

Network Working Group
Request for Comments: 3019
Category: Standards Track

B. Haberman
Nortel Networks
R. Worzella
IBM
January 2001

IP Version 6 Management Information Base for The Multicast Listener Discovery Protocol

Status of this Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

Copyright Notice

Copyright (C) The Internet Society (2001). All Rights Reserved.

Abstract

This document defines a portion of the Management Information Base (MIB) for use with network management protocols in Internet Protocol Version 6 internets. Specifically, this document is the MIB module that defines managed objects for implementations of the Multicast Listener Discovery Protocol [RFC2710].

Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

1. The SNMP Management Framework

The SNMP Management Framework presently consists of five major components:

An overall architecture, described in RFC 2571 [RFC2571].

Mechanisms for describing and naming objects and events for the purpose of management. The first version of this Structure of Management Information (SMI) is called SMIV1 and described in STD 16,

RFC 1155 [RFC1155], STD 16, RFC 1212 [RFC1212] and RFC 1215 [RFC1215]. The second version, called SMIV2, is described in STD 58, RFC 2578 [RFC2578], STD 58, RFC 2579 [RFC2579] and STD 58, RFC 2580 [RFC2580].

Message protocols for transferring management information. The first version of the SNMP message protocol is called SNMPv1 and described in STD 15, RFC 1157 [RFC1157]. A second version of the SNMP message protocol, which is not an Internet standards track protocol, is called SNMPv2c and described in RFC 1901 [RFC1901] and RFC 1906 [RFC1906]. The third version of the message protocol is called SNMPv3 and described in RFC 1906 [RFC1906], RFC 2572 [RFC2572] and RFC 2574 [RFC2574].

Protocol operations for accessing management information. The first set of protocol operations and associated PDU formats is described in STD 15, RFC 1157 [RFC1157]. A second set of protocol operations and associated PDU formats is described in RFC 1905 [RFC1905].

A set of fundamental applications described in RFC 2573 [RFC2573] and the view-based access control mechanism described in RFC 2575 [RFC2575].

A more detailed introduction to the current SNMP Management Framework can be found in RFC 2570 [RFC2570].

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. Objects in the MIB are defined using the mechanisms defined in the SMI.

This memo specifies a MIB module that is compliant to the SMIV2. A MIB conforming to the SMIV1 can be produced through the appropriate translations. The resulting translated MIB must be semantically equivalent, except where objects or events are omitted because no translation is possible (use of Counter64). Some machine-readable information in SMIV2 will be converted into textual descriptions in SMIV1 during the translation process. However, this loss of machine-readable information is not considered to change the semantics of the MIB.

2. Overview

This MIB module contains two tables:

1. The MLD Interface Table, which contains one row for each interface on which MLD is enabled.

2. The MLD Cache Table which contains one row for each IPv6 Multicast group for which there are members on a particular interface.

Both tables are intended to be implemented by hosts and routers. Some objects in each table apply to routers only.

3. Definitions

```
IPV6-MLD-MIB DEFINITIONS ::= BEGIN
```

```
IMPORTS
```

```
    MODULE-IDENTITY, OBJECT-TYPE, Counter32, Gauge32,
    Unsigned32, TimeTicks, mib-2          FROM SNMPv2-SMI
    RowStatus, TruthValue                FROM SNMPv2-TC
    InetAddressIPv6                      FROM INET-ADDRESS-MIB
    InterfaceIndex, InterfaceIndexOrZero
                                         FROM IF-MIB
    MODULE-COMPLIANCE, OBJECT-GROUP      FROM SNMPv2-CONF;
```

```
mldMIB MODULE-IDENTITY
```

```
    LAST-UPDATED "200101250000Z" -- 25 Jan 2001
```

```
    ORGANIZATION "IETF IPNGWG Working Group."
```

```
    CONTACT-INFO
```

```
        " Brian Haberman
        Nortel Networks
        4309 Emperor Blvd.
        Durham, NC 27703
        USA
```

```
        Phone: +1 919 992 4439
```

```
        e-mail: haberman@nortelnetworks.com"
```

```
    DESCRIPTION
```

```
        "The MIB module for MLD Management."
```

```
    REVISION "200101250000Z" -- 25 Jan 2001
```

```
    DESCRIPTION
```

```
        "Initial version, published as RFC 3019."
```

```
 ::= { mib-2 91 }
```

```
mldMIBObjects      OBJECT IDENTIFIER ::= { mldMIB 1 }
```

```
--
```

```
-- The MLD Interface Table
```

```
--
```

```
mldInterfaceTable OBJECT-TYPE
```

```
    SYNTAX      SEQUENCE OF MldInterfaceEntry
```

```

MAX-ACCESS not-accessible
STATUS      current
DESCRIPTION
    "The (conceptual) table listing the interfaces on which
    MLD is enabled."
 ::= { mldMIBObjects 1 }

```

```

mldInterfaceEntry OBJECT-TYPE
    SYNTAX      MldInterfaceEntry
    MAX-ACCESS not-accessible
    STATUS      current
    DESCRIPTION
        "An entry (conceptual row) representing an interface on
        which MLD is enabled."
    INDEX       { mldInterfaceIfIndex }
    ::= { mldInterfaceTable 1 }

```

```

MldInterfaceEntry ::= SEQUENCE {
    mldInterfaceIfIndex          InterfaceIndex,
    mldInterfaceQueryInterval    Unsigned32,
    mldInterfaceStatus           RowStatus,
    mldInterfaceVersion          Unsigned32,
    mldInterfaceQuerier          InetAddressIPv6,
    mldInterfaceQueryMaxResponseDelay Unsigned32,
    mldInterfaceJoins            Counter32,
    mldInterfaceGroups           Gauge32,
    mldInterfaceRobustness       Unsigned32,
    mldInterfaceLastListenQueryIntvl Unsigned32,
    mldInterfaceProxyIfIndex     InterfaceIndexOrZero,
    mldInterfaceQuerierUpTime    TimeTicks,
    mldInterfaceQuerierExpiryTime TimeTicks
}

```

```

mldInterfaceIfIndex OBJECT-TYPE

    SYNTAX      InterfaceIndex
    MAX-ACCESS not-accessible
    STATUS      current
    DESCRIPTION
        "The internetwork-layer interface value of the interface
        for which MLD is enabled."
    ::= { mldInterfaceEntry 1 }

```

```

mldInterfaceQueryInterval OBJECT-TYPE
    SYNTAX      Unsigned32
    UNITS       "seconds"
    MAX-ACCESS read-create
    STATUS      current

```

```
DESCRIPTION
    "The frequency at which MLD Host-Query packets are
    transmitted on this interface."
DEFVAL      { 125 }
::= { mldInterfaceEntry 2 }

mldInterfaceStatus OBJECT-TYPE
    SYNTAX      RowStatus
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "The activation of a row enables MLD on the interface.
        The destruction of a row disables MLD on the interface."
    ::= { mldInterfaceEntry 3 }

mldInterfaceVersion OBJECT-TYPE
    SYNTAX      Unsigned32
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "The version of MLD which is running on this interface.
        This object is a place holder to allow for new versions
        of MLD to be introduced.  Version 1 of MLD is defined
        in RFC 2710."
    DEFVAL      { 1 }
    ::= { mldInterfaceEntry 4 }

mldInterfaceQuerier OBJECT-TYPE
    SYNTAX      InetAddressIPv6 (SIZE (16))
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The address of the MLD Querier on the IPv6 subnet to
        which this interface is attached."
    ::= { mldInterfaceEntry 5 }

mldInterfaceQueryMaxResponseDelay OBJECT-TYPE
    SYNTAX      Unsigned32
    UNITS       "seconds"
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "The maximum query response time advertised in MLD
        queries on this interface."
    DEFVAL      { 10 }
    ::= { mldInterfaceEntry 6 }

mldInterfaceJoins OBJECT-TYPE
```

```
SYNTAX      Counter32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "The number of times a group membership has been added on
    this interface; that is, the number of times an entry for
    this interface has been added to the Cache Table. This
    object gives an indication of the amount of MLD activity
    over time."
 ::= { mldInterfaceEntry 7 }

mldInterfaceGroups OBJECT-TYPE
SYNTAX      Gauge32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "The current number of entries for this interface in the
    Cache Table."
 ::= { mldInterfaceEntry 8 }

mldInterfaceRobustness OBJECT-TYPE
SYNTAX      Unsigned32
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION
    "The Robustness Variable allows tuning for the expected
    packet loss on a subnet. If a subnet is expected to be
    lossy, the Robustness Variable may be increased. MLD is
    robust to (Robustness Variable-1) packet losses. The
    discussion of the Robustness Variable is in Section 7.1
    of RFC 2710."
DEFVAL      { 2 }
 ::= { mldInterfaceEntry 9 }

mldInterfaceLastListenQueryIntvl OBJECT-TYPE
SYNTAX      Unsigned32
UNITS       "seconds"
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION
    "The Last Member Query Interval is the Max Response
    Delay inserted into Group-Specific Queries sent in
    response to Leave Group messages, and is also the amount
    of time between Group-Specific Query messages. This
    value may be tuned to modify the leave latency of the
    network. A reduced value results in reduced time to
    detect the loss of the last member of a group."
DEFVAL      { 1 }
```

```

 ::= { mldInterfaceEntry 10 }

mldInterfaceProxyIfIndex OBJECT-TYPE
    SYNTAX      InterfaceIndexOrZero
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "Some devices implement a form of MLD proxying whereby
        memberships learned on the interface represented by this
        row, cause MLD Multicast Listener Reports to be sent on
        the internetwork-layer interface identified by this
        object.  Such a device would implement mldRouterMIBGroup
        only on its router interfaces (those interfaces with
        non-zero mldInterfaceProxyIfIndex).  Typically, the
        value of this object is 0, indicating that no proxying
        is being done."
    DEFVAL      { 0 }
 ::= { mldInterfaceEntry 11 }

mldInterfaceQuerierUpTime OBJECT-TYPE
    SYNTAX      TimeTicks
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The time since mldInterfaceQuerier was last changed."
 ::= { mldInterfaceEntry 12 }

mldInterfaceQuerierExpiryTime OBJECT-TYPE
    SYNTAX      TimeTicks
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The time remaining before the Other Querier Present
        Timer expires.  If the local system is the querier,
        the value of this object is zero."
 ::= { mldInterfaceEntry 13 }

--
-- The MLD Cache Table
--

mldCacheTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF MldCacheEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The (conceptual) table listing the IPv6 multicast

```

```

        groups for which there are members on a particular
        interface."
 ::= { mldMIBObjects 2 }

mldCacheEntry OBJECT-TYPE
    SYNTAX      MldCacheEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "An entry (conceptual row) in the mldCacheTable."
    INDEX       { mldCacheAddress, mldCacheIfIndex }
    ::= { mldCacheTable 1 }

MldCacheEntry ::= SEQUENCE {
    mldCacheAddress      InetAddressIPv6,
    mldCacheIfIndex      InterfaceIndex,
    mldCacheSelf         TruthValue,
    mldCacheLastReporter InetAddressIPv6,
    mldCacheUpTime       TimeTicks,
    mldCacheExpiryTime   TimeTicks,
    mldCacheStatus       RowStatus
}

mldCacheAddress OBJECT-TYPE
    SYNTAX      InetAddressIPv6 (SIZE (16))
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The IPv6 multicast group address for which this entry
        contains information."
    ::= { mldCacheEntry 1 }

mldCacheIfIndex OBJECT-TYPE
    SYNTAX      InterfaceIndex
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The internetwork-layer interface for which this entry
        contains information for an IPv6 multicast group
        address."
    ::= { mldCacheEntry 2 }

mldCacheSelf OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "An indication of whether the local system is a member of

```



```
        this group address on this interface."
DEFVAL      { true }
 ::= { mldCacheEntry 3 }

mldCacheLastReporter OBJECT-TYPE
SYNTAX      InetAddressIPv6 (SIZE (16))
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "The IPv6 address of the source of the last membership
    report received for this IPv6 Multicast group address on
    this interface.  If no membership report has been
    received, this object has the value 0::0."
 ::= { mldCacheEntry 4 }

mldCacheUpTime OBJECT-TYPE
SYNTAX      TimeTicks
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "The time elapsed since this entry was created."
 ::= { mldCacheEntry 5 }

mldCacheExpiryTime OBJECT-TYPE
SYNTAX      TimeTicks
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "The minimum amount of time remaining before this entry
    will be aged out.  A value of 0 indicates that the entry
    is only present because mldCacheSelf is true and that if
    the router left the group, this entry would be aged out
    immediately.  Note that some implementations may process
    Membership Reports from the local system in the same way
    as reports from other hosts, so a value of 0 is not
    required."
 ::= { mldCacheEntry 6 }

mldCacheStatus OBJECT-TYPE
SYNTAX      RowStatus
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION
    "The status of this row, by which new entries may be
    created, or existing entries deleted from this table."
 ::= { mldCacheEntry 7 }
```

```
-- conformance information

mldMIBConformance
    OBJECT IDENTIFIER ::= { mldMIB 2 }
mldMIBCompliances
    OBJECT IDENTIFIER ::= { mldMIBConformance 1 }
mldMIBGroups
    OBJECT IDENTIFIER ::= { mldMIBConformance 2 }

-- compliance statements

mldHostMIBCompliance MODULE-COMPLIANCE
    STATUS current
    DESCRIPTION
        "The compliance statement for hosts running MLD and
        implementing the MLD MIB."
    MODULE -- this module
    MANDATORY-GROUPS { mldBaseMIBGroup,
                        mldHostMIBGroup
                      }

    OBJECT      mldInterfaceStatus
    MIN-ACCESS  read-only
    DESCRIPTION
        "Write access is not required."

    ::= { mldMIBCompliances 1 }

mldRouterMIBCompliance MODULE-COMPLIANCE
    STATUS current
    DESCRIPTION
        "The compliance statement for routers running MLD and
        implementing the MLD MIB."
    MODULE -- this module
    MANDATORY-GROUPS { mldBaseMIBGroup,
                        mldRouterMIBGroup
                      }

    OBJECT      mldInterfaceStatus
    MIN-ACCESS  read-only
    DESCRIPTION
        "Write access is not required."

    ::= { mldMIBCompliances 2 }

-- units of conformance
```

```
mldBaseMIBGroup OBJECT-GROUP
    OBJECTS { mldCacheSelf,
              mldCacheStatus, mldInterfaceStatus
            }
    STATUS current
    DESCRIPTION
        "The basic collection of objects providing management of
        MLD. The mldBaseMIBGroup is designed to allow for the
        manager creation and deletion of MLD cache entries."
    ::= { mldMIBGroups 1 }

mldRouterMIBGroup OBJECT-GROUP
    OBJECTS { mldCacheUpTime, mldCacheExpiryTime,
              mldInterfaceQueryInterval,
              mldInterfaceJoins, mldInterfaceGroups,
              mldCacheLastReporter,
              mldInterfaceQuerierUpTime,
              mldInterfaceQuerierExpiryTime,
              mldInterfaceQuerier,
              mldInterfaceVersion,
              mldInterfaceQueryMaxResponseDelay,
              mldInterfaceRobustness,
              mldInterfaceLastListenQueryIntvl
            }
    STATUS current
    DESCRIPTION
        "A collection of additional objects for management of MLD
        in routers."
    ::= { mldMIBGroups 2 }

mldHostMIBGroup OBJECT-GROUP
    OBJECTS { mldInterfaceQuerier
            }
    STATUS current
    DESCRIPTION
        "A collection of additional objects for management of MLD
        in hosts."
    ::= { mldMIBGroups 3 }

mldProxyMIBGroup OBJECT-GROUP
    OBJECTS { mldInterfaceProxyIfIndex }
    STATUS current
    DESCRIPTION
        "A collection of additional objects for management of MLD
        proxy devices."
```

```
::= { mldMIBGroups 4 }
```

END

Security Considerations

This MIB contains readable objects whose values provide information related to multicast sessions. Some of these objects could contain sensitive information. In particular, the mldCacheSelf and mldCacheLastReporter could be used to identify machines which are listening to a given group address. There are also a number of objects that have a MAX-ACCESS clause of read-write and/or read-create, which allow an administrator to configure MLD in the router.

While unauthorized access to the readable objects is relatively innocuous, unauthorized access to the write-able objects could cause a denial of service. Hence, the support of SET operations in a non-secure environment without proper protection can have a negative effect on network operations.

SNMPv1 by itself is such an insecure environment. Even if the network itself is secure (for example by using IPSec), even then, there is no control as to who on the network is allowed to access and SET (change/create/delete) the objects in this MIB.

It is recommended that the implementers consider the security features as provided by the SNMPv3 framework. Specifically, the use of the User-based Security Model RFC 2574 [RFC2574] and the View-based Access Control Model RFC 2575 [RFC2575] is recommended.

It is then a customer/user responsibility to ensure that the SNMP entity giving access to this MIB, is properly configured to give access to those objects only to those principals (users) that have legitimate rights to access them.

Acknowledgements

This MIB module is based on the IGMP MIB authored by Keith McCloghrie, Dino Farinacci, and Dave Thaler. It was updated based on feedback from the IPNGWG working group, Bert Wijnen, Peder Norgaard, and extensive comments from Juergen Schoenwaelder.

References

- [RFC2710] Deering, S., Fenner, W. and B. Haberman, "Multicast Listener Discovery (MLD) for IPv6", RFC 2710, October 1999.
- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.
- [RFC2571] Harrington, D., Presuhn, R. and B. Wijnen, "An Architecture for Describing SNMP Management Frameworks", RFC 2571, April 1999.
- [RFC1155] Rose, M. and K. McCloghrie, "Structure and Identification of Management Information for TCP/IP-based Internets", STD 16, RFC 1155, May 1990.
- [RFC1212] Rose, M. and K. McCloghrie, "Concise MIB Definitions", STD 16, RFC 1212, March 1991.
- [RFC1215] Rose, M., "A Convention for Defining Traps for use with the SNMP", RFC 1215, March 1991.
- [RFC2578] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M. and S. Waldbusser, "Structure of Management Information Version 2 (SMIv2)", STD 58, RFC 2578, April 1999.
- [RFC2579] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M. and S. Waldbusser, "Textual Conventions for SMIv2", STD 58, RFC 2579, April 1999.
- [RFC2580] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M. and S. Waldbusser, "Conformance Statements for SMIv2", STD 58, RFC 2580, April 1999.
- [RFC1157] Case, J., Fedor, M., Schoffstall, M. and J. Davin, "Simple Network Management Protocol", STD 15, RFC 1157, May 1990.
- [RFC1901] Case, J., McCloghrie, K., Rose, M. and S. Waldbusser, "Introduction to Community-based SNMPv2", RFC 1901, January 1996.
- [RFC1906] Case, J., McCloghrie, K., Rose, M. and S. Waldbusser, "Transport Mappings for Version 2 of the Simple Network Management Protocol (SNMPv2)", RFC 1906, January 1996.

- [RFC2572] Case, J., Harrington D., Presuhn R. and B. Wijnen, "Message Processing and Dispatching for the Simple Network Management Protocol (SNMP)", RFC 2572, April 1999.
- [RFC2574] Blumenthal, U. and B. Wijnen, "User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3)", RFC 2574, April 1999.
- [RFC1905] Case, J., McCloghrie, K., Rose, M. and S. Waldbusser, "Protocol Operations for Version 2 of the Simple Network Management Protocol (SNMPv2)", RFC 1905, January 1996.
- [RFC2573] Levi, D., Meyer, P. and B. Stewart, "SNMPv3 Applications", RFC 2573, April 1999.
- [RFC2575] Wijnen, B., Presuhn, R. and K. McCloghrie, "View-based Access Control Model (VACM) for the Simple Network Management Protocol (SNMP)", RFC 2575, April 1999.
- [RFC2570] Case, J., Mundy, R., Partain, D. and B. Stewart, "Introduction to Version 3 of the Internet-standard Network Management Framework", RFC 2570, April 1999.

Authors' Addresses

Brian Haberman
Nortel Networks
4309 Emperor Blvd.
Suite 200
Durham, NC 27703
USA

Phone: +1-919-992-4439
EMail: haberman@nortelnetworks.com

Randy Worzella
IBM Corporation
800 Park Office Drive
Research Triangle Park, NC 27709
USA

Phone: +1-919-254-2202
EMail: worzella@us.ibm.com

Full Copyright Statement

Copyright (C) The Internet Society (2001). All Rights Reserved.

This document and translations of it may be copied and furnished to others, and derivative works that comment on or otherwise explain it or assist in its implementation may be prepared, copied, published and distributed, in whole or in part, without restriction of any kind, provided that the above copyright notice and this paragraph are included on all such copies and derivative works. However, this document itself may not be modified in any way, such as by removing the copyright notice or references to the Internet Society or other Internet organizations, except as needed for the purpose of developing Internet standards in which case the procedures for copyrights defined in the Internet Standards process must be followed, or as required to translate it into languages other than English.

The limited permissions granted above are perpetual and will not be revoked by the Internet Society or its successors or assigns.

This document and the information contained herein is provided on an "AS IS" basis and THE INTERNET SOCIETY AND THE INTERNET ENGINEERING TASK FORCE DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY THAT THE USE OF THE INFORMATION HEREIN WILL NOT INFRINGE ANY RIGHTS OR ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Acknowledgement

Funding for the RFC Editor function is currently provided by the Internet Society.

