude List
89. Enable MLDv2 on the RUT.
90. Observe the packets on all networks.
91. TN1 transmits Report A.
92. Observe the packets on all networks.
93. TN1 transmits Report I.
94. Observe the packets on all networks.
95. Wait [LLQI] seconds. TN1 transmits Report J.
96. Observe the packets on all networks.
97. Wait [LLQI] seconds. TN1 transmits Report O.
98. Observe the packets on all networks.

Part K: Excluding source and request different source, receives Block source and Allow different source, Check Requested List

99. Enable MLDv2 on the RUT.
100. Observe the packets on all networks.
101. TN1 transmits Report K.
102. Observe the packets on all networks.
103. TN1 transmits Report L.
104. Observe the packets on all networks.
105. TN1 transmits Report M.
106. Observe the packets on all networks.
107. Wait [LLQI] seconds. TN1 transmits Report O.
108. Observe the packets on all networks.

Part L: Excluding source and request different source, receives Block source and Allow different source, Check Exclude List

109. Enable MLDv2 on the RUT.
110. Observe the packets on all networks.
111. TN1 transmits Report K.
112. Observe the packets on all networks.
113. TN1 transmits Report L.
114. Observe the packets on all networks.
115. TN1 transmits Report M.
116. Observe the packets on all networks.
117. Wait [LLQI] seconds. TN1 transmits Report N.
118. Observe the packets on all networks.
119. Wait [LLQI] seconds. TN1 transmits Report O.
120. Observe the packets on all networks.

Observable Results:

- *Part A*
  Step 2: The RUT must transmit 2 MLDv2 General Queries.
  Step 4: The RUT must not transmit Queries other then periodic General Queries.
  Step 6: The RUT must not transmit Queries other then periodic General Queries
  Step 8: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part B*
  Step 10: The RUT must transmit 2 MLDv2 General Queries.
  Step 12: The RUT must not transmit Queries other then periodic General Queries.
  Step 14: The RUT must not transmit Queries other then periodic General Queries.
  Step 16: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1.
  Step 18: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part C*
  Step 20: The RUT must transmit 2 MLDv2 General Queries.
  Step 22: The RUT must not transmit Queries other then periodic General Queries.
  Step 24: The RUT must not transmit Queries other then periodic General Queries.
  Step 26: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1. The RUT must transmit 2 Multicast

Address Specific Query with a Multicast Address of M1.

- *Part D*
  - **Step 28:** The RUT must transmit 2 MLDv2 General Queries.
  - **Step 30:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 32:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 34:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
  - **Step 36:** The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part E*
  - **Step 38:** The RUT must transmit 2 MLDv2 General Queries.
  - **Step 40:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 42:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 44:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 46:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S2 and S5. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part F*
  - **Step 48:** The RUT must transmit 2 MLDv2 General Queries.
  - **Step 50:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 52:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 54:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 56:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S2 and S5.
  - **Step 58:** The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part G*
  - **Step 60:** The RUT must transmit 2 MLDv2 General Queries.
  - **Step 62:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 64:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 66:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2.
  - **Step 68:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S5. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part H*
  - **Step 70:** The RUT must transmit 2 MLDv2 General Queries.
  - **Step 72:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 74:** The RUT must not transmit Queries other then periodic General Queries
  - **Step 76:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2.
  - **Step 78:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S5.
  - **Step 80:** The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part I*
  - **Step 82:** The RUT must transmit 2 MLDv2 General Queries.
  - **Step 84:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 86:** The RUT must transmit 2 Multicast Address and Source Specific Query with a

Multicast Address of M1 and Source Addresses of S1.

Step 88: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S2. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

- *Part J*

  Step 90: The RUT must transmit 2 MLDv2 General Queries.

  Step 92: The RUT must not transmit Queries other then periodic General Queries.

  Step 94: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1.

  Step 96: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S2.

  Step 98: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

- *Part K*

  Step 100: The RUT must transmit 2 MLDv2 General Queries.

  Step 102: The RUT must not transmit Queries other then periodic General Queries.

  Step 104: The RUT must not transmit Queries other then periodic General Queries.

  Step 106: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S2, and S3.

  Step 108: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S5, S6, S7 and S8. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

- *Part L*

  Step 110: The RUT must transmit 2 MLDv2 General Queries.

  Step 112: The RUT must not transmit Queries other then periodic General Queries.

  Step 114: The RUT must not transmit Queries other then periodic General Queries.

  Step 116: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S2, and S3.

  Step 118: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S4, S5, S6, S7 and S8.

  Step 120: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

Possible Problems:

- None.

Test MLD.4.20: Excluding – Receives Block and Updates Timer

Purpose: To verify that an MLDv2 router properly processes Block while in Is Excluding and updates timer.

References:

- [MLD] – 7.4.2. Reception of Filter Mode Change and Source List Change Records

Router State	Report Received	New Router State	Actions
EXCLUDE (X,Y)	BLOCK (A)	EXCLUDE (X+(A-Y),Y)	(A-X-Y) = Filter Timer Send Q(MA,A-Y)

- [MLD] – 7.5. Switching Router Filter Modes

  A router uses the sources from the Requested List as its state for the switch to a filter mode of INCLUDE. Sources from the Requested List are moved in the Include List, while sources from the Exclude List are deleted. For example, if a router's state for a multicast address is EXCLUDE(X,Y) and the Filter Timer expires for that multicast address, the router switches to filter mode of INCLUDE with state INCLUDE(X). If at the moment of the switch the Requested List (X) is empty, the multicast address record is deleted from the router.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A	Report B
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_EX (S3,S4)	MLDv2 Report Multicast Address Record: M1, IS_IN (S2, S5)

Report C	Report D
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, BLOCK (S1, S2, S3)	MLDv2 Report Multicast Address Record: M1, BLOCK (S1, S2, S3, S4, S5)

Report E

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN ()

Procedure:

Part A: Before filter timer expires, Check Requested List
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A.
4. Observe the packets on all networks.
5. Wait [QI/2] seconds after step 3. TN1 transmits Report B.
6. Observe the packets on all networks.
7. Wait [QI] seconds after Step 3. TN1 transmits Report C.
8. Observe the packets on all networks.
9. Wait [MALI – LLQT - ∝] seconds after Step 3. TN1 transmits Report E.
10. Observe the packets on all networks.

Part B: Before filter timer expires, Check Exclude List
11. Enable MLDv2 on the RUT.
12. Observe the packets on all networks.
13. TN1 transmits Report A.
14. Observe the packets on all networks.
15. Wait [QI/2] seconds after step 13. TN1 transmits Report B.
16. Observe the packets on all networks.
17. Wait [QI] seconds after Step 13. TN1 transmits Report C.
18. Observe the packets on all networks.
19. Wait [MALI – LLQT - ∝] seconds after Step 13. TN1 transmits Report D.
20. Observe the packets on all networks.
21. Wait [LLQI] seconds. TN1 transmits Report E.
22. Observe the packets on all networks.

Part C: After filter timer expires, Check Include List
23. Enable MLDv2 on the RUT.
24. Observe the packets on all networks.
25. TN1 transmits Report A.
26. Observe the packets on all networks.
27. Wait [QI/2] seconds after step 25. TN1 transmits Report B.
28. Observe the packets on all networks.
29. Wait [QI] seconds after Step 25. TN1 transmits Report C.
30. Observe the packets on all networks.
31. Wait [MALI] seconds after Step 25. TN1 transmits Report E.
32. Observe the packets on all networks.

Part D: Before second timer expire, Check Include List
33. Enable MLDv2 on the RUT.
34. Observe the packets on all networks.

---

35. TN1 transmits Report A.
36. Observe the packets on all networks.
37. Wait [QI/2] seconds after step 35. TN1 transmits Report B.
38. Observe the packets on all networks.
39. Wait [QI] seconds after Step 35. TN1 transmits Report C.
40. Observe the packets on all networks.
41. Wait [MALI – LLQT - ∝] seconds after Step 37. TN1 transmits Report E.
42. Observe the packets on all networks.

Part E: After expiring second source timer, Check Include List
43. Enable MLDv2 on the RUT.
44. Observe the packets on all networks.
45. TN1 transmits Report A.
46. Observe the packets on all networks.
47. Wait [QI/2] seconds after step 45. TN1 transmits Report B.
48. Observe the packets on all networks.
49. Wait [QI] seconds after Step 45. TN1 transmits Report C.
50. Observe the packets on all networks.
51. Wait [MALI] seconds after Step 47. TN1 transmits Report E.
52. Observe the packets on all networks.

Observable Results:

- *Part A*
  - **Step 2:** The RUT must transmit 2 MLDv2 General Queries.
  - **Step 4:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 6:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 8:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2.
  - **Step 10:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S5. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part B*
  - **Step 12:** The RUT must transmit 2 MLDv2 General Queries.
  - **Step 14:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 16:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 18:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2.
  - **Step 20:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S5.
  - **Step 22:** The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part C*
  - **Step 24:** The RUT must transmit 2 MLDv2 General Queries.
  - **Step 26:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 28:** The RUT must not transmit Queries other then periodic General Queries.
  - **Step 30:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2.
  - **Step 32:** The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S5.

- *Part D*
  Step 34: The RUT must transmit 2 MLDv2 General Queries.
  Step 36: The RUT must not transmit Queries other then periodic General Queries.
  Step 38: The RUT must not transmit Queries other then periodic General Queries.
  Step 40: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2.
  Step 42: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S5.
- *Part E*
  Step 44: The RUT must transmit 2 MLDv2 General Queries.
  Step 46: The RUT must not transmit Queries other then periodic General Queries.
  Step 48: The RUT must not transmit Queries other then periodic General Queries.
  Step 50: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2.
  Step 52: The RUT must not transmit Queries other then periodic General Queries.

Possible Problems:

- None.

Test MLD.4.21: Excluding – Receives To Exclude

Purpose: To verify that an MLDv2 router properly processes TO_EX while in Is Excluding.

References:

- [MLD] – 7.4.2. Reception of Filter Mode Change and Source List Change Records

Router State	Report Received	New Router State	Actions
------------	---------------	----------------	-------
EXCLUDE (X,Y)	TO_EX (A)	EXCLUDE (A-Y,Y*A)	(A-X-Y) = Filter Timer
			Delete (X-A)
			Delete (Y-A)
			Send Q(MA,A-Y)
			Filter Timer=MALI

- [MLD] – 7.6.1. Timer Updates

Query	Action
-----	------
Q(MA,A)	Source Timers for sources in A are lowered to LLQT

- [MLD] – 7.6.3.2. Building and Sending Multicast Address and Source Specific

  - o Lower source timer to LLQT;
  - o Add the sources to the Retransmission List;
  - o Set the Source Retransmission Counter for each source to [Last Listener Query Count].

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A
IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record:
M1, IS_EX ()

Report B
IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record:
M1, TO_EX ()

Report C
IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert

Report D
IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert

MLDv2 Report
Multicast Address Record:
M1, BLOCK (S1)

MLDv2 Report
Multicast Address Record:
M1, TO_EX (S1)

Report E

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record:
M1, IS_EX (S4)

Report F

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record:
M1, IS_IN (S5)

Report G

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record:
M1, BLOCK (S4, S5)

Report H

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record:
M1, IS_EX (S3, S4)

Report I

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record:
M1, IS_IN (S2, S5)

Report J

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record:
M1, TO_EX (S1, S2, S3)

Report K

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record:
M1, BLOCK (S1, S2, S3, S4, S5)

Report L

IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record:
M1, TO_IN ()

Procedure:

Part A: Excluding nothing, receives To Exclude nothing, Check Requested List
1. Enable MLDv2 on the RUT.

2. Observe the packets on all networks.
3. TN1 transmits Report A.
4. Observe the packets on all networks.
5. TN1 transmits Report B.
6. Observe the packets on all networks.
7. TN1 transmits Report L.
8. Observe the packets on all networks.

Part B: Excluding nothing, receives To Exclude nothing, Check Exclude List
9. Enable MLDv2 on the RUT.
10. Observe the packets on all networks.
11. TN1 transmits Report A.
12. Observe the packets on all networks.
13. TN1 transmits Report B.
14. Observe the packets on all networks.
15. TN1 transmits Report C.
16. Observe the packets on all networks.
17. Wait [LLQI] seconds. TN1 transmits Report L.
18. Observe the packets on all networks.

Part C: Excluding nothing, receives To Exclude source, Check Requested List
19. Enable MLDv2 on the RUT.
20. Observe the packets on all networks.
21. TN1 transmits Report A.
22. Observe the packets on all networks.
23. TN1 transmits Report D.
24. Observe the packets on all networks.
25. Wait [LLQT] seconds. TN1 transmits Report L.
26. Observe the packets on all networks.

Part D: Excluding nothing, receives To Exclude source, Check Exclude List
27. Enable MLDv2 on the RUT.
28. Observe the packets on all networks.
29. TN1 transmits Report A.
30. Observe the packets on all networks.
31. TN1 transmits Report D.
32. Observe the packets on all networks.
33. Wait [LLQI] seconds. TN1 transmits Report C.
34. Observe the packets on all networks.
35. TN1 transmits Report L.
36. Observe the packets on all networks.

Part E: Excluding source and request different source, receives To Exclude nothing, Check Requested List
37. Enable MLDv2 on the RUT.
38. Observe the packets on all networks.
39. TN1 transmits Report E.
40. Observe the packets on all networks.
41. TN1 transmits Report F.
42. Observe the packets on all networks.
43. TN1 transmits Report B.
44. Observe the packets on all networks.
45. TN1 transmits Report L.

46. Observe the packets on all networks.

Part F: Excluding source and request different source, receives To Exclude nothing, Check Exclude List

47. Enable MLDv2 on the RUT.
48. Observe the packets on all networks.
49. TN1 transmits Report E.
50. Observe the packets on all networks.
51. TN1 transmits Report F.
52. Observe the packets on all networks.
53. TN1 transmits Report B.
54. Observe the packets on all networks.
55. TN1 transmits Report G.
56. Observe the packets on all networks.
57. Wait [LLQI] seconds. TN1 transmits Report L.
58. Observe the packets on all networks.

Part G: Excluding source and request different source, receives To Exclude source, Check Requested List

59. Enable MLDv2 on the RUT.
60. Observe the packets on all networks.
61. TN1 transmits Report H.
62. Observe the packets on all networks.
63. TN1 transmits Report I.
64. Observe the packets on all networks.
65. TN1 transmits Report J.
66. Observe the packets on all networks.
67. Wait [LLQI] seconds. TN1 transmits Report L.
68. Observe the packets on all networks.

Part H: Excluding source and request different source, receives To Exclude source, Check Exclude List

69. Enable MLDv2 on the RUT.
70. Observe the packets on all networks.
71. TN1 transmits Report H.
72. Observe the packets on all networks.
73. TN1 transmits Report I.
74. Observe the packets on all networks.
75. TN1 transmits Report J.
76. Observe the packets on all networks.
77. Wait [LLQI] seconds. TN1 transmits Report K.
78. Observe the packets on all networks.
79. Wait [LLQI] seconds. TN1 transmits Report L.
80. Observe the packets on all networks.

Observable Results:

- *Part A*
  Step 2: The RUT must transmit 2 MLDv2 General Queries.
  Step 4: The RUT must not transmit Queries other then periodic General Queries.
  Step 6: The RUT must not transmit Queries other then periodic General Queries
  Step 8: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
- *Part B*
  Step 10: The RUT must transmit 2 MLDv2 General Queries.

Step 12: The RUT must not transmit Queries other then periodic General Queries.
Step 14: The RUT must not transmit Queries other then periodic General Queries.
Step 16: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
Step 18: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

- *Part C*
  Step 20: The RUT must transmit 2 MLDv2 General Queries.
  Step 22: The RUT must not transmit Queries other then periodic General Queries.
  Step 24: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
  Step 26: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

- *Part D*
  Step 28: The RUT must transmit 2 MLDv2 General Queries.
  Step 30: The RUT must not transmit Queries other then periodic General Queries.
  Step 32: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
  Step 34: The RUT must not transmit Queries other then periodic General Queries.
  Step 36: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

- *Part E*
  Step 38: The RUT must transmit 2 MLDv2 General Queries.
  Step 40: The RUT must not transmit Queries other then periodic General Queries.
  Step 42: The RUT must not transmit Queries other then periodic General Queries.
  Step 44: The RUT must not transmit Queries other then periodic General Queries.
  Step 46: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

- *Part F*
  Step 48: The RUT must transmit 2 MLDv2 General Queries.
  Step 50: The RUT must not transmit Queries other then periodic General Queries.
  Step 52: The RUT must not transmit Queries other then periodic General Queries.
  Step 54: The RUT must not transmit Queries other then periodic General Queries.
  Step 56: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S4 and S5.
  Step 58: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

- *Part G*
  Step 60: The RUT must transmit 2 MLDv2 General Queries.
  Step 62: The RUT must not transmit Queries other then periodic General Queries.
  Step 64: The RUT must not transmit Queries other then periodic General Queries.
  Step 66: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2.
  Step 68: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

- *Part H*
  Step 70: The RUT must transmit 2 MLDv2 General Queries.
  Step 72: The RUT must not transmit Queries other then periodic General Queries.
  Step 74: The RUT must not transmit Queries other then periodic General Queries

Step 76: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2.
Step 78: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S4 and S5.
Step 80: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

Possible Problems:

- None.

Test MLD.4.22: Excluding – Receives To Exclude and Updates Timer

Purpose: To verify that an MLDv2 router properly processes To Exclude while in Is Excluding and updates timer.

References:

- [MLD] – 7.4.2. Reception of Filter Mode Change and Source List Change Records

Router State	Report Received	New Router State	Actions
------------	---------------	----------------	-------
EXCLUDE (X,Y)	TO_EX (A)	EXCLUDE (A-Y,Y*A)	(A-X-Y) = Filter Timer
			Delete (X-A)
			Delete (Y-A)
			Send Q(MA,A-Y)
			Filter Timer=MALI

- [MLD] – 7.5. Switching Router Filter Modes

    If at the moment of the switch the Requested List (X) is empty, the multicast address record is deleted from the router.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_EX (S3,S4)

Report B
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S2, S5)

Report C
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_EX (S1, S2, S3)

Report D
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, BLOCK (S1, S2, S3, S4, S5)

Report E
IPv6 Header

Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record: M1, TO_IN ()

Procedure:

Part A: Before filter timer expires, Check Requested List
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A.
4. Observe the packets on all networks.
5. Wait [QI/2] seconds after step 3. TN1 transmits Report B.
6. Observe the packets on all networks.
7. Wait [QI] seconds after Step 3. TN1 transmits Report C.
8. Observe the packets on all networks.
9. Wait [MALI – LLQT - ∝] seconds after Step 7. TN1 transmits Report E.
10. Observe the packets on all networks.

Part B: Before filter timer expires, Check Exclude List
11. Enable MLDv2 on the RUT.
12. Observe the packets on all networks.
13. TN1 transmits Report A.
14. Observe the packets on all networks.
15. Wait [QI/2] seconds after step 13. TN1 transmits Report B.
16. Observe the packets on all networks.
17. Wait [QI] seconds after Step 13. TN1 transmits Report C.
18. Observe the packets on all networks.
19. Wait [MALI – LLQT - ∝] seconds after Step 17. TN1 transmits Report D.
20. Observe the packets on all networks.
21. Wait [LLQI] seconds. TN1 transmits Report E.
22. Observe the packets on all networks.

Part C: After filter timer expires, Check Include List
23. Enable MLDv2 on the RUT.
24. Observe the packets on all networks.
25. TN1 transmits Report A.
26. Observe the packets on all networks.
27. Wait [QI/2] seconds after step 25. TN1 transmits Report B.
28. Observe the packets on all networks.
29. Wait [QI] seconds after Step 25. TN1 transmits Report C.
30. Observe the packets on all networks.
31. Wait [MALI] seconds after Step 29. TN1 transmits Report E.
32. Observe the packets on all networks.

Observable Results:

- *Part A*

Step 2: The RUT must transmit 2 MLDv2 General Queries.
Step 4: The RUT must not transmit Queries other then periodic General Queries.
Step 6: The RUT must not transmit Queries other then periodic General Queries.
Step 8: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2.
Step 10: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

- *Part B*
  Step 12: The RUT must transmit 2 MLDv2 General Queries.
  Step 14: The RUT must not transmit Queries other then periodic General Queries.
  Step 16: The RUT must not transmit Queries other then periodic General Queries.
  Step 18: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2.
  Step 20: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S4 and S5.
  Step 22: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

- *Part C*
  Step 24: The RUT must transmit 2 MLDv2 General Queries.
  Step 26: The RUT must not transmit Queries other then periodic General Queries.
  Step 28: The RUT must not transmit Queries other then periodic General Queries.
  Step 30: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2.
  Step 32: The RUT must not transmit Queries other then periodic General Queries.

Possible Problems:

- None.

Test MLD.4.23: Excluding – Receives To Include

Purpose: To verify that an MLDv2 router properly processes TO_IN while in Is Excluding.

References:

- [MLD] – 7.4.2. Reception of Filter Mode Change and Source List Change Records

Router State	Report Received	New Router State	Actions
------------	---------------	----------------	-------
EXCLUDE (X,Y)	TO_IN (A)	EXCLUDE (X+A,Y-A)	(A)=MALI Send Q(MA,X-A) Send Q(MA)

- [MLD] – 7.6.1. Timer Updates

Query	Action
-----	------
Q(MA,A)	Source Timers for sources in A are lowered to LLQT
(MA)	Filter Timer is lowered to LLQT

- [MLD] – 7.6.3.1. Building and Sending Multicast Address Specific Queries

  When a table action "Send Q(MA)" is encountered, the Filter Timer must be lowered to LLQT. The Querier must then immediately send a Multicast Address Specific query as well as schedule [Last Listener Query Count - 1] query retransmissions to be sent every [Last Listener Query Interval], over [Last Listener Query Time].

- [MLD] – 7.6.3.2. Building and Sending Multicast Address and Source Specific

  o Lower source timer to LLQT;
  o Add the sources to the Retransmission List;
  o Set the Source Retransmission Counter for each source to [Last Listener Query Count].

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A	Report B
IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_EX ()	MLDv2 Report Multicast Address Record: M1, TO_IN ()

Report C	Report D
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN (S1)	MLDv2 Report Multicast Address Record: M1, IS_EX (S5)

Report E	Report F
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S4)	MLDv2 Report Multicast Address Record: M1, IS_EX (S3, S4)

Report G	Report H
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S2, S5)	MLDv2 Report Multicast Address Record: M1, TO_IN (S1, S2, S3)

Procedure:

Part A: Excluding nothing, receives To Include nothing, Check Include List
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A.
4. Observe the packets on all networks.
5. TN1 transmits Report B.
6. Observe the packets on all networks.
7. Wait [LLQI] seconds. TN1 transmits Report B.
8. Observe the packets on all networks.

Part B: Excluding nothing, receives To Include source, Check Include List
9. Enable MLDv2 on the RUT.
10. Observe the packets on all networks.
11. TN1 transmits Report A.
12. Observe the packets on all networks.
13. TN1 transmits Report C.
14. Observe the packets on all networks.

15. Wait [LLQI] seconds after Step 13. TN1 transmits Report B.
16. Observe the packets on all networks.

Part C: Excluding source and request different source, receives To Include nothing, Check Requested List

17. Enable MLDv2 on the RUT.
18. Observe the packets on all networks.
19. TN1 transmits Report D.
20. Observe the packets on all networks.
21. TN1 transmits Report E.
22. Observe the packets on all networks.
23. TN1 transmits Report B.
24. Observe the packets on all networks.
25. Wait [LLQI] seconds. TN1 transmits Report B.
26. Observe the packets on all networks.

Part D: Excluding source and request different source, receives To Exclude source, Check Requested List

27. Enable MLDv2 on the RUT.
28. Observe the packets on all networks.
29. TN1 transmits Report F.
30. Observe the packets on all networks.
31. TN1 transmits Report G.
32. Observe the packets on all networks.
33. TN1 transmits Report H.
34. Observe the packets on all networks.
35. Wait [LLQI] seconds. TN1 transmits Report B.
36. Observe the packets on all networks.

Observable Results:

- *Part A*
    Step 2: The RUT must transmit 2 MLDv2 General Queries.
    Step 4: The RUT must not transmit Queries other then periodic General Queries.
    Step 6: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
    Step 8: The RUT must not transmit Queries other then periodic General Queries.
- *Part B*
    Step 10: The RUT must transmit 2 MLDv2 General Queries.
    Step 12: The RUT must not transmit Queries other then periodic General Queries.
    Step 14: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
    Step 16: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
- *Part C*
    Step 18: The RUT must transmit 2 MLDv2 General Queries.
    Step 20: The RUT must not transmit Queries other then periodic General Queries.
    Step 22: The RUT must not transmit Queries other then periodic General Queries.
    Step 24: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S4. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
    Step 26: The RUT must not transmit Queries other then periodic General Queries.
- *Part D*

Step 28: The RUT must transmit 2 MLDv2 General Queries.
Step 30: The RUT must not transmit Queries other then periodic General Queries.
Step 32: The RUT must not transmit Queries other then periodic General Queries.
Step 34: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Address of S5. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
Step 36: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S2 and S3.

Possible Problems:

- None.

Test MLD.4.24: Excluding – Receives To Include and Updates Timer

Purpose: To verify that an MLDv2 router properly processes To Include while in Is Excluding and updates timer.

References:

- [MLD] – 7.4.2. Reception of Filter Mode Change and Source List Change Records

Router State	Report Received	New Router State	Actions
------------	---------------	----------------	-------
EXCLUDE (X,Y)	TO_IN (A)	EXCLUDE (X+A,Y-A)	(A)=MALI Send Q(MA,X-A) Send Q(MA)

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A	Report B
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_EX (S3,S4)	MLDv2 Report Multicast Address Record: M1, IS_IN (S2, S5)

Report C	Report D
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN (S1, S2, S3)	MLDv2 Report Multicast Address Record: M1, TO_IN ()

Procedure:

Part A: Before second source timer expires, Check Include List
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A.
4. Observe the packets on all networks.
5. Wait [QI/2] seconds after step 3. TN1 transmits Report B.
6. Observe the packets on all networks.

---

7. Wait [QI] seconds after Step 3. TN1 transmits Report C.
8. Observe the packets on all networks.
9. Wait [MALI – LLQT - ∝] seconds after Step 7. TN1 transmits Report D.
10. Observe the packets on all networks.
Part B: Before filter timer expires, Check Include List
11. Enable MLDv2 on the RUT.
12. Observe the packets on all networks.
13. TN1 transmits Report A.
14. Observe the packets on all networks.
15. Wait [QI/2] seconds after step 13. TN1 transmits Report B.
16. Observe the packets on all networks.
17. Wait [QI] seconds after Step 13. TN1 transmits Report C.
18. Observe the packets on all networks.
19. Wait [MALI] seconds after Step 17. TN1 transmits Report D.
20. Observe the packets on all networks.

Observable Results:

- *Part A*
    Step 2: The RUT must transmit 2 MLDv2 General Queries.
    Step 4: The RUT must not transmit Queries other then periodic General Queries.
    Step 6: The RUT must not transmit Queries other then periodic General Queries.
    Step 8: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S5. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
    Step 10: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S2, and S3.
- *Part B*
    Step 12: The RUT must transmit 2 MLDv2 General Queries.
    Step 14: The RUT must not transmit Queries other then periodic General Queries.
    Step 16: The RUT must not transmit Queries other then periodic General Queries.
    Step 18: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S5. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.
    Step 20: The RUT must not transmit Queries other then periodic General Queries.

Possible Problems:

- None.

Test MLD.4.25: Receive Current State Record After Receiving State Change Record

Purpose: To verify that an MLDv2 router properly process current state records after a state change record.

References:

- [MLD] – 2.2. Exchanging Messages between the Querier and the Listening Nodes

  Nevertheless, while waiting for the next scheduled queries to be sent, the Querier may receive a report that updates the timers. The scheduled queries still have to be sent, in order to ensure that a non-querier router keeps its state synchronized with the current Querier (the non-querier router might have missed the first query). Nevertheless, the timers should not be lowered again, as a valid answer was already received. Therefore, in subsequent queries the Querier sets the S flag.

- [MLD] – 7.6.1. Timer Updates

  When a router sends or receives a query with the Suppress Router-Side Processing flag set, it will not update its timers.

- [MLD] – 7.6.3.1. Building and Sending Multicast Address Specific Queries

  When a table action "Send Q(MA)" is encountered, the Filter Timer must be lowered to LLQT. The Querier must then immediately send a Multicast Address Specific query as well as schedule [Last Listener Query Count - 1] query retransmissions to be sent every [Last Listener Query Interval], over [Last Listener Query Time].

  When transmitting a Multicast Address Specific Query, if the Filter Timer is larger than LLQT, the "Suppress Router-Side Processing" bit is set in the query message.

- [MLD] – 7.6.3.2. Building and Sending Multicast Address and Source Specific

  When building a Multicast Address and Source Specific Query for a multicast address MA, two separate query messages are sent for the multicast address. The first one has the "Suppress Router-Side Processing" bit set and contains all the sources with retransmission state (i.e., sources from the Retransmission List of that multicast address), and timers greater than LLQT. The second has the "Suppress Router-Side Processing" bit clear and contains all the sources with retransmission state and timers lower or equal to LLQT. If either of the two calculated messages does not contain any sources, then its transmission is suppressed.

  Note: If a Multicast Address Specific query is scheduled to be transmitted at the same time as a Multicast Address and Source specific query for the same multicast address, then transmission of the Multicast Address and Source Specific message with the "Suppress Router-Side Processing" bit set may be suppressed.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed

after each test.

Report A	Report B
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S1, S2)	MLDv2 Report Multicast Address Record: M1, BLOCK (S1, S2)

Report C	Report D
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S1, S3)	MLDv2 Report Multicast Address Record: M1, IS_EX (S1, S3)

Report E	Report F
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, TO_EX (S1, S2)	MLDv2 Report Multicast Address Record: M1, TO_IN (S3, S4)

Report G	Report H
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_EX ()	MLDv2 Report Multicast Address Record: M1, TO_IN ()

Procedure:

Part A: Including S1, Sends a Query after Block S2, receives Is Include S3
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A.

4. Observe the packets on all networks.
5. TN1 transmits Report B.
6. Observe the packets on all networks.
7. Before Query is transmitted by the RUT. TN1 transmits Report C.
8. Observe the packets on all networks.
9. Wait [LLQI] seconds. TN1 transmits Report H.
10. Observe the packets on all networks.

Part B: Including S1, Sends a Query after Block S2, receives Is Exclude S3
11. Enable MLDv2 on the RUT.
12. Observe the packets on all networks.
13. TN1 transmits Report A.
14. Observe the packets on all networks.
15. TN1 transmits Report B.
16. Observe the packets on all networks.
17. Before Query is transmitted by the RUT. TN1 transmits Report D.
18. Observe the packets on all networks.
19. Wait [LLQI] seconds. TN1 transmits Report H.
20. Observe the packets on all networks.

Part C: Including S1, Sends a Query after To Exclude S2, receives Is Include S3
21. Enable MLDv2 on the RUT.
22. Observe the packets on all networks.
23. TN1 transmits Report A.
24. Observe the packets on all networks.
25. TN1 transmits Report E.
26. Observe the packets on all networks.
27. Before Query is transmitted by the RUT. TN1 transmits Report C.
28. Observe the packets on all networks.
29. Wait [LLQI] seconds. TN1 transmits Report H.
30. Observe the packets on all networks.

Part D: Including S1, Sends a Query after To Exclude S2, receives Is Exclude S3
31. Enable MLDv2 on the RUT.
32. Observe the packets on all networks.
33. TN1 transmits Report A.
34. Observe the packets on all networks.
35. TN1 transmits Report E.
36. Observe the packets on all networks.
37. Before Query is transmitted by the RUT. TN1 transmits Report D.
38. Observe the packets on all networks.
39. Wait [LLQI] seconds. TN1 transmits Report H.
40. Observe the packets on all networks.

Part E: Including S1, Sends a Query after To Include S2, receives Is Include S3
41. Enable MLDv2 on the RUT.
42. Observe the packets on all networks.
43. TN1 transmits Report A.
44. Observe the packets on all networks.
45. TN1 transmits Report H.
46. Observe the packets on all networks.
47. Before Query is transmitted by the RUT. TN1 transmits Report C.
48. Observe the packets on all networks.

49. Wait [LLQI] seconds. TN1 transmits Report H.
50. Observe the packets on all networks.

Part F: Including S1, Sends a Query after To Include S2, receives Is Exclude S3
51. Enable MLDv2 on the RUT.
52. Observe the packets on all networks.
53. TN1 transmits Report A.
54. Observe the packets on all networks.
55. TN1 transmits Report F.
56. Observe the packets on all networks.
57. Before Query is transmitted by the RUT. TN1 transmits Report D.
58. Observe the packets on all networks.
59. Wait [LLQI] seconds. TN1 transmits Report H.
60. Observe the packets on all networks.

Part G: Excluding nothing, Sends a Query after Block S2, receives Is Include S3
61. Enable MLDv2 on the RUT.
62. Observe the packets on all networks.
63. TN1 transmits Report G.
64. Observe the packets on all networks.
65. TN1 transmits Report B.
66. Observe the packets on all networks.
67. Before Query is transmitted by the RUT. TN1 transmits Report C.
68. Observe the packets on all networks.
69. Wait [LLQI] seconds. TN1 transmits Report H.
70. Observe the packets on all networks.

Part H: Excluding nothing, Sends a Query after Block S2, receives Is Exclude S3
71. Enable MLDv2 on the RUT.
72. Observe the packets on all networks.
73. TN1 transmits Report G.
74. Observe the packets on all networks.
75. TN1 transmits Report B.
76. Observe the packets on all networks.
77. Before Query is transmitted by the RUT. TN1 transmits Report D.
78. Observe the packets on all networks.
79. Wait [LLQI] seconds. TN1 transmits Report H.
80. Observe the packets on all networks.

Part I: Excluding nothing, Sends a Query after To Exclude S2, receives Is Include S3
81. Enable MLDv2 on the RUT.
82. Observe the packets on all networks.
83. TN1 transmits Report G.
84. Observe the packets on all networks.
85. TN1 transmits Report E.
86. Observe the packets on all networks.
87. Before Query is transmitted by the RUT. TN1 transmits Report C.
88. Observe the packets on all networks.
89. Wait [LLQI] seconds. TN1 transmits Report H.
90. Observe the packets on all networks.

Part J: Excluding nothing, Sends a Query after Is Exclude S2, receives Is Exclude S3
91. Enable MLDv2 on the RUT.
92. Observe the packets on all networks.

93. TN1 transmits Report G.
94. Observe the packets on all networks.
95. TN1 transmits Report E.
96. Observe the packets on all networks.
97. Before Query is transmitted by the RUT. TN1 transmits Report D.
98. Observe the packets on all networks.
99. Wait [LLQI] seconds. TN1 transmits Report H.
100. Observe the packets on all networks.

Part K: Excluding nothing with Requested S4, Sends a Query after To Include S2, receives Is Include S3
101. Enable MLDv2 on the RUT.
102. Observe the packets on all networks.
103. TN1 transmits Report G.
104. Observe the packets on all networks.
105. TN1 transmits Report A.
106. Observe the packets on all networks.
107. TN1 transmits Report H.
108. Observe the packets on all networks.
109. Before Query is transmitted by the RUT. TN1 transmits Report C.
110. Observe the packets on all networks.
111. Wait [LLQI] seconds. TN1 transmits Report H.
112. Observe the packets on all networks.

Part L: Excluding nothing with Requested S4, Sends a Query after To Include S2, receives Is Exclude S3
113. Enable MLDv2 on the RUT.
114. Observe the packets on all networks.
115. TN1 transmits Report G.
116. Observe the packets on all networks.
117. TN1 transmits Report A.
118. Observe the packets on all networks.
119. TN1 transmits Report H.
120. Observe the packets on all networks.
121. Before Query is transmitted by the RUT. TN1 transmits Report D.
122. Observe the packets on all networks.
123. Wait [LLQI] seconds after Step 119. TN1 transmits Report H.
124. Observe the packets on all networks.

Observable Results:

- *Part A*
    Step 2: The RUT must transmit 2 MLDv2 General Queries.
    Step 4: The RUT must not transmit Queries other then periodic General Queries.
    Step 6: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear.
    Step 8: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1 with the S Flag set. The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S2 with the S Flag clear.
    Step 10: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S3 with the S Flag clear.
- *Part B*

Step 12: The RUT must transmit 2 MLDv2 General Queries.

Step 14: The RUT must not transmit Queries other then periodic General Queries.

Step 16: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear.

Step 18: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1 with the S Flag clear. The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S2 with the S Flag set.

Step 20: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear.

- *Part C*

  Step 22: The RUT must transmit 2 MLDv2 General Queries.

  Step 24: The RUT must not transmit Queries other then periodic General Queries.

  Step 26: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear.

  Step 28: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1 with the S Flag set. The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Address of S2 with the S Flag clear.

  Step 30: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S3 with the S Flag clear. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear.

- *Part D*

  Step 32: The RUT must transmit 2 MLDv2 General Queries.

  Step 34: The RUT must not transmit Queries other then periodic General Queries.

  Step 36: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear.

  Step 38: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1 with the S Flag clear. The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S2 with the S Flag set.

  Step 40: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S3 with the S Flag clear. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear.

- *Part E*

  Step 42: The RUT must transmit 2 MLDv2 General Queries.

  Step 44: The RUT must not transmit Queries other then periodic General Queries.

  Step 46: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear.

  Step 48: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1 with the S Flag set. The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S2 with the S Flag clear.

  Step 50: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S3 with the S Flag clear.

- *Part F*

  Step 52: The RUT must transmit 2 MLDv2 General Queries.

Step 54: The RUT must not transmit Queries other then periodic General Queries.
Step 56: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear.
Step 58: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1 with the S Flag clear. The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S2 with the S Flag set.
Step 60: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S3 with the S Flag clear. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear.

- *Part G*

    Step 62: The RUT must transmit 2 MLDv2 General Queries.
    Step 64: The RUT must not transmit Queries other then periodic General Queries.
    Step 66: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear.
    Step 68: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1 with the S Flag set. The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S2 with the S Flag clear.
    Step 70: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S3 with the S Flag clear. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear.

- *Part H*

    Step 72: The RUT must transmit 2 MLDv2 General Queries.
    Step 74: The RUT must not transmit Queries other then periodic General Queries.
    Step 76: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear.
    Step 78: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1 with the S Flag clear. The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S2 with the S Flag set.
    Step 80: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S3 with the S Flag clear. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear.

- *Part I*

    Step 82: The RUT must transmit 2 MLDv2 General Queries.
    Step 84: The RUT must not transmit Queries other then periodic General Queries.
    Step 86: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear.
    Step 88: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1 with the S Flag set. The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S2 with the S Flag clear.
    Step 90: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S3 with the S Flag clear. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1

with the S Flag clear.

- *Part J*

     Step 92: The RUT must transmit 2 MLDv2 General Queries.
     Step 94: The RUT must not transmit Queries other then periodic General Queries.
     Step 96: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear.
     Step 98: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Addresses of S1 with the S Flag clear.   The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S2 with the S Flag set.
     Step 100: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Address of S3 with the S Flag clear. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear.

- *Part K*

     Step 102: The RUT must transmit 2 MLDv2 General Queries.
     Step 104: The RUT must not transmit Queries other then periodic General Queries.
     Step 106: The RUT must not transmit Queries other then periodic General Queries.
     Step 108: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear. The RUT must transmit a Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear.
     Step 110: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1 with the S Flag set, however, this may be suppressed. (See [MLD] - 7.6.3.2 Note). The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S2 with the S Flag clear. The RUT must transmit a Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear.
     Step 112: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S3 with the S Flag clear.

- *Part L*

     Step 114: The RUT must transmit 2 MLDv2 General Queries.
     Step 116: The RUT must not transmit Queries other then periodic General Queries.
     Step 118: The RUT must not transmit Queries other then periodic General Queries.
     Step 120: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear. The RUT must transmit a Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear.
     Step 122: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1 with the S Flag clear. The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S2 with the S Flag set, however this may be suppressed. (See [MLD] - 7.6.3.2 Note). The RUT must transmit a Multicast Address Specific Query with a Multicast Address of M1 with the S Flag set.
     Step 124: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S3 with the S Flag clear. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear.

Possible Problems:

- This test has a timing matter. Before implementation retransmits the MLD Query by the 1st MLD Report, you have to make the 2nd MLD Report accepted in implementation. It may be possible by extending Last Listener Query Interval in the implementation

Test MLD.4.26: Receive State Change Record After Receiving State Change Record

Purpose: To verify that an MLDv2 router properly process state change records after a state change record.

References:

- [MLD] – 2.2. Exchanging Messages between the Querier and the Listening Nodes

  Nevertheless, while waiting for the next scheduled queries to be sent, the Querier may receive a report that updates the timers. The scheduled queries still have to be sent, in order to ensure that a non-querier router keeps its state synchronized with the current Querier (the non-querier router might have missed the first query). Nevertheless, the timers should not be lowered again, as a valid answer was already received. Therefore, in subsequent queries the Querier sets the S flag.

- [MLD] – 7.4.2. Reception of Filter Mode Change and Source List Change Records

  If while scheduling new queries, there are already pending queries to be retransmitted for the same multicast address, the new and pending queries have to be merged. In addition, received host reports for a multicast address with pending queries may affect the contents of those queries. Section 7.6.3. describes the process of building and maintaining the state of pending queries.

- [MLD] – 7.6.3.1. Building and Sending Multicast Address Specific Queries

  When a table action "Send Q(MA)" is encountered, the Filter Timer must be lowered to LLQT. The Querier must then immediately send a Multicast Address Specific query as well as schedule [Last Listener Query Count - 1] query retransmissions to be sent every [Last Listener Query Interval], over [Last Listener Query Time].

  When transmitting a Multicast Address Specific Query, if the Filter Timer is larger than LLQT, the "Suppress Router-Side Processing" bit is set in the query message.

- [MLD] – 7.6.3.2. Building and Sending Multicast Address and Source Specific

  When building a Multicast Address and Source Specific Query for a multicast address MA, two separate query messages are sent for the multicast address. The first one has the "Suppress Router-Side Processing" bit set and contains all the sources with retransmission state (i.e., sources from the Retransmission List of that multicast address), and timers greater than LLQT. The second has the "Suppress Router-Side Processing" bit clear and contains all the sources with retransmission state and timers lower or equal to LLQT. If either of the two calculated messages does not contain any sources, then its transmission is suppressed.

  Note: If a Multicast Address Specific query is scheduled to be transmitted at the same time as a Multicast Address and Source specific query for the same multicast address, then transmission of the Multicast Address and Source Specific message with the "Suppress Router-Side Processing" bit set may be suppressed.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A	Report B
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S1, S2)	MLDv2 Report Multicast Address Record: M1, BLOCK (S1, S2)

Report C	Report D
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, ALLOW (S1, S3)	MLDv2 Report Multicast Address Record: M1, IS_IN (S1, S2, S3, S4)

Report E	Report F
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, BLOCK (S2, S3)	MLDv2 Report Multicast Address Record: M1, TO_EX (S1, S3)

Report G	Report H
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN (S1, S3)	MLDv2 Report Multicast Address Record: M1, TO_EX (S1, S2)

Report I	Report J
IPv6 Header Source Address: TN1's Link-local Address	IPv6 Header Source Address: TN1's Link-local Address

Destination Address: FF02::16	Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, BLOCK (S1, S3)	MLDv2 Report Multicast Address Record: M1, TO_IN (S3, S4)

Report K	Report L
IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_EX ()	MLDv2 Report Multicast Address Record: M1, TO_IN ()

Procedure:

Part A: Including S1, Sends a Query after Block S2, receives Allow S3
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A.
4. Observe the packets on all networks.
5. TN1 transmits Report B.
6. Observe the packets on all networks.
7. Before Query is transmitted by the RUT. TN1 transmits Report C.
8. Observe the packets on all networks.
9. Wait [LLQI] seconds. TN1 transmits Report L.
10. Observe the packets on all networks.

Part B: Including S1, Sends a Query after Block S2, receives Block S3
11. Enable MLDv2 on the RUT.
12. Observe the packets on all networks.
13. TN1 transmits Report D.
14. Observe the packets on all networks.
15. TN1 transmits Report B.
16. Observe the packets on all networks.
17. Before Query is transmitted by the RUT. TN1 transmits Report E.
18. Observe the packets on all networks.
19. Wait [LLQI] seconds. TN1 transmits Report L.
20. Observe the packets on all networks.

Part C: Including S1, Sends a Query after Block S2, receives To Exclude S3
21. Enable MLDv2 on the RUT.
22. Observe the packets on all networks.
23. TN1 transmits Report A.
24. Observe the packets on all networks.
25. TN1 transmits Report B.
26. Observe the packets on all networks.
27. Before Query is transmitted by the RUT. TN1 transmits Report F.
28. Observe the packets on all networks.

29. Wait [LLQI] seconds. TN1 transmits Report L.
30. Observe the packets on all networks.
Part D: Including S1, Sends a Query after Block S2, receives To Include S3
31. Enable MLDv2 on the RUT.
32. Observe the packets on all networks.
33. TN1 transmits Report A.
34. Observe the packets on all networks.
35. TN1 transmits Report B.
36. Observe the packets on all networks.
37. Before Query is transmitted by the RUT. TN1 transmits Report G.
38. Observe the packets on all networks.
39. Wait [LLQI] seconds. TN1 transmits Report L.
40. Observe the packets on all networks.
Part E: Including S1, Sends a Query after To Exclude S2, receives Allow S3
41. Enable MLDv2 on the RUT.
42. Observe the packets on all networks.
43. TN1 transmits Report A.
44. Observe the packets on all networks.
45. TN1 transmits Report H.
46. Observe the packets on all networks.
47. Before Query is transmitted by the RUT. TN1 transmits Report C.
48. Observe the packets on all networks.
49. Wait [LLQI] seconds. TN1 transmits Report L.
50. Observe the packets on all networks.
Part F: Including S1, Sends a Query after To Exclude S2, receives Block S3
51. Enable MLDv2 on the RUT.
52. Observe the packets on all networks.
53. TN1 transmits Report A.
54. Observe the packets on all networks.
55. TN1 transmits Report H.
56. Observe the packets on all networks.
57. Before Query is transmitted by the RUT. TN1 transmits Report I.
58. Observe the packets on all networks.
59. Wait [LLQI] seconds. TN1 transmits Report L.
60. Observe the packets on all networks.
Part G: Including S1, Sends a Query after To Exclude S2, receives To Exclude S3
61. Enable MLDv2 on the RUT.
62. Observe the packets on all networks.
63. TN1 transmits Report A.
64. Observe the packets on all networks.
65. TN1 transmits Report H.
66. Observe the packets on all networks.
67. Before Query is transmitted by the RUT. TN1 transmits Report F.
68. Observe the packets on all networks.
69. Wait [LLQI] seconds. TN1 transmits Report L.
70. Observe the packets on all networks.
Part H: Including S1, Sends a Query after To Exclude S2, receives To Include S3
71. Enable MLDv2 on the RUT.
72. Observe the packets on all networks.

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73. TN1 transmits Report A.
74. Observe the packets on all networks.
75. TN1 transmits Report H.
76. Observe the packets on all networks.
77. Before Query is transmitted by the RUT. TN1 transmits Report G.
78. Observe the packets on all networks.
79. Wait [LLQI] seconds. TN1 transmits Report L.
80. Observe the packets on all networks.

Part I: Including S1, Sends a Query after To Include S2, receives Allow S3
81. Enable MLDv2 on the RUT.
82. Observe the packets on all networks.
83. TN1 transmits Report A.
84. Observe the packets on all networks.
85. TN1 transmits Report L.
86. Observe the packets on all networks.
87. Before Query is transmitted by the RUT. TN1 transmits Report C.
88. Observe the packets on all networks.
89. Wait [LLQI] seconds. TN1 transmits Report L.
90. Observe the packets on all networks.

Part J: Including S1, Sends a Query after To Include S2, receives Block S3
91. Enable MLDv2 on the RUT.
92. Observe the packets on all networks.
93. TN1 transmits Report A.
94. Observe the packets on all networks.
95. TN1 transmits Report J.
96. Observe the packets on all networks.
97. Before Query is transmitted by the RUT. TN1 transmits Report I.
98. Observe the packets on all networks.
99. Wait [LLQI] seconds. TN1 transmits Report L.
100. Observe the packets on all networks.

Part K: Including S1, Sends a Query after To Include S2, receives To Exclude S3
101. Enable MLDv2 on the RUT.
102. Observe the packets on all networks.
103. TN1 transmits Report A.
104. Observe the packets on all networks.
105. TN1 transmits Report J.
106. Observe the packets on all networks.
107. Before Query is transmitted by the RUT. TN1 transmits Report F.
108. Observe the packets on all networks.
109. Wait [LLQI] seconds. TN1 transmits Report L.
110. Observe the packets on all networks.

Part L: Including S1, Sends a Query after To Include S2, receives To Include S3
111. Enable MLDv2 on the RUT.
112. Observe the packets on all networks.
113. TN1 transmits Report A.
114. Observe the packets on all networks.
115. TN1 transmits Report J.
116. Observe the packets on all networks.
117. Before Query is transmitted by the RUT. TN1 transmits Report G.

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118. Observe the packets on all networks.
119. Wait [LLQI] seconds. TN1 transmits Report L.
120. Observe the packets on all networks.

Part M: Excluding nothing, Sends a Query after Block S2, receives Allow S3
121. Enable MLDv2 on the RUT.
122. Observe the packets on all networks.
123. TN1 transmits Report K.
124. Observe the packets on all networks.
125. TN1 transmits Report B.
126. Observe the packets on all networks.
127. Before Query is transmitted by the RUT. TN1 transmits Report C.
128. Observe the packets on all networks.
129. Wait [LLQI] seconds. TN1 transmits Report L.
130. Observe the packets on all networks.

Part N: Excluding nothing, Sends a Query after Block S2, receives Block S3
131. Enable MLDv2 on the RUT.
132. Observe the packets on all networks.
133. TN1 transmits Report K.
134. Observe the packets on all networks.
135. TN1 transmits Report B.
136. Observe the packets on all networks.
137. Before Query is transmitted by the RUT. TN1 transmits Report I.
138. Observe the packets on all networks.
139. Wait [LLQI] seconds. TN1 transmits Report L.
140. Observe the packets on all networks.

Part O: Excluding nothing, Sends a Query after Block S2, receives To Exclude S3
141. Enable MLDv2 on the RUT.
142. Observe the packets on all networks.
143. TN1 transmits Report K.
144. Observe the packets on all networks.
145. TN1 transmits Report B.
146. Observe the packets on all networks.
147. Before Query is transmitted by the RUT. TN1 transmits Report F.
148. Observe the packets on all networks.
149. Wait [LLQI] seconds. TN1 transmits Report L.
150. Observe the packets on all networks.

Part P: Excluding nothing, Sends a Query after Block S2, receives To Include S3
151. Enable MLDv2 on the RUT.
152. Observe the packets on all networks.
153. TN1 transmits Report K.
154. Observe the packets on all networks.
155. TN1 transmits Report B.
156. Observe the packets on all networks.
157. Before Query is transmitted by the RUT. TN1 transmits Report G.
158. Observe the packets on all networks.
159. Wait [LLQI] seconds. TN1 transmits Report .
160. Observe the packets on all networks.

Part Q: Excluding nothing, Sends a Query after To Exclude S2, receives Allow S3
161. Enable MLDv2 on the RUT.

162. Observe the packets on all networks.
163. TN1 transmits Report K.
164. Observe the packets on all networks.
165. TN1 transmits Report H.
166. Observe the packets on all networks.
167. Before Query is transmitted by the RUT. TN1 transmits Report C.
168. Observe the packets on all networks.
169. Wait [LLQI] seconds. TN1 transmits Report L.
170. Observe the packets on all networks.

Part R: Excluding nothing, Sends a Query after To Exclude S2, receives Block S3
171. Enable MLDv2 on the RUT.
172. Observe the packets on all networks.
173. TN1 transmits Report K.
174. Observe the packets on all networks.
175. TN1 transmits Report H.
176. Observe the packets on all networks.
177. Before Query is transmitted by the RUT. TN1 transmits Report I.
178. Observe the packets on all networks.
179. Wait [LLQI] seconds. TN1 transmits Report L.
180. Observe the packets on all networks.

Part S: Excluding nothing, Sends a Query after To Exclude S2, receives To Exclude S3
181. Enable MLDv2 on the RUT.
182. Observe the packets on all networks.
183. TN1 transmits Report K.
184. Observe the packets on all networks.
185. TN1 transmits Report H.
186. Observe the packets on all networks.
187. Before Query is transmitted by the RUT. TN1 transmits Report F.
188. Observe the packets on all networks.
189. Wait [LLQI] seconds. TN1 transmits Report L.
190. Observe the packets on all networks.

Part T: Excluding nothing, Sends a Query after To Exclude S2, receives To Include S3
191. Enable MLDv2 on the RUT.
192. Observe the packets on all networks.
193. TN1 transmits Report K.
194. Observe the packets on all networks.
195. TN1 transmits Report H.
196. Observe the packets on all networks.
197. Before Query is transmitted by the RUT. TN1 transmits Report G.
198. Observe the packets on all networks.
199. Wait [LLQI] seconds. TN1 transmits Report L.
200. Observe the packets on all networks.

Part U: Excluding nothing with Requested, Sends a Query after To Include S2, receives Allow S3
201. Enable MLDv2 on the RUT.
202. Observe the packets on all networks.
203. TN1 transmits Report K.
204. Observe the packets on all networks.
205. TN1 transmits Report A.
206. Observe the packets on all networks.

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207. TN1 transmits Report L.
208. Observe the packets on all networks.
209. Before Query is transmitted by the RUT. TN1 transmits Report C.
210. Observe the packets on all networks.
211. Wait [LLQI] seconds. TN1 transmits Report L.
212. Observe the packets on all networks.

Part V: Excluding nothing with Requested, Sends a Query after To Include S2, receives Block S3
213. Enable MLDv2 on the RUT.
214. Observe the packets on all networks.
215. TN1 transmits Report K.
216. Observe the packets on all networks.
217. TN1 transmits Report A.
218. Observe the packets on all networks.
219. TN1 transmits Report J.
220. Observe the packets on all networks.
221. Before Query is transmitted by the RUT. TN1 transmits Report I.
222. Observe the packets on all networks.
223. Wait [LLQI] seconds. TN1 transmits Report L.
224. Observe the packets on all networks.

Part W: Excluding nothing with Requested, Sends a Query after To Include S2, receives To Exclude S3
225. Enable MLDv2 on the RUT.
226. Observe the packets on all networks.
227. TN1 transmits Report K.
228. Observe the packets on all networks.
229. TN1 transmits Report A.
230. Observe the packets on all networks.
231. TN1 transmits Report J.
232. Observe the packets on all networks.
233. Before Query is transmitted by the RUT. TN1 transmits Report F.
234. Observe the packets on all networks.
235. Wait [LLQI] seconds. TN1 transmits Report L.
236. Observe the packets on all networks.

Part X: Excluding nothing with Requested, Sends a Query after To Include S2, receives To Include S3
237. Enable MLDv2 on the RUT.
238. Observe the packets on all networks.
239. TN1 transmits Report K.
240. Observe the packets on all networks.
241. TN1 transmits Report A.
242. Observe the packets on all networks.
243. TN1 transmits Report J.
244. Observe the packets on all networks.
245. Before Query is transmitted by the RUT. TN1 transmits Report G.
246. Observe the packets on all networks.
247. Wait [LLQI] seconds. TN1 transmits Report L.
248. Observe the packets on all networks.

Observable Results:

- *Part A*

Step 2: The RUT must transmit 2 MLDv2 General Queries.
Step 4: The RUT must not transmit Queries other then periodic General Queries.
Step 6: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear.
Step 8: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1 with the S Flag set. The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S2 with the S Flag clear.
Step 10: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S3 with the S Flag clear.

- *Part B*
  Step 12: The RUT must transmit 2 MLDv2 General Queries.
  Step 14: The RUT must not transmit Queries other then periodic General Queries.
  Step 16: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear.
  Step 18: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S2 and S3 with the S Flag clear. Then, the RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S3 with the S Flag clear.
  Step 20: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Address of S4 with the S Flag clear.

- *Part C*
  Step 22: The RUT must transmit MLDv2 General Queries.
  Step 24: The RUT must not transmit Queries other then periodic General Queries.
  Step 26: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear.
  Step 28: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1 with the S Flag clear. The RUT must transmit a Multicast Address and Source Specific Query with a Multicast address of M1 and a Source Address of S2 with the S Flag set.
  Step 30: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear.

- *Part D*
  Step 32: The RUT must transmit 2 MLDv2 General Queries.
  Step 34: The RUT must not transmit Queries other then periodic General Queries.
  Step 36: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear.
  Step 38: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1 with the S Flag set. The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S2 with the S Flag clear.
  Step 40: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S3 with the S Flag clear.

- *Part E*
  Step 42: The RUT must transmit 2 MLDv2 General Queries.
  Step 44: The RUT must not transmit Queries other then periodic General Queries.
  Step 46: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Address of S1 and S2 with the S Flag clear.
  Step 48: The RUT must transmit a Multicast Address and Source Specific Query with a

Multicast Address of M1 and a Source Address of S1 with the S Flag set. The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S2 with the S Flag clear.

Step 50: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S3 with the S Flag clear. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear.

- *Part F*

  Step 52: The RUT must transmit 2 MLDv2 General Queries.

  Step 54: The RUT must not transmit Queries other then periodic General Queries.

  Step 56: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear.

  Step 58: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S2 and S3 with the S Flag clear. Then, the RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S3 with the S Flag clear.

  Step 60: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear.

- *Part G*

  Step 62: The RUT must transmit 2 MLDv2 General Queries.

  Step 64: The RUT must not transmit Queries other then periodic General Queries.

  Step 66: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear.

  Step 68: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S3 with the S Flag clear. The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S2 with the S Flag set. Then, the RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S3 with the S Flag clear.

  Step 70: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear.

- *Part H*

  Step 72: The RUT must transmit 2 MLDv2 General Queries.

  Step 74: The RUT must not transmit Queries other then periodic General Queries.

  Step 76: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear.

  Step 78: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1 with the S Flag set. The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S2 with the S Flag clear. The RUT must transmit a Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear. Then, the RUT must transmit a Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear.

  Step 80: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S3 with the S Flag clear.

- *Part I*

  Step 82: The RUT must transmit 2 MLDv2 General Queries.

  Step 84: The RUT must not transmit Queries other then periodic General Queries.

  Step 86: The RUT must transmit a Multicast Address and Source Specific Query with a

Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear.

Step 88: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1 with the S Flag set. The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S2 with the S Flag clear.

Step 90: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S3 with the S Flag clear.

- *Part J*

    Step 92: The RUT must transmit 2 MLDv2 General Queries.

    Step 94: The RUT must not transmit Queries other then periodic General Queries.

    Step 96: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear.

    Step 98: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S2 and S3 with the S Flag clear. Then, the RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S3 with the S Flag clear.

    Step 100: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S4 with the S Flag clear.

- *Part K*

    Step 102: The RUT must transmit 2 MLDv2 General Queries.

    Step 104: The RUT must not transmit Queries other then periodic General Queries.

    Step 106: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear.

    Step 108: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S3 with the S Flag clear. The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S2 with the S Flag set. Then, the RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S3 with the S Flag clear.

    Step 110: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear.

- *Part L*

    Step 112: The RUT must transmit 2 MLDv2 General Queries.

    Step 114: The RUT must not transmit Queries other then periodic General Queries.

    Step 116: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear.

    Step 118: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1 with the S Flag set. The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S2 and S4 with the S Flag clear. Then, the RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S4 with the S Flag clear.

    Step 120: The RUT must transmit 2 Multicast Address and Source Specific Query with Multicast Address of M1 and Source Addresses of S1 and S3 with the S Flag clear.

- *Part M*

    Step 122: The RUT must transmit 2 MLDv2 General Queries.

    Step 124: The RUT must not transmit Queries other then periodic General Queries.

    Step 126: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear.

Step 128: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1 with the S Flag set. The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S2 with the S Flag clear.

Step 130: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S3 with the S Flag clear. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear.

- *Part N*

    Step 132: The RUT must transmit 2 MLDv2 General Queries.

    Step 134: The RUT must not transmit Queries other then periodic General Queries.

    Step 136: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear.

    Step 138: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S2 and S3 with the S Flag clear. Then, the RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S3 with the S Flag clear.

    Step 140: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear.

- *Part O*

    Step 142: The RUT must transmit 2 MLDv2 General Queries.

    Step 144: The RUT must not transmit Queries other then periodic General Queries.

    Step 146: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear.

    Step 148: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S3 with the S Flag clear. The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S2 with the S Flag set. Then, the RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S3 with the S Flag clear.

    Step 150: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear.

- *Part P*

    Step 152: The RUT must transmit 2 MLDv2 General Queries.

    Step 154: The RUT must not transmit Queries other then periodic General Queries.

    Step 156: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear.

    Step 158: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Addresses of S1 with the S Flag set. The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S2 with the S Flag clear. The RUT must transmit a Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear. Then, the RUT must transmit a Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear.

    Step 160: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S3 with the S Flag clear.

- *Part Q*

    Step 162: The RUT must transmit 2 MLDv2 General Queries.

    Step 164: The RUT must not transmit Queries other then periodic General Queries.

Step 166: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear.
Step 168: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1 with the S Flag set. The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S2 with the S Flag clear.
Step 170: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Address of S1 and S3 with the S Flag clear. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear.

- *Part R*
  Step 172: The RUT must transmit 2 MLDv2 General Queries.
  Step 174: The RUT must not transmit Queries other then periodic General Queries.
  Step 176: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear.
  Step 178: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S2 and S3 with the S Flag clear. Then, the RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S3 with the S Flag clear.
  Step 180: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear.

- *Part S*
  Step 182: The RUT must transmit 2 MLDv2 General Queries.
  Step 184: The RUT must not transmit Queries other then periodic General Queries.
  Step 186: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear.
  Step 188: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S3 with the S Flag clear. The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S2 with the S Flag set. Then, the RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S3 with the S Flag clear.
  Step 190: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear.

- *Part T*
  Step 192: The RUT must transmit 2 MLDv2 General Queries.
  Step 194: The RUT must not transmit Queries other then periodic General Queries.
  Step 196: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear.
  Step 198: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1 with the S Flag set. The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S2 with the S Flag clear. The RUT must transmit a Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear. Then, the RUT must transmit a Multicast address Specific Query with a Multicast Address of M1 with the S Flag clear.
  Step 200: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S3 with the S Flag clear.

- *Part U*

Step 202: The RUT must transmit 2 MLDv2 General Queries.
Step 204: The RUT must not transmit Queries other then periodic General Queries.
Step 206: The RUT must not transmit Queries other then periodic General Queries.
Step 208: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear. The RUT must transmit a Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear.
Step 210: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 with the S Flag set. The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S2 with the S Flag clear. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear.
Step 212: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S3 with the S Flag clear.

- *Part V*
  Step 214: The RUT must transmit 2 MLDv2 General Queries.
  Step 216: The RUT must not transmit Queries other then periodic General Queries.
  Step 218: The RUT must not transmit Queries other then periodic General Queries.
  Step 220: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear. The RUT must transmit a Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear.
  Step 222: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S2, and S3 with the S Flag clear. The RUT must transmit a Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear. Then, the RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S3 with the S Flag clear.
  Step 224: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S4 with the S Flag clear.

- *Part W*
  Step 226: The RUT must transmit 2 MLDv2 General Queries.
  Step 228: The RUT must not transmit Queries other then periodic General Queries.
  Step 230: The RUT must not transmit Queries other then periodic General Queries.
  Step 232: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear. The RUT must transmit a Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear.
  Step 234: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S3 with the S Flag clear. The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S2 with the S Flag set. The RUT must transmit a Multicast Address Specific Query with a Multicast Address of M1 with the S Flag set. Then, the RUT must transmit a Multicast Address and a Source Specific Query with a Multicast Address of M1 and a Source Address of S3 with the S Flag clear.
  Step 236: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear.

- *Part X*
  Step 238: The RUT must transmit 2 MLDv2 General Queries.

Step 240: The RUT must not transmit Queries other then periodic General Queries.
Step 242: The RUT must not transmit Queries other then periodic General Queries.
Step 244: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2 with the S Flag clear. The RUT must transmit a Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear.
Step 246: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1 with the S Flag set. The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S2 and S4 with the S Flag clear. The RUT must transmit a Multicast Address Specific Query with a Multicast Address of M1 with the S Flag clear. Then, the RUT must a transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S4 with the S Flag clear.
Step 248: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S3 with the S Flag clear.

Possible Problems:

- This test has a timing matter. Before implementation retransmits the MLD Query by the 1st MLD Report, you have to make the 2nd MLD Report accepted in implementation. It may be possible by extending Last Listener Query Interval in the implementation.

Test MLD.4.27: Multiple Records

Purpose: To verify that an MLDv2 router properly process a report message with multiple records.

References:

- [MLD] – 7.4.1. Reception of Current State Records

  When receiving Current State Records, a router updates both its Filter Timer and its source timers. In some circumstances, the reception of a type of multicast address record will cause the Router Filter Mode for that multicast address to change. The table below describes the actions, with respect to state and timers, that occur to a router's state upon reception of Current State Records.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A	Report B
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S1, S2) M2, IS_EX (S1, S3)	MLDv2 Report Multicast Address Record: M1, IS_IN (S1, S2) M2, IS_IN (S1, S2)

Report C	Report D
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S1, S3) M2, IS_IN (S2, S3)	MLDv2 Report Multicast Address Record: M1, IS_EX () M2, IS_EX ()

Report E	Report F
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record:	MLDv2 Report Multicast Address Record:

| M1, IS_IN (S1, S2) | M1, IS_EX (S3, S4) |
| M2, IS_EX (S1, S2) | M2, IS_EX (S3, S4) |

Report G	Report H
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, ALLOW (S1, S2) M2, ALLOW (S1, S2)	MLDv2 Report Multicast Address Record: M1, IS_IN (S1, S3, S5) M2, IS_IN (S1, S3, S5)

Report I	Report J
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN ()	MLDv2 Report Multicast Address Record: M2, TO_IN ()

Procedure:

Part A: Two Records in one message
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A.
4. Observe the packets on all networks.
5. TN1 transmits Report I.
6. Observe the packets on all networks.
7. Wait [LLQI] seconds. TN1 transmits Report I.
8. Observe the packets on all networks.
9. TN1 transmits Report J.
10. Observe the packets on all networks.
11. Wait [LLQI] seconds. TN1 transmits Report J.
12. Observe the packets on all networks.

Part B: Current State is Include, receiving multiple records
13. Enable MLDv2 on the RUT.
14. Observe the packets on all networks.
15. TN1 transmits Report B.
16. Observe the packets on all networks.
17. Wait [QI] seconds after Step 15. TN1 transmits Report C.
18. Observe the packets on all networks.
19. Wait [MALI] seconds after Step 15. TN1 transmits Report I.
20. Observe the packets on all networks.

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21. Wait [LLQI] seconds. TN1 transmits Report I.
22. Observe the packets on all networks.
23. TN1 transmits Report J.
24. Observe the packets on all networks.
25. Wait [LLQI] seconds. TN1 transmits Report J.
26. Observe the packets on all networks.

Part C: Current State is Exclude nothing, receiving multiple record

27. Enable MLDv2 on the RUT.
28. Observe the packets on all networks.
29. TN1 transmits Report D.
30. Observe the packets on all networks.
31. Wait [QI] seconds after Step 29. TN1 transmits Report E.
32. Observe the packets on all networks.
33. Wait [MALI] seconds after Step 29. TN1 transmits Report I.
34. Observe the packets on all networks.
35. Wait [LLQI] seconds. TN1 transmits Report I.
36. Observe the packets on all networks.
37. TN1 transmits Report J.
38. Observe the packets on all networks.
39. Wait [LLQI] seconds. TN1 transmits Report J.
40. Observe the packets on all networks.

Part D: Current State is Exclude Source, receiving multiple record

41. Enable MLDv2 on the RUT.
42. Observe the packets on all networks.
43. TN1 transmits Report F.
44. Observe the packets on all networks.
45. Wait [QI / 2] seconds after Step 43. TN1 transmits Report G.
46. Observe the packets on all networks.
47. Wait [QI] seconds after Step 43. TN1 transmits Report H.
48. Observe the packets on all networks.
49. Wait [MALI] seconds after Step 43. TN1 transmits Report I.
50. Observe the packets on all networks.
51. Wait [LLQI] seconds. TN1 transmits Report I.
52. Observe the packets on all networks.
53. TN1 transmits Report J.
54. Observe the packets on all networks.
55. Wait [LLQI] seconds. TN1 transmits Report J.
56. Observe the packets on all networks.

Observable Results:

- *Part A*
    Step 2: The RUT must transmit 2 MLDv2 General Queries.
    Step 4: The RUT must not transmit Queries other then periodic General Queries.
    Step 6: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2.
    Step 8: The RUT must not transmit Queries other then periodic General Queries.
    Step 10: The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M2.

Step 12: The RUT must not transmit Queries other then periodic General Queries.
- *Part B*
    Step 14: The RUT must transmit 2 MLDv2 General Queries.
    Step 16: The RUT must not transmit Queries other then periodic General Queries.
    Step 18: The RUT must not transmit Queries other then periodic General Queries.
    Step 20: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S3.
    Step 22: The RUT must not transmit Queries other then periodic General Queries.
    Step 24: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S2 and S3.
    Step 26: The RUT must not transmit Queries other then periodic General Queries.
- *Part C*
    Step 28: The RUT must transmit 2 MLDv2 General Queries.
    Step 30: The RUT must not transmit Queries other then periodic General Queries.
    Step 32: The RUT must not transmit Queries other then periodic General Queries.
    Step 34: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1 and S2.
    Step 36: The RUT must not transmit Queries other then periodic General Queries.
    Step 38: The RUT must transmit a Multicast Address and Source Specific Query with a Multicast Address of M2 and Source Addresses of S1 and S2. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M2.
    Step 40: The RUT must not transmit Queries other then periodic General Queries.
- *Part D*
    Step 42: The RUT must transmit 2 MLDv2 General Queries.
    Step 44: The RUT must not transmit Queries other then periodic General Queries.
    Step 46: The RUT must not transmit Queries other then periodic General Queries.
    Step 48: The RUT must not transmit Queries other then periodic General Queries.
    Step 50: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and Source Addresses of S1, S2, S3 and S5.
    Step 52: The RUT must not transmit Queries other then periodic General Queries.
    Step 54: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M2 and Source Addresses of S1 and S5. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M2.
    Step 56: The RUT must not transmit Queries other then periodic General Queries.

Possible Problems:

- None.

Test MLD.4.28: MTU

Purpose: To verify that an MLDv2 router limits the size of a query packet by caring about MTU.

References:

- [MLD] – 5.1.10. Number of Sources (N)

  This number is limited by the MTU of the link over which the Query is transmitted. For example, on an Ethernet link with an MTU of 1500 octets, the IPv6 header (40 octets) together with the Hop-By-Hop Extension Header (8 octets) that includes the Router Alert option consume 48 octets; the MLD fields up to the Number of Sources (N) field consume 28 octets; thus, there are 1424 octets left for source addresses, which limits the number of source addresses to 89 (1424/16).

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

<table>
<tr><td align="center">Report A</td><td align="center">Report B</td></tr>
<tr><td align="center">IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16</td><td align="center">IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16</td></tr>
<tr><td align="center">Router Alert</td><td align="center">Router Alert</td></tr>
<tr><td align="center">MLDv2 Report
Multicast Address Record:
M1, ALLOW (S1,S2 … S89)</td><td align="center">MLDv2 Report
Multicast Address Record:
M1, ALLOW (S90)</td></tr>
</table>

<table>
<tr><td align="center">Report C</td><td align="center">Report D</td></tr>
<tr><td align="center">IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16</td><td align="center">IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16</td></tr>
<tr><td align="center">Router Alert</td><td align="center">Router Alert</td></tr>
<tr><td align="center">MLDv2 Report
Multicast Address Record:
M1, TO_IN ()</td><td align="center">MLDv2 Report
Multicast Address Record:
M1, IS_EX ()</td></tr>
</table>

<table>
<tr><td align="center">Report E</td><td align="center">Report F</td></tr>
<tr><td align="center">IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16</td><td align="center">IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16</td></tr>
<tr><td align="center">Router Alert</td><td align="center">Router Alert</td></tr>
</table>

MLDv2 Report Multicast Address Record: M1, ALLOW (S1,S2 … S89)	MLDv2 Report Multicast Address Record: M1, ALLOW (S90)

Procedure:

Part A: Include List
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A.
4. Observe the packets on all networks.
5. TN1 transmits Report B.
6. Observe the packets on all networks.
7. TN1 transmits Report C.
8. Observe the packets on all networks.

Part B: Requested List
9. Enable MLDv2 on the RUT.
10. Observe the packets on all networks.
11. TN1 transmits Report D.
12. Observe the packets on all networks.
13. TN1 transmits Report A.
14. Observe the packets on all networks.
15. TN1 transmits Report B.
16. Observe the packets on all networks.
17. TN1 transmits Report C.
18. Observe the packets on all networks.

Observable Results:

- *Part A*
  Step 2: The RUT must transmit 2 MLDv2 General Queries.
  Step 4: The RUT must not transmit Queries other then periodic General Queries.
  Step 6: The RUT must not transmit Queries other then periodic General Queries.
  Step 8: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and 89 Source Addresses. The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and another one Source Address.
- *Part B*
  Step 10: The RUT must transmit 2 MLDv2 General Queries.
  Step 12: The RUT must not transmit Queries other then periodic General Queries.
  Step 14: The RUT must not transmit Queries other then periodic General Queries.
  Step 16: The RUT must not transmit Queries other then periodic General Queries.
  Step 18: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and 89 Source Addresses. The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and another one Source Address. The RUT must transmit 2 Multicast Address Specific Query with a Multicast Address of M1.

Possible Problems:

- None.

GROUP 5: Version Interoperability

Scope:

The following tests are designed to verify that an MLDv2 Router Interoperates with MLDv2 and MLDv1 hosts and routers as described in RFC 3810.

Overview:

These tests verify that an MLDv2 Router ignores the appropriate Reports when in MLDv1 Group Member Compatibility Modes. These tests also verify the Router translates MLDv1 Reports into their corresponding MLDv2 Reports, that the Router has the appropriate Group Compatibility Mode scope, and that the Other Host Present Interval expires and transitions modes as expected.

Test MLD.5.1: MLDv1 Query in MLDv2 Mode

Purpose: To verify that an MLDv2 router properly process a MLDv1 Query while in MLDv2 mode.

References:

- [MLD] – 8.1. Query Version Distinctions

  The MLD version of a Multicast Listener Query message is determined as follows:

    MLDv1 Query: length = 24 octets

    MLDv2 Query: length >= 28 octets

  Query messages that do not match any of the above conditions (e.g., a Query of length 26 octets) MUST be silently ignored.

- [MLD] – 8.3.1. In the Presence of MLDv1 Routers

  MLDv2 routers may be placed on a network where there is at least one MLDv1 router. The following requirements apply:

  o If an MLDv1 router is present on the link, the Querier MUST use the lowest version of MLD present on the network. This must be administratively assured. Routers that desire to be compatible with MLDv1 MUST have a configuration option to act in MLDv1 mode; if an MLDv1 router is present on the link, the system administrator must explicitly configure all MLDv2 routers to act in MLDv1 mode. When in MLDv1 mode, the Querier MUST send periodic General Queries truncated at the Multicast Address field (i.e., 24 bytes long), and SHOULD also warn about receiving an MLDv2 Query (such warnings must be rate-limited). The Querier MUST also fill in the Maximum Response Delay in the Maximum Response Code field, i.e., the exponential algorithm described in section 5.1.3. is not used.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Query A

| IPv6 Header |
| Source Address: TR2's Link-local Address |
| Destination Address: FF02::1 |
| Router Alert |
| MLDv1 General Query |

Query B

| IPv6 Header |
| Source Address: TR2's Link-local Address |

Destination Address: M1
Router Alert
MLDv1 MA Query Multicast Address: M1

Procedure:

Part A: MLDv1 General Query
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TR1 transmits Query A.
4. Wait [QI] seconds.
5. Observe the packets on all networks.

Part B: MLDv1 Multicast Address Specific Query
6. Enable MLDv2 on the RUT.
7. Observe the packets on all networks.
8. TR1 transmits Query B.
9. Wait [QI] seconds.
10. Observe the packets on all networks.

Observable Results:

- *Part A*
  Step 2: The RUT must transmit 2 MLDv2 General Queries.
  Step 5: The RUT must transmit a MLDv2 General Query.
- *Part B*
  Step 7: The RUT must transmit 2 MLDv2 General Queries.
  Step 10: The RUT must transmit a MLDv2 General Query.

Possible Problems:

- None.

Test MLD.5.2: MLDv1 Report in MLDv2 Mode

Purpose: To verify that an MLDv2 router properly process a MLDv1 Report while in MLDv2 mode.

References:

- [MLD] – 8.3.2. In the Presence of MLDv1 Multicast Address Listeners

  MLDv2 routers may be placed on a network where there are hosts that have not yet been upgraded to MLDv2. In order to be compatible with MLDv1 hosts, MLDv2 routers MUST operate in version 1 compatibility mode. MLDv2 routers keep a compatibility mode per multicast address record. The compatibility mode of a multicast address is determined from the Multicast Address Compatibility Mode variable, which can be in one of the two following states: MLDv1 or MLDv2.

  If the Older Version Host Present timer expires, the router switches back to Multicast Address Compatibility Mode of MLDv2 for that multicast address.

MLDv1 Message	MLDv2 Equivalent
-------------	----------------
Report	IS_EX({})
Done	TO_IN({})

- [MLD] – 9.13. Older Version Host Present Timeout

  The Older Version Host Present Timeout is the time-out for transitioning a router back to MLDv2 Multicast Address Compatibility Mode for a specific multicast address. When an MLDv1 report is received for that multicast address, routers set their Older Version Host Present Timer to [Older Version Host Present Timeout].

  This value MUST be ([Robustness Variable] times [Query Interval]) plus ([Query Response Interval]).

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A	Report B
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: M1
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S1)	MLDv1 Report Multicast Address: M1

Report C	Report D

IPv6 Header Source Address: TN1's Link-local Address Destination Address: M1	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv1 Done Multicast Address: M1	MLDv2 Report Multicast Address Record: M1, IS_EX (S2)

Report E

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN ()

Procedure:

Part A: Including Source, MLDv1 Report
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A.
4. Observe the packets on all networks.
5. TN1 transmits Report B.
6. Observe the packets on all networks.
7. TN1 transmits Report E.
8. Observe the packets on all networks.

Part B: Including Source, MLDv1 Report before Filter Timer expires
9. Enable MLDv2 on the RUT.
10. Observe the packets on all networks.
11. TN1 transmits Report A.
12. Observe the packets on all networks.
13. TN1 transmits Report B.
14. Observe the packets on all networks.
15. Wait [OVHPT - LLQT - ∝] seconds after Step 13. TN1 transmits Report E.
16. Observe the packets on all networks.

Part C: Including Source, MLDv1 Report after Filter Timer expires
17. Enable MLDv2 on the RUT.
18. Observe the packets on all networks.
19. TN1 transmits Report A.
20. Observe the packets on all networks.
21. TN1 transmits Report B.
22. Observe the packets on all networks.
23. Wait [OVHPT] seconds after Step 21. TN1 transmits Report E.
24. Observe the packets on all networks.

Part D: Including Source, MLDv1 Done
    25. Enable MLDv2 on the RUT.
    26. Observe the packets on all networks.
    27. TN1 transmits Report A.
    28. Observe the packets on all networks.
    29. TN1 transmits Report C.
    30. Observe the packets on all networks.
    31. Wait [LLQI] seconds. TN1 transmits Report E.
    32. Observe the packets on all networks.
Part E: Excluding Source with Requested Another Source, MLDv1 Report
    33. Enable MLDv2 on the RUT.
    34. Observe the packets on all networks.
    35. TN1 transmits Report D.
    36. Observe the packets on all networks.
    37. TN1 transmits Report A.
    38. Observe the packets on all networks.
    39. TN1 transmits Report B.
    40. Observe the packets on all networks.
    41. TN1 transmits Report E.
    42. Observe the packets on all networks.
Part F: Excluding Source with Requested Another Source, MLDv1 Report before Filter Timer expires
    43. Enable MLDv2 on the RUT.
    44. Observe the packets on all networks.
    45. TN1 transmits Report D.
    46. Observe the packets on all networks.
    47. TN1 transmits Report A.
    48. Observe the packets on all networks.
    49. TN1 transmits Report B.
    50. Observe the packets on all networks.
    51. Wait [OVHPT - LLQT - $\propto$] seconds after Step 49. TN1 transmits Report E.
    52. Observe the packets on all networks.
Part G: Excluding Source with Requested Another Source, MLDv1 Report after Filter Timer expires
    53. Enable MLDv2 on the RUT.
    54. Observe the packets on all networks.
    55. TN1 transmits Report D.
    56. Observe the packets on all networks.
    57. TN1 transmits Report A.
    58. Observe the packets on all networks.
    59. TN1 transmits Report B.
    60. Observe the packets on all networks.
    61. Wait [OVHPT] seconds after Step 59. TN1 transmits Report E.
    62. Observe the packets on all networks.
Part H: Excluding Source with Requested Another Source, MLDv1 Done
    63. Enable MLDv2 on the RUT.
    64. Observe the packets on all networks.
    65. TN1 transmits Report D.
    66. Observe the packets on all networks.
    67. TN1 transmits Report A.
    68. Observe the packets on all networks.

69. TN1 transmits Report C.
70. Observe the packets on all networks.
71. Wait [LLQI] seconds. TN1 transmits Report E.
72. Observe the packets on all networks.

Observable Results:

- *Part A*
  Step 2: The RUT must transmit 2 MLDv2 General Queries.
  Step 4: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 6: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 8: The RUT must transmit 2 MLDv2 Multicast Address Specific Queries with a Multicast Address of M1.
- *Part B*
  Step 10: The RUT must transmit 2 MLDv2 General Queries.
  Step 12: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 14: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 16: The RUT must transmit 2 MLDv2 Multicast Address Specific Queries with a Multicast Address of M1.
- *Part C*
  Step 18: The RUT must transmit 2 MLDv2 General Queries.
  Step 20: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 22: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 24: The RUT must not transmit a MLDv2 Multicast Address Specific Queries with a Multicast Address of M1.
- *Part D*
  Step 26: The RUT must transmit 2 MLDv2 General Queries.
  Step 28: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 30: The RUT must transmit 2 MLDv2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.
  Step 32: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
- *Part E*
  Step 34: The RUT must transmit 2 MLDv2 General Queries.
  Step 36: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 38: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 40: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 42: The RUT must transmit 2 MLDv2 Multicast Address Specific Queries with a Multicast Address of M1.
- *Part F*
  Step 44: The RUT must transmit 2 MLDv2 General Queries.
  Step 46: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 48: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 50: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 52: The RUT must transmit 2 MLDv2 Multicast Address Specific Queries with a Multicast Address of M1.
- *Part G*
  Step 54: The RUT must transmit 2 MLDv2 General Queries.
  Step 56: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 58: The RUT must not transmit Queries other then periodic MLDv2 General Queries.

Step 60: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
Step 62: The RUT must not transmit a MLDv2 Multicast Address Specific Query with a Multicast Address of M1.

- *Part H*

  Step 64: The RUT must transmit 2 MLDv2 General Queries.
  Step 66: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 68: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 70: The RUT must transmit 2 MLDv2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1. The RUT must transmit 2 MLDv2 Multicast Address Specific Query with a Multicast Address of M1.
  Step 72: The RUT must not transmit Queries other then periodic MLDv2 General Queries.

Possible Problems:

- None.

Test MLD.5.3: MLDv1 Compatibility Mode

Purpose: To verify that an MLDv2 router properly process MLDv2 messages while in MLDv1 compatibility mode.

References:

- [MLD] – 8.3.2. In the Presence of MLDv1 Multicast Address Listeners

  The Multicast Address Compatibility Mode of a multicast address record is set to MLDv1 whenever an MLDv1 Multicast Listener Report is received for that multicast address. At the same time, the Older Version Host Present timer for the multicast address is set to Older Version Host Present Timeout seconds. The timer is re-set whenever a new MLDv1 Report is received for that multicast address. If the Older Version Host Present timer expires, the router switches back to Multicast Address Compatibility Mode of MLDv2 for that multicast address.

  Note that when a router switches back to MLDv2 Multicast Address Compatibility Mode for a multicast address, it takes some time to regain source-specific state information. Source-specific information will be learned during the next General Query, but sources that should be blocked will not be blocked until [Multicast Address Listening Interval] after that.

  When Multicast Address Compatibility Mode is MLDv2, a router acts using the MLDv2 protocol for that multicast address. When Multicast Address Compatibility Mode is MLDv1, a router internally translates the following MLDv1 messages for that multicast address to their MLDv2 equivalents:

  MLDv1 Message   MLDv2 Equivalent
  -------------   ----------------
    Report   IS_EX({})
    Done   TO_IN({})

  MLDv2 BLOCK messages are ignored, as are source-lists in TO_EX() messages (i.e., any TO_EX() message is treated as TO_EX({})). On the other hand, the Querier continues to send MLDv2 queries, regardless of its Multicast Address Compatibility Mode.

- [MLD] – 9.13. Older Version Host Present Timeout

  The Older Version Host Present Timeout is the time-out for transitioning a router back to MLDv2 Multicast Address Compatibility Mode for a specific multicast address. When an MLDv1 report is received for that multicast address, routers set their Older Version Host Present Timer to [Older Version Host Present Timeout].

  This value MUST be ([Robustness Variable] times [Query Interval]) plus ([Query Response Interval]).

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed

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after each test.

Report A	Report B
IPv6 Header Source Address: TN1's Link-local Address Destination Address: M1	IPv6 Header Source Address: TN1's Link-local Address Destination Address: M1
Router Alert	Router Alert
MLDv1 Report Multicast Address: M1	MLDv1 Done Multicast Address: M1

Report C	Report D
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S1)	MLDv2 Report Multicast Address Record: M1, IS_EX ()

Report E	Report F
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_EX (S1)	MLDv2 Report Multicast Address Record: M1, ALLOW (S1)

Report G	Report H
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, TO_EX ()	MLDv2 Report Multicast Address Record: M1, BLOCK (S1)

Report I	Report J
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert

MLDv2 Report Multicast Address Record: M1, TO_EX (S1)	MLDv2 Report Multicast Address Record: M1, TO_IN (S1)

Report K	Report L
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, ALLOW (S1, S2)	MLDv2 Report Multicast Address Record: M1, TO_IN ()

Procedure:

Part A: MLDv1 Report and MLDv1 Done
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A.
4. Observe the packets on all networks.
5. TN1 transmits Report B.
6. Observe the packets on all networks.
7. Wait [LLQI] seconds. TN1 transmits Report L.
8. Observe the packets on all networks.

Part B: Is Include Source
9. Enable MLDv2 on the RUT.
10. Observe the packets on all networks.
11. TN1 transmits Report A.
12. Observe the packets on all networks.
13. Wait [QI] seconds from Step 11. TN1 transmits Report C.
14. Observe the packets on all networks.
15. Wait [OVHPT] seconds after Step 11. TN1 transmits Report L.
16. Observe the packets on all networks.

Part C: Is Exclude nothing
17. Enable MLDv2 on the RUT.
18. Observe the packets on all networks.
19. TN1 transmits Report A.
20. Observe the packets on all networks.
21. Wait [QI] seconds from Step 19. TN1 transmits Report D.
22. Observe the packets on all networks.
23. Wait [OVHPT] seconds after Step 19. TN1 transmits Report L.
24. Observe the packets on all networks.

Part D: Is Exclude source
25. Enable MLDv2 on the RUT.
26. Observe the packets on all networks.
27. TN1 transmits Report A.
28. Observe the packets on all networks.
29. Wait [QI] second from Step 27. TN1 transmits Report E.

30. Observe the packets on all networks.
31. Wait [OVHPT] seconds after Step 27. TN1 transmits Report L.
32. Observe the packets on all networks.

Part E: Allow source
33. Enable MLDv2 on the RUT.
34. Observe the packets on all networks.
35. TN1 transmits Report A.
36. Observe the packets on all networks.
37. Wait [QI] seconds from Step 35. TN1 transmits Report F.
38. Observe the packets on all networks.
39. Wait [OVHPT] seconds after Step 35. TN1 transmits Report L.
40. Observe the packets on all networks.

Part F: Block Source
41. Enable MLDv2 on the RUT.
42. Observe the packets on all networks.
43. TN1 transmits Report A.
44. Observe the packets on all networks.
45. Wait [QI] seconds from Step 43. TN1 transmits Report D and Report H.
46. Observe the packets on all networks.
47. Wait [OVHPT] seconds after Step 43. TN1 transmits Report H.
48. Observe the packets on all networks.

Part G: To Exclude nothing
49. Enable MLDv2 on the RUT.
50. Observe the packets on all networks.
51. TN1 transmits Report A.
52. Observe the packets on all networks.
53. Wait [QI] seconds from Step 51. TN1 transmits Report G.
54. Observe the packets on all networks.
55. Wait [OVHPT] seconds after Step 51. TN1 transmits Report L.
56. Observe the packets on all networks.

Part H: To Exclude source
57. Enable MLDv2 on the RUT.
58. Observe the packets on all networks.
59. TN1 transmits Report A.
60. Observe the packets on all networks.
61. Wait [QI] seconds from Step 59. TN1 transmits Report I.
62. Observe the packets on all networks.
63. Wait [OVHPT] seconds after step 59. TN1 transmits Report H.
64. Observe the packets on all networks.
65. TN1 transmits Report L.
66. Observe the packets on all networks.

Part I: To Include nothing
67. Enable MLDv2 on the RUT.
68. Observe the packets on all networks.
69. TN1 transmits Report A.
70. Observe the packets on all networks.
71. Wait [QI] seconds from Step 69. TN1 transmits Report L.
72. Observe the packets on all networks.
73. Wait [LLQI] seconds. TN1 transmits Report L.

74. Observe the packets on all networks.

Part J: To Include source
75. Enable MLDv2 on the RUT.
76. Observe the packets on all networks.
77. TN1 transmits Report A.
78. Observe the packets on all networks.
79. Wait [QI] seconds from Step 77. TN1 transmits Report J.
80. Observe the packets on all networks.
81. Wait [LLQI] seconds. TN1 transmits Report L.
82. Observe the packets on all networks.

Part K: Allow two sources
83. Enable MLDv2 on the RUT.
84. Observe the packets on all networks.
85. TN1 transmits Report A.
86. Observe the packets on all networks.
87. Wait [QI / 2] seconds from Step 85. TN1 transmits Report K.
88. Observe the packets on all networks.
89. Wait [QI] seconds from Step 85. TN1 transmits Report J.
90. Observe the packets on all networks.
91. Wait [LLQI] seconds. TN1 transmits Report L.
92. Observe the packets on all networks.

Observable Results:

- *Part A*
    Step 2: The RUT must transmit 2 MLDv2 General Queries.
    Step 4: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
    Step 6: The RUT must transmit 2 MLDv2 Multicast Address Specific Queries with a Multicast Address of M1.
    Step 8: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
- *Part B*
    Step 10: The RUT must transmit 2 MLDv2 General Queries.
    Step 12: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
    Step 14: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
    Step 16: The RUT must transmit 2 MLDv2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S1.
- *Part C*
    Step 18: The RUT must transmit 2 MLDv2 General Queries.
    Step 20: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
    Step 22: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
    Step 24: The RUT must transmit 2 MLDv2 Multicast Address Specific Queries with a Multicast Address of M1.
- *Part D*
    Step 26: The RUT must transmit 2 MLDv2 General Queries.
    Step 28: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
    Step 30: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
    Step 32: The RUT must transmit 2 Multicast Address Specific Queries with a Multicast Address of M1.
- *Part E*

Step 34: The RUT must transmit 2 MLDv2 General Queries.
Step 36: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
Step 38: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
Step 40: The RUT must transmit 2 MLDv2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S1.

- *Part F*
  Step 42: The RUT must transmit 2 MLDv2 General Queries.
  Step 44: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 46: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 48: The RUT must transmit 2 MLDv2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S1.

- *Part G*
  Step 50: The RUT must transmit 2 MLDv2 General Queries.
  Step 52: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 54: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 56: The RUT must transmit 2 MLDv2 Multicast Address Specific Queries with a Multicast Address of M1.

- *Part H*
  Step 58: The RUT must transmit 2 MLDv2 General Queries.
  Step 60: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 62: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 64: The RUT must transmit 2 MLDv2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S1.
  Step 66: The RUT must transmit 2 MLDv2 Multicast Address Specific Queries with a Multicast Address of M1.

- *Part I*
  Step 68: The RUT must transmit 2 MLDv2 General Queries.
  Step 70: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 72: The RUT must transmit 2 MLDv2 Multicast Address Specific Queries with a Multicast Address of M1.
  Step 74: The RUT must not transmit Queries other then periodic MLDv2 General Queries.

- *Part J*
  Step 76: The RUT must transmit 2 MLDv2 General Queries.
  Step 78: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 80: The RUT must transmit 2 MLDv2 Multicast Address Specific Queries with a Multicast Address of M1.
  Step 82: The RUT must transmit 2 MLDv2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S1.

- *Part K*
  Step 84: The RUT must transmit 2 MLDv2 General Queries.
  Step 86: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 88: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 90: The RUT must transmit 2 MLDv2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S2. The RUT must transmit 2 MLDv2 Multicast Address Specific Query with a Multicast Address of M1.
  Step 92: The RUT must transmit 2 MLDv2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S1.

Possible Problems:

- None.

Test MLD.5.4: MLDv1 Compatibility Mode Scope

Purpose: To verify that an MLDv2 router properly process MLDv1 compatibility mode scope.

References:

- [MLD] – 8.3.2. In the Presence of MLDv1 Multicast Address Listeners

  MLDv2 routers may be placed on a network where there are hosts that have not yet been upgraded to MLDv2. In order to be compatible with MLDv1 hosts, MLDv2 routers MUST operate in version 1 compatibility mode. MLDv2 routers keep a compatibility mode per multicast address record. The compatibility mode of a multicast address is determined from the Multicast Address Compatibility Mode variable, which can be in one of the two following states: MLDv1 or MLDv2.

  The Multicast Address Compatibility Mode of a multicast address record is set to MLDv1 whenever an MLDv1 Multicast Listener Report is received for that multicast address. At the same time, the Older Version Host Present timer for the multicast address is set to Older Version Host Present Timeout seconds. The timer is re-set whenever a new MLDv1 Report is received for that multicast address. If the Older Version Host Present timer expires, the router switches back to Multicast Address Compatibility Mode of MLDv2 for that multicast address.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test. Enable MLDv2 on the RUT for both Network 0 and Network 1

Report A	Report B
IPv6 Header Source Address: TN2's Link-local Address Destination Address: M1	IPv6 Header Source Address: TN1's Link-local Address Destination Address: M1
Router Alert	Router Alert
MLDv1 Report Multicast Address: M1	MLDv1 Report Multicast Address: M1

Report C	Report D
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN2's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, IS_EX ()	MLDv2 Report Multicast Address Record: M1, BLOCK (S1)

Report E	Report F
IPv6 Header	IPv6 Header

Source Address: TN1's Link-local Address Destination Address: FF02::16	Source Address: TN2's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: M1, BLOCK (S1)	MLDv2 Report Multicast Address Record: M1, ALLOW (S1)

Report G	Report H
IPv6 Header Source Address: TN1's Link-local Address Destination Address: M2	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv1 Report Multicast Address: M2	MLDv2 Report Multicast Address Record: M2, BLOCK (S1)

Report I
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M2, ALLOW (S1)

Procedure:

Part A: MLDv1 Compatibility Mode Per Interface
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN2 transmits Report A on Network 1.
4. Observe the packets on all networks.
5. TN1 transmits Report C on Network 0.
6. Observe the packets on all networks.
7. TN2 transmits Report D on Network 1.
8. Observe the packets on all networks.
9. TN1 transmits Report E on Network 0.
10. Observe the packets on all networks.

Part B: MLDv1 Compatibility Mode Per Interface: Older Version Host Present Timeout
11. Enable MLDv2 on the RUT.
12. Observe the packets on all networks.
13. TN2 transmits Report A on Network 1.
14. Observe the packets on all networks.
15. TN1 transmits Report B on Network 0.
16. Observe the packets on all networks.

17. Wait [QI] seconds after Step 13. TN2 transmits Report F on Network 1.
18. Observe the packets on all networks.
19. TN1 transmits Report B on the Network 0.
20. Observe the packets on all networks.
21. Wait [OVHPT] seconds after Step 13. TN2 transmits Report D on the Network 1.
22. Observe the packets on all networks.
23. TN1 transmits Report E on the Network 0.
24. Observe the packets on all networks.

Part C: MLDv1 Compatibility Mode Per Multicast Address Record
25. Enable MLDv2 on the RUT.
26. Observe the packets on all networks.
27. TN1 transmits Report G.
28. Observe the packets on all networks.
29. TN1 transmits Report C.
30. Observe the packets on all networks.
31. TN1 transmits Report H.
32. Observe the packets on all networks.
33. TN1 transmits Report E.
34. Observe the packets on all networks.

Part D: MLDv1 Compatibility Mode Per Multicast Address Record: *Older Version Host Present Timeout*
35. Enable MLDv2 on the RUT.
36. Observe the packets on all networks.
37. TN1 transmits Report G.
38. Observe the packets on all networks.
39. TN1 transmits Report B.
40. Observe the packets on all networks.
41. Wait [QI] seconds after Step 37. TN1 transmits Report I.
42. Observe the packets on all networks.
43. TN1 transmits Report B.
44. Observe the packets on all networks.
45. Wait [OVHPT] seconds after Step 37. TN1 transmits Report H.
46. Observe the packets on all networks.
47. TN1 transmits Report E.
48. Observe the packets on all networks.

Observable Results:

- *Part A*
    Step 2: The RUT must transmit 2 MLDv2 General Queries on the all networks.
    Step 4: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
    Step 6: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
    Step 8: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
    Step 10: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S1 on Network 0.
- *Part B*
    Step 12: The RUT must transmit 2 MLDv2 General Queries on all networks.
    Step 14: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
    Step 16: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
    Step 18: The RUT must not transmit Queries other then periodic MLDv2 General Queries.

Step 20: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
Step 22: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S1 on Network 1.
Step 24: The RUT must not transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1 on Network 0.

- *Part C*

  Step 26: The RUT must transmit 2 MLDv2 General Queries.
  Step 28: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 30: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 32: The RUT must not transmit a Multicast Address and Source Specific Query with a Multicast Address of M2 and a Source Address of S1.
  Step 34: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M1 and a Source Address of S1.

- *Part D*

  Step 36: The RUT must transmit 2 MLDv2 General Queries.
  Step 38: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 40: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 42: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 44: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 46: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of M2 and a Source Address of S1.
  Step 48: The RUT must not transmit a Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Address of S1.

Possible Problems:

- None.

Test MLD.5.5: MLDv2 fixed mode

Purpose: To verify that an MLDv2 router ignores MLDv1 messages completely.

References:

- [MLD] – 10.2. Current State Report messages

  A forged Version 1 Report Message may put a router into MLDv1 Multicast Address Compatibility Mode for a particular multicast address, meaning that the router will ignore MLDv2 source specific state messages. This can cause traffic to flow from unwanted sources for up to [Multicast Address Listener Interval]. This can be solved by providing routers with a configuration switch to ignore Version 1 messages completely. This breaks automatic compatibility with Version 1 hosts, so it should only be used in situations where source filtering is critical.

Test Requirement:
- RUT is set as MLDv2 fixed mode. (Advanced Function)

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, IS_IN (S1)

Report B
IPv6 Header Source Address: TN1's Link-local Address Destination Address: M1
Router Alert
MLDv1 Report Multicast Address: M1

Report C
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: M1, TO_IN ()

Report D
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv1 Done Multicast Address: M1

Procedure:

Part A: MLDv1 Report
1. Enable MLDv2 on the RUT.

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2. Observe the packets on all networks.
3. TN1 transmits Report A.
4. Observe the packets on all networks.
5. TN1 transmits Report B.
6. Observe the packets on all networks.
7. TN1 transmits Report C.
8. Observe the packets on all networks.

Part B: MLDv1 Done
9. Enable MLDv2 on the RUT.
10. Observe the packets on all networks.
11. TN1 transmits Report A.
12. Observe the packets on all networks.
13. TN1 transmits Report D.
14. Observe the packets on all networks.
15. TN1 transmits Report C.
16. Observe the packets on all networks.

Observable Results:

- *Part A*
  Step 2: The RUT must transmit 2 MLDv2 General Queries.
  Step 4: The RUT must not transmit Queries other then periodic General Queries.
  Step 6: The RUT must not transmit Queries other then periodic General Queries.
  Step 8: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Addresses of S1.
- *Part B*
  Step 10: The RUT must transmit 2 MLDv2 General Queries.
  Step 12: The RUT must not transmit Queries other then periodic General Queries.
  Step 14: The RUT must not transmit Queries other then periodic General Queries.
  Step 16: The RUT must transmit 2 Multicast Address and Source Specific Query with a Multicast Address of M1 and a Source Addresses of S1.

Possible Problems:

- None.

GROUP 6: Source Specific Multicast

Scope:

The following tests are designed to verify that an SSM-aware Router accommodates MLDv2 source-specific multicast as described in RFC 4604.

Overview:

These tests verify that an MLDv2 Router accommodates source-specific multicast (SSM). Source-specific multicast is a form of multicast in which a receiver is required to specify both the network-layer address of the source and the multicast destination address in order to receive the multicast transmission.

Test MLD.6.1: SSM Range

Purpose: To verify that an MLDv2 router properly process SSM range.

References:

- [SSM] – 2. Host Requirements for Source-Specific Multicast

  A host or router may be configured to apply SSM semantics to addresses other than those in the IANA-allocated range. The GMP module on a host or router SHOULD have a configuration option to set the SSM address range(s). If this configuration option exists, it MUST default to the IANA-allocated SSM range. The mechanism for setting this configuration option MUST at least allow for manual configuration. Protocol mechanisms to set this option may be defined in the future.

- [SSM] – 3. Router Requirements for Source-Specific Multicast

  Routers must be aware of the SSM address range in order to provide the SSM service model. A router that knows the SSM address range and is capable of applying SSM semantics to it as described in this section is described as an "SSM-aware" router. An SSM-aware router MAY have a configuration option to apply SSM semantics to addresses other than the IANA-allocated range, but if such an option exists, it MUST default to the IANA-allocated range.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A
IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record: FF3E::3FFF:FFFF, IS_EX ()

Report B
IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record: FF3E::3FFF:FFFF, TO_IN()

Report C
IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record: FF3E::4000:0001, IS_EX ()

Report D
IPv6 Header
Source Address: TN1's Link-local Address
Destination Address: FF02::16
Router Alert
MLDv2 Report
Multicast Address Record: FF3E::4000:0001, TO_IN ()

Report E   Report F

IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: FF3E::7FFF:FFFF, IS_EX ()	MLDv2 Report Multicast Address Record: FF3E::7FFF:FFFF, TO_IN ()

Report G	Report H
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: FF3E::8000:0001, IS_EX ()	MLDv2 Report Multicast Address Record: FF3E::8000:0001, TO_IN ()

Report I	Report J
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: FF3E::8FFF:FFFF, IS_EX ()	MLDv2 Report Multicast Address Record: FF3E::8FFF:FFFF, TO_IN ()

Report K	Report L
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: FF3E::9000:0001, IS_EX ()	MLDv2 Report Multicast Address Record: FF3E::9000:0001, TO_IN ()

Report M	Report N
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record:	MLDv2 Report Multicast Address Record:

FF3E::9FFF:FFFF, IS_EX ()	FF3E::9FFF:FFFF, TO_IN ()

Report O	Report P
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: FF3E::A000:0001, IS_EX ()	MLDv2 Report Multicast Address Record: FF3E::A000:0001, BLOCK (S1)

Procedure:

Part A: Default SSM Range
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A.
4. Observe the packets on all networks.
5. TN1 transmits Report B.
6. Observe the packets on all networks.
7. TN1 transmits Report C.
8. Observe the packets on all networks.
9. TN1 transmits Report D.
10. Observe the packets on all networks.
11. TN1 transmits Report E.
12. Observe the packets on all networks.
13. TN1 transmits Report F.
14. Observe the packets on all networks.
15. TN1 transmits Report G.
16. Observe the packets on all networks.
17. TN1 transmits Report H.
18. Observe the packets on all networks.

Part B: Configured SSM Range
19. Configure the RUT to have a SSM range to be FF3E::9000:0000/100.
20. Enable MLDv2 on the RUT.
21. Observe the packets on all networks.
22. TN1 transmits Report I.
23. Observe the packets on all networks.
24. TN1 transmits Report J.
25. Observe the packets on all networks.
26. TN1 transmits Report K.
27. Observe the packets on all networks.
28. TN1 transmits Report L.
29. Observe the packets on all networks.
30. TN1 transmits Report M.
31. Observe the packets on all networks.
32. TN1 transmits Report N.
33. Observe the packets on all networks.

34. TN1 transmits Report O.
35. Observe the packets on all networks.
36. TN1 transmits Report P.
37. Observe the packets on all networks.

Observable Results:

- *Part A*
  Step 2: The RUT must transmit 2 MLDv2 General Queries.
  Step 4: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 6: The RUT must transmit 2 Multicast Address Specific Queries with a Multicast Address of FF3E::3FFF:FFFF.
  Step 8: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 10: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 12: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 14: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 16: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 18: The RUT must transmit 2 Multicast Address Specific Queries with a Multicast Address of FF3E::8000:0001.
- *Part B*
  Step 21: The RUT must transmit 2 MLDv2 General Queries.
  Step 23: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 25: The RUT must transmit a 2 Multicast Address Specific Queries with a Multicast Address of FF3E::8FFF:FFFF.
  Step 27: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 29: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 31: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 33: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 35: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 37: The RUT must transmit 2 Multicast Address Specific Queries with a Multicast Address of FF3E::A000:0001.

Possible Problems:

- None.

Test MLD.6.2: SSM MLDv2 Report

Purpose: To verify that an MLDv2 router properly process SSM MLDv2 Reports.

References:

- [SSM] –3.1 Host Requirements for Source-Specific Multicast

  SFGMP Reports are used to report source-specific subscriptions in the SSM address range. A router SHOULD ignore a group record of either of the following types if it refers to an SSM destination address:

  - MODE_IS_EXCLUDE Current-State Record

  - CHANGE_TO_EXCLUDE_MODE Filter-Mode-Change Record

  A router MAY choose to log an error in either case. It MUST proceany other group records within the same report. These behaviors are MODIFICATIONS to [IGMPv3, MLDv2] to prevent non-source-specific semantics from being applied to SSM addresses, and to avoid reverting to older-version compatibility mode.

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A	Report B
IPv6 Header Source Address: TN2's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: FF3E::4000:0001, IS_IN (S1)	MLDv2 Report Multicast Address Record: FF3E::4000:0001, TO_IN()

Report C	Report D
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN2's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: FF3E::4000:0001, IS_EX ()	MLDv2 Report Multicast Address Record: FF3E::4000:0001, IS_EX (S1)

Report E	Report F
IPv6 Header Source Address: TN1's Link-	IPv6 Header Source Address: TN2's Link-

local Address Destination Address: FF02::16	local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: FF3E::4000:0001, ALLOW (S1)	MLDv2 Report Multicast Address Record: FF3E::4000:0001, ALLOW (S1, S2)

Report G	Report H
IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: FF3E::4000:0001, BLOCK (S1)	MLDv2 Report Multicast Address Record: FF3E::4000:0001, TO_IN (S1)

Report I	Report J
IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: FF3E::4000:0001, TO_EX ()	MLDv2 Report Multicast Address Record: FF3E::4000:0001, TO_EX (S1)

Report K
IPv6 Header Source Address: TN1's Link- local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: FF3E::7FFF:FFFF, TO_EX (), FF3E::4000:0001,TO_IN (S1)

Procedure:

Part A: Accept Is Include
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A.
4. Observe the packets on all networks.
5. TN1 transmits Report B.
6. Observe the packets on all networks.

Part B: Ignores Is Exclude
7. Enable MLDv2 on the RUT.
8. Observe the packets on all networks.
9. TN1 transmits Report C.
10. Observe the packets on all networks.
11. TN1 transmits Report B.
12. Observe the packets on all networks.
13. TN1 transmits Report D.
14. Observe the packets on all networks.
15. TN1 transmits Report H.
16. Observe the packets on all networks.
Part C: Accepts Allow
17. Enable MLDv2 on the RUT.
18. Observe the packets on all networks.
19. TN1 transmits Report E.
20. Observe the packets on all networks.
21. TN1 transmits Report B.
22. Observe the packets on all networks.
Part D: All Sources Processed
23. Enable MLDv2 on the RUT.
24. Observe the packets on all networks.
25. TN1 transmits Report F.
26. Observe the packets on all networks.
27. TN1 transmits Report B.
28. Observe the packets on all networks.
Part E: Accepts Blocks
29. Enable MLDv2 on the RUT.
30. Observe the packets on all networks.
31. TN1 transmits Report E.
32. Observe the packets on all networks.
33. TN1 transmits Report G.
34. Observe the packets on all networks.
Part F: Accepts To Include
35. Enable MLDv2 on the RUT.
36. Observe the packets on all networks.
37. TN1 transmits Report H.
38. Observe the packets on all networks.
39. TN1 transmits Report B.
40. Observe the packets on all networks.
Part G: Ignores To Exclude
41. Enable MLDv2 on the RUT.
42. Observe the packets on all networks.
43. TN1 transmits Report I.
44. Observe the packets on all networks.
45. TN1 transmits Report B.
46. Observe the packets on all networks.
47. TN1 transmits Report J.
48. Observe the packets on all networks.
Part H: All Multicast address Records Processed

49. Enable MLDv2 on the RUT.
50. Observe the packets on all networks.
51. TN1 transmits Report K.
52. Observe the packets on all networks.
53. TN1 transmits Report B.
54. Observe the packets on all networks.

Observable Results:

- *Part A*
  Step 2: The RUT must transmit 2 MLDv2 General Queries.
  Step 4: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 6: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of FF3E::4000:0001 and a Source Address of S1.
- *Part B*
  Step 8: The RUT must transmit 2 MLDv2 General Queries.
  Step 10: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 12: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 14: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 16: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
- *Part C*
  Step 18: The RUT must transmit 2 MLDv2 General Queries.
  Step 20: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 22: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of FF3E::4000:0001 and a Source Address of S1.
- *Part D*
  Step 24: The RUT must transmit 2 MLDv2 General Queries.
  Step 26: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 28: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of FF3E::4000:0001 and Source Addresses of S1 and S2.
- *Part E*
  Step 30: The RUT must transmit 2 MLDv2 General Queries.
  Step 32: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 34: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of FF3E::4000:0001 and a Source Address of S1.
- *Part F*
  Step 36: The RUT must transmit 2 MLDv2 General Queries.
  Step 38: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 40: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of FF3E::4000:0001 and a Source Address of S1.
- *Part G*
  Step 42: The RUT must transmit 2 MLDv2 General Queries.
  Step 44: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 46: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 48: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
- *Part H*
  Step 50: The RUT must transmit 2 MLDv2 General Queries.
  Step 52: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 54: The RUT must transmit 2 Multicast Address and Source Specific Queries with a

Multicast Address of FF3E::4000:0001 and a Source Address of S1.

Possible Problems:

- None.

Test MLD.6.3: SSM MLDv2 Multicast Address and Source Specific Queries

Purpose: To verify that an MLDv2 router properly process SSM MLDv2 Multicast Address and Source Specific Queries.

References:

- [SSM] –3.4. IGMPv3 and MLDv2 Group-and-Source-Specific Queries

  SFGMP Group-and-Source-Specific Queries are used when a receiver has indicated that it is no longer interested in receiving traffic from a particular (S,G) pair to determine if there are any remaining directly-attached hosts with interest in that (S,G) pair. Group-and-Source-Specific Queries are used within the source-specific address range when a router receives a BLOCK_OLD_SOURCES Record for one or more source-specific groups. These queries are sent normally, as per [IGMPv3, MLDv2].

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A	Report B
IPv6 Header Source Address: TN2's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv2 Report Multicast Address Record: FF3E::4000:0001, IS_IN (S1)	MLDv2 Report Multicast Address Record: FF3E::4000:0001, BLOCK(S1)

Report C
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert
MLDv2 Report Multicast Address Record: FF3E::4000:0001, TO_IN ()

Procedure:

Part A: Block caused Multicast Address and Source Specific Query
1. Enable MLDv2 on the RUT.
2. Observe the packets on all networks.
3. TN1 transmits Report A.
4. Observe the packets on all networks.
5. TN1 transmits Report B.

6. Observe the packets on all networks.
7. Wait [LLQI] seconds. TN1 transmits Report B.
8. Observe the packets on all networks.

Part B: To Include caused Multicast Address and Source Specific Query
9. Enable MLDv2 on the RUT.
10. Observe the packets on all networks.
11. TN1 transmits Report A.
12. Observe the packets on all networks.
13. TN1 transmits Report C.
14. Observe the packets on all networks.
15. Wait [LLQI] seconds. TN1 transmits Report C.
16. Observe the packets on all networks.

Observable Results:

- *Part A*
  Step 2: The RUT must transmit 2 MLDv2 General Queries.
  Step 4: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 6: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of FF3E::4000:0001 and a Source Address of S1.
  Step 8: The RUT must not transmit a Multicast Address and Source Specific Queries with a Multicast Address of FF3E::4000:0001 and a Source Address of S1.
- *Part B*
  Step 10: The RUT must transmit 2 MLDv2 General Queries.
  Step 12: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 14: The RUT must transmit 2 Multicast Address and Source Specific Queries with a Multicast Address of FF3E::4000:0001 and a Source Address of S1.
  Step 16: The RUT must not transmit a Multicast Address and Source Specific Query with a Multicast Address of FF3E::4000:0001 and a Source Address of S1.

Possible Problems:

- None.

Test MLD.6.4: SSM MLDv1 Report and Done Message

Purpose: To verify that an MLDv2 router properly process SSM MLDv1 Report and Done message.

References:

- [SSM] –3.5. IGMPv1/v2 and MLDv1 Reports

  An IGMPv1/v2 or MLDv1 report for an address in the source-specific range could be sent by a non-SSM-aware host. A router SHOULD ignore all such reports and specifically SHOULD NOT use them to establish IP forwarding state. This is a MODIFICATION to [IGMPv3, MLDv2]. A router MAY log an error if it receives such a report (also a MODIFICATION).

- [SSM] – 3.7. IGMPv2 Leave and MLDv1 Done

  An IGMPv2 Leave or MLDv1 Done message may be sent by a non-SSM-aware host. A router SHOULD ignore all such messages in the source-specific address range and MAY log an error (MODIFICATION).

Test Setup: The *Common Test Setup* is performed on the RUT. The *Common Test Cleanup* is performed after each test.

Report A	Report B
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv1 Report Multicast Address: FF3E::4000:0001	MLDv2 Report Multicast Address Record: FF3E::4000:0001, TO_IN()

Report C	Report D
IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16	IPv6 Header Source Address: TN1's Link-local Address Destination Address: FF02::16
Router Alert	Router Alert
MLDv1 Done Multicast Address: FF3E::4000:0001	MLDv2 Report Multicast Address Record: FF3E::4000:0001, IS_IN(S1)

Procedure:

Part A: MLDv1 Report Ignored
  1. Enable MLDv2 on the RUT.

2. Observe the packets on all networks.
3. TN1 transmits Report A.
4. Observe the packets on all networks.
5. TN1 transmits Report B.
6. Observe the packets on all networks.

Part B: MLDv1 Done Ignored
7. Enable MLDv2 on the RUT.
8. Observe the packets on all networks.
9. TN1 transmits Report D.
10. Observe the packets on all networks.
11. TN1 transmits Report C.
12. Observe the packets on all networks.

Observable Results:

- *Part A*
  Step 2: The RUT must transmit 2 MLDv2 General Queries.
  Step 4: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 6: The RUT must not transmit 2 Multicast Address Specific Query with a Multicast Address of FF3E::4000:0001.
- *Part B*
  Step 8: The RUT must transmit 2 MLDv2 General Queries.
  Step 10: The RUT must not transmit Queries other then periodic MLDv2 General Queries.
  Step 12: The RUT must not transmit 2 Multicast Address Specific Query with a Multicast Address of FF3E::4000:0001.

Possible Problems:

- None.