MBONED WG   D. McWalter
Internet-Draft   Data Connection Ltd
Proposed Status: Standards Track   D. Thaler
Expires: September 2, 2007   Microsoft Corporation
                                                     A. Kessler
                                                   Cisco Systems
                                                  March 1, 2007

IP Multicast MIB
draft-ietf-mboned-ip-mcast-mib-05.txt

Status of this Memo

   By submitting this Internet-Draft, each author represents that any
   applicable patent or other IPR claims of which he or she is aware
   have been or will be disclosed, and any of which he or she becomes
   aware will be disclosed, in accordance with Section 6 of BCP 79.

   Internet-Drafts are working documents of the Internet Engineering
   Task Force (IETF), its areas, and its working groups. Note that
   other groups may also distribute working documents as Internet-
   Drafts.

   Internet-Drafts are draft documents valid for a maximum of six months
   and may be updated, replaced, or obsoleted by other documents at any
   time. It is inappropriate to use Internet-Drafts as reference
   material or to cite them other than as "work in progress."

   The list of current Internet-Drafts can be accessed at
   http://www.ietf.org/ietf/1id-abstracts.txt.

   The list of Internet-Draft Shadow Directories can be accessed at
   http://www.ietf.org/shadow.html.

   This Internet-Draft will expire on September 2, 2007.

Copyright Notice

Abstract

   This memo defines a portion of the Management Information Base (MIB)
   for use with network management protocols in the Internet community.
   In particular, it describes objects used for managing multicast
   function, independent of the specific multicast protocol(s) in use.
   This document obsoletes RFC 2932.

Table of Contents

1. **Introduction**

   This MIB describes objects used for managing IP multicast function,
   including IP multicast routing. These objects are independent of the
   specific multicast routing protocol in use. Managed objects specific
   to particular multicast protocols are defined elsewhere.

2. **History**

   This document obsoletes [RFC2932]. The MIB module defined by this
   document is a re-working of the MIB module from [RFC2932], with
   changes that include the following.

   o This MIB module includes support for IPv6 addressing and the IPv6
      scoped address architecture. [RFC2932] supported only IPv4.

   o This MIB module allows several multicast protocols to perform
      routing on a single interface, where [RFC2932] assumed each
      interface supported at most one multicast routing protocol.
      Multicast routing protocols are now per-route, see
      ipMcastRouteProtocol.

   o This MIB module includes objects that are not specific to
      multicast routing. It allows management of multicast function on
      systems that do not perform routing, whereas [RFC2932] was
      restricted to multicast routing.

   o This MIB module includes a table of Source-Specific Multicast
      (SSM) address ranges to which SSM semantics [RFC3569] should be
      applied.

   o This MIB module includes a table of local applications that are
      receiving multicast data.

   o This MIB module includes a table of multicast scope zones.

   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].

3. **The Internet-Standard Management Framework**

   For a detailed overview of the documents that describe the current
   Internet-Standard Management Framework, please refer to section 7 of
   [RFC3410].

   Managed objects are accessed via a virtual information store, termed
   the Management Information Base or MIB. MIB objects are generally

accessed through the Simple Network Management Protocol (SNMP).
Objects in the MIB are defined using the mechanisms defined in the
Structure of Management Information (SMI). This memo specifies a MIB
module that is compliant to the SMIv2, which is described in STD 58,
([RFC2578], [RFC2579] and [RFC2580]).

4. Overview

This MIB module contains two scalars and eight tables. The tables
are:

1. The IP Multicast Interface Table, which contains multicast
    information specific to interfaces.

2. The IP Multicast SSM Range Table, which contains one row per
    range of multicast group addresses to which Source-Specific
    Multicast semantics [RFC3569] should be applied.

3. The IP Multicast Route Table, which contains multicast routing
    information for IP datagrams sent by particular sources to the IP
    multicast groups known to a system.

4. The IP Multicast Routing Next Hop Table, which contains
    information about next-hops for the routing of IP multicast
    datagrams. Each entry is one of a list of next-hops on outgoing
    interfaces for particular sources sending to a particular
    multicast group address.

5. The IP Multicast Scope Boundary Table, which contains the
    boundaries configured for multicast scopes [RFC2365].

6. The IP Multicast Scope Name Table, which contains human-readable
    names for multicast scopes.

7. The IP Multicast Local Listener Table, which contains identifiers
    for local applications that are receiving multicast data.

8. The IP Multicast Zone Table, which contains an entry for each
    scope zone known to a system, and maps each zone to the multicast
    address range that is the corresponding scope.

This MIB module uses textual conventions defined in the IF-MIB
[RFC4293], the INET-ADDRESS-MIB [RFC4001] and the IANA-RTPROTO-MIB.

5. Definitions

IPMCAST-MIB DEFINITIONS ::= BEGIN

```
IMPORTS
     MODULE-IDENTITY, OBJECT-TYPE,
     mib-2, Unsigned32, Counter64,
     Gauge32, TimeTicks              FROM SNMPv2-SMI          -- [RFC2578]
     RowStatus, TruthValue,
     StorageType, TimeStamp          FROM SNMPv2-TC           -- [RFC2579]
     MODULE-COMPLIANCE, OBJECT-GROUP FROM SNMPv2-CONF         -- [RFC2580]
     CounterBasedGauge64             FROM HCNUM-TC            -- [RFC2856]
     InterfaceIndexOrZero,
     InterfaceIndex                  FROM IF-MIB              -- [RFC2863]
     IANAipRouteProtocol,
     IANAipMRouteProtocol            FROM IANA-RTPROTO-MIB
     SnmpAdminString                 FROM SNMP-FRAMEWORK-MIB -- [RFC3411]
     InetAddress, InetAddressType,
     InetAddressPrefixLength,
     InetZoneIndex, InetVersion      FROM INET-ADDRESS-MIB   -- [RFC4001]
     LangTag                         FROM LANGTAG-TC-MIB;    -- [RFCyyyy]
-- RFC Ed.: replace yyyy with LangTag RFC number & remove this note

ipMcastMIB MODULE-IDENTITY
     LAST-UPDATED "200703010000Z" -- 1 March 2007
     ORGANIZATION "IETF MBONE Deployment (MBONED) Working Group"
     CONTACT-INFO "David McWalter
                   Data Connection Limited
                   100 Church Street
                   Enfield, EN2 6BQ
                   UK

                   Phone: +44 208 366 1177
                   EMail: dmcw@dataconnection.com

                   Dave Thaler
                   Microsoft Corporation
                   One Microsoft Way
                   Redmond, WA 98052-6399
                   US

                   Phone: +1 425 703 8835
                   EMail: dthaler@dthaler.microsoft.com

                   Andrew Kessler
                   Cisco Systems
                   425 E. Tasman Drive
                   San Jose, CA 95134
                   US

                   Phone: +1 408 526 5139
                   EMail: kessler@cisco.com"
```

     DESCRIPTION
             "The MIB module for management of IP Multicast, including
             multicast routing, data forwarding, and data reception.

             Copyright (C) The IETF Trust (2007). This version of this
             MIB module is part of RFC yyyy; see the RFC itself for full
             legal notices."
-- RFC Ed.: replace yyyy with actual RFC number & remove this note
     REVISION   "200703010000Z" -- 1 March 2007
     DESCRIPTION "Initial version, published as RFC yyyy."
-- RFC Ed.: replace yyyy with actual RFC number & remove this note
     ::= { mib-2 XXX }
-- RFC Ed.: replace XXX with IANA-assigned number & remove this note

--
-- Top-level structure of the MIB
--

ipMcastMIBObjects OBJECT IDENTIFIER ::= { ipMcastMIB 1 }

ipMcast   OBJECT IDENTIFIER ::= { ipMcastMIBObjects 1 }

ipMcastEnable OBJECT-TYPE
    SYNTAX   INTEGER { enabled(1), disabled(2) }
    MAX-ACCESS read-write
    STATUS   current
    DESCRIPTION
            "The enabled status of IP Multicast function on this
            system."
    ::= { ipMcast 1 }

ipMcastRouteEntryCount OBJECT-TYPE
    SYNTAX   Gauge32
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
            "The number of rows in the ipMcastRouteTable. This can be
            used to check for multicast routing activity, and to monitor
            the multicast routing table size."
    ::= { ipMcast 2 }

--
-- The Multicast Interface Table
--

ipMcastInterfaceTable OBJECT-TYPE
    SYNTAX   SEQUENCE OF IpMcastInterfaceEntry
    MAX-ACCESS not-accessible

     STATUS   current
     DESCRIPTION
             "The (conceptual) table used to manage the multicast
             protocol active on an interface."
     ::= { ipMcast 3 }

ipMcastInterfaceEntry OBJECT-TYPE
     SYNTAX   IpMcastInterfaceEntry
     MAX-ACCESS not-accessible
     STATUS   current
     DESCRIPTION
             "An entry (conceptual row) containing the multicast protocol
             information for a particular interface."
     INDEX   { ipMcastInterfaceIPVersion,
                   ipMcastInterfaceIfIndex }
     ::= { ipMcastInterfaceTable 1 }

IpMcastInterfaceEntry ::= SEQUENCE {
     ipMcastInterfaceIPVersion   InetVersion,
     ipMcastInterfaceIfIndex   InterfaceIndex,
     ipMcastInterfaceTtl   Unsigned32,
     ipMcastInterfaceRateLimit   Unsigned32,
     ipMcastInterfaceInMcastOctets   Counter64,
     ipMcastInterfaceOutMcastOctets   Counter64,
     ipMcastInterfaceInMcastPkts   Counter64,
     ipMcastInterfaceOutMcastPkts   Counter64,
     ipMcastInterfaceDiscontinuityTime TimeStamp
}

ipMcastInterfaceIPVersion OBJECT-TYPE
     SYNTAX   InetVersion
     MAX-ACCESS not-accessible
     STATUS   current
     DESCRIPTION
           "The IP version of this row."
     ::= { ipMcastInterfaceEntry 1 }

ipMcastInterfaceIfIndex OBJECT-TYPE
     SYNTAX   InterfaceIndex
     MAX-ACCESS not-accessible
     STATUS   current
     DESCRIPTION
           "The index value that uniquely identifies the interface to
            which this entry is applicable. The interface identified by
            a particular value of this index is the same interface as
            identified by the same value of the IF-MIB's ifIndex."
     ::= { ipMcastInterfaceEntry 2 }

ipMcastInterfaceTtl OBJECT-TYPE
    SYNTAX   Unsigned32 (0..255)
    MAX-ACCESS read-write
    STATUS   current
    DESCRIPTION
            "The datagram TTL threshold for the interface. Any IP
            multicast datagrams with a TTL (IPv4) or Hop Limit (IPv6)
            less than this threshold will not be forwarded out the
            interface. The default value of 0 means all multicast
            packets are forwarded out the interface."
    DEFVAL   { 0 }
    ::= { ipMcastInterfaceEntry 3 }

ipMcastInterfaceRateLimit OBJECT-TYPE
    SYNTAX   Unsigned32
    MAX-ACCESS read-write
    STATUS   current
    DESCRIPTION
            "The rate-limit, in kilobits per second, of forwarded
            multicast traffic on the interface. A rate-limit of 0
            indicates that no rate limiting is done."
    DEFVAL   { 0 }
    ::= { ipMcastInterfaceEntry 4 }

ipMcastInterfaceInMcastOctets OBJECT-TYPE
    SYNTAX   Counter64
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
            "The number of octets of multicast packets that have arrived
            on the interface, including framing characters. This object
            is similar to ifInOctets in the Interfaces MIB, except that
            only multicast packets are counted.

            Discontinuities in the value of this counter can occur at
            re-initialization of the management system, and at other
            times as indicated by the value of
            ipMcastInterfaceDiscontinuityTime."
    REFERENCE "RFC 4293 ifInOctets"
     ::= { ipMcastInterfaceEntry 5 }

ipMcastInterfaceOutMcastOctets OBJECT-TYPE
    SYNTAX   Counter64
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
            "The number of octets of multicast packets that have been
            sent on the interface, including framing characters. This

            object is similar to ifOutOctets in the Interfaces MIB,
            except that only multicast packets are counted.

            Discontinuities in the value of this counter can occur at
            re-initialization of the management system, and at other
            times as indicated by the value of
            ipMcastInterfaceDiscontinuityTime."
   REFERENCE "RFC 4293 ifOutOctets"
    ::= { ipMcastInterfaceEntry 6 }

ipMcastInterfaceInMcastPkts OBJECT-TYPE
    SYNTAX   Counter64
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
            "The number of multicast packets that have arrived on the
            interface. In many cases, this object is identical to
            ifInMulticastPkts in the Interfaces MIB.

            However, some implementations use ifXTable for Layer 2
            traffic statistics and ipMcastInterfaceTable at Layer 3. In
            this case a difference between these objects probably
            indicates that some Layer 3 multicast packets are being
            transmitted as unicast at Layer 2.

            Discontinuities in the value of this counter can occur at
            re-initialization of the management system, and at other
            times as indicated by the value of
            ipMcastInterfaceDiscontinuityTime."
    REFERENCE "RFC 4293 ifInMulticastPkts"
    ::= { ipMcastInterfaceEntry 7 }

ipMcastInterfaceOutMcastPkts OBJECT-TYPE
    SYNTAX   Counter64
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
            "The number of multicast packets that have been sent on the
            interface. In many cases, this object is identical to
            ifOutMulticastPkts in the Interfaces MIB.

            However, some implementations use ifXTable for Layer 2
            traffic statistics and ipMcastInterfaceTable at Layer 3. In
            this case a difference between these objects probably
            indicates that some Layer 3 multicast packets are being
            transmitted as unicast at Layer 2.

            Discontinuities in the value of this counter can occur at

```
            re-initialization of the management system, and at other
            times as indicated by the value of
            ipMcastInterfaceDiscontinuityTime."
    REFERENCE "RFC 4293 ifOutMulticastPkts"
    ::= { ipMcastInterfaceEntry 8 }

ipMcastInterfaceDiscontinuityTime OBJECT-TYPE
    SYNTAX     TimeStamp
    MAX-ACCESS read-only
    STATUS     current
    DESCRIPTION
            "The value of sysUpTime on the most recent occasion at which
            any one or more of this entry's counters suffered a
            discontinuity.

            If no such discontinuities have occurred since the last re-
            initialization of the local management subsystem, then this
            object contains a zero value."
    ::= { ipMcastInterfaceEntry 9 }

--
-- The SSM Range Table
--

ipMcastSsmRangeTable OBJECT-TYPE
    SYNTAX     SEQUENCE OF IpMcastSsmRangeEntry
    MAX-ACCESS not-accessible
    STATUS     current
    DESCRIPTION
            "This table is used to create and manage the range(s) of
            group addresses to which SSM semantics should be applied."
    REFERENCE "RFC 3569"
    ::= { ipMcast 4 }

ipMcastSsmRangeEntry OBJECT-TYPE
    SYNTAX     IpMcastSsmRangeEntry
    MAX-ACCESS not-accessible
    STATUS     current
    DESCRIPTION
            "An entry (conceptual row) containing a range of group
            addresses to which SSM semantics should be applied."
    REFERENCE "RFC 3569"
    INDEX      { ipMcastSsmRangeAddressType,
                 ipMcastSsmRangeAddress,
                 ipMcastSsmRangePrefixLength }
    ::= { ipMcastSsmRangeTable 1 }

IpMcastSsmRangeEntry ::= SEQUENCE {
```

        ipMcastSsmRangeAddressType   InetAddressType,
        ipMcastSsmRangeAddress   InetAddress,
        ipMcastSsmRangePrefixLength   InetAddressPrefixLength,
        ipMcastSsmRangeRowStatus   RowStatus,
        ipMcastSsmRangeStorageType   StorageType
}

ipMcastSsmRangeAddressType OBJECT-TYPE
    SYNTAX   InetAddressType
    MAX-ACCESS not-accessible
    STATUS   current
    DESCRIPTION
            "The address type of the multicast group prefix."
    ::= { ipMcastSsmRangeEntry 1 }

ipMcastSsmRangeAddress OBJECT-TYPE
    SYNTAX   InetAddress (SIZE (4|8|16|20))
    MAX-ACCESS not-accessible
    STATUS   current
    DESCRIPTION
            "The multicast group address which, when combined with
            ipMcastSsmRangePrefixLength, gives the group prefix for this
            SSM range. The InetAddressType is given by
            ipMcastSsmRangeAddressType.

            This address object is only significant up to
            ipMcastSsmRangePrefixLength bits. The remainder of the
            address bits are zero. This is especially important for
            this index field, which is part of the index of this entry.
            Any non-zero bits would signify an entirely different
            entry.

            For IPv6 SSM address ranges, only ranges prefixed by
            FF3x::/16 are permitted, where 'x' is a valid IPv6 RFC 4291
            multicast address scope. The syntax of the address range is
            given by RFC 3306 sections 4 and 7.

            For addresses of type ipv4z or ipv6z, the appended zone
            index is significant even though it lies beyond the prefix
            length. The use of these address types indicate that this
            SSM range entry applies only within the given zone. Zone
            index zero is not valid in this table.

            If non-global scope SSM range entries are present, then
            consistent ipMcastBoundaryTable entries are required on
            routers at the zone boundary."
    REFERENCE "RFC 2365, RFC 4291 section 2.7, RFC 3306 sections 4, 6
            and 7"

```
    ::= { ipMcastSsmRangeEntry 2 }

ipMcastSsmRangePrefixLength OBJECT-TYPE
    SYNTAX      InetAddressPrefixLength (4..128)
    MAX-ACCESS not-accessible
    STATUS      current
    DESCRIPTION
            "The length in bits of the mask which, when combined with
            ipMcastSsmRangeAddress, gives the group prefix for this SSM
            range.  The InetAddressType is given by
            ipMcastSsmRangeAddressType.  For values 'ipv4' and 'ipv4z',
            this object must be in the range 4..32.  For values 'ipv6'
            and 'ipv6z', this object must be in the range 8..128."
    REFERENCE "RFC 2365, RFC 4291 section 2.7, RFC 3306 sections 4, 6
            and 7"
    ::= { ipMcastSsmRangeEntry 3 }

ipMcastSsmRangeRowStatus OBJECT-TYPE
    SYNTAX      RowStatus
    MAX-ACCESS read-create
    STATUS      current
    DESCRIPTION
            "The status of this row, by which rows in this table can
            be created and destroyed.

            This status object can be set to active(1) without setting
            any other columnar objects in this entry.

            All writeable objects in this entry can be modified when the
            status of this entry is active(1)."
    ::= { ipMcastSsmRangeEntry 4 }

ipMcastSsmRangeStorageType OBJECT-TYPE
    SYNTAX       StorageType
    MAX-ACCESS  read-create
    STATUS       current
    DESCRIPTION
            "The storage type for this row.  Rows having the value
            'permanent' need not allow write-access to any columnar
            objects in the row."
       DEFVAL { nonVolatile }
    ::= { ipMcastSsmRangeEntry 5 }

--
--  The IP Multicast Routing Table
--

ipMcastRouteTable OBJECT-TYPE
```

     SYNTAX   SEQUENCE OF IpMcastRouteEntry
     MAX-ACCESS not-accessible
     STATUS   current
     DESCRIPTION
             "The (conceptual) table containing multicast routing
             information for IP datagrams sent by particular sources to
             to the IP multicast groups known to this router."
     ::= { ipMcast 5 }

ipMcastRouteEntry OBJECT-TYPE
     SYNTAX   IpMcastRouteEntry
     MAX-ACCESS not-accessible
     STATUS   current
     DESCRIPTION
             "An entry (conceptual row) containing the multicast routing
             information for IP datagrams from a particular source and
             addressed to a particular IP multicast group address."
     INDEX   { ipMcastRouteGroupAddressType,
                   ipMcastRouteGroup,
                   ipMcastRouteGroupPrefixLength,
                   ipMcastRouteSourceAddressType,
                   ipMcastRouteSource,
                   ipMcastRouteSourcePrefixLength }
     ::= { ipMcastRouteTable 1 }

IpMcastRouteEntry ::= SEQUENCE {
     ipMcastRouteGroupAddressType   InetAddressType,
     ipMcastRouteGroup   InetAddress,
     ipMcastRouteGroupPrefixLength   InetAddressPrefixLength,
     ipMcastRouteSourceAddressType   InetAddressType,
     ipMcastRouteSource   InetAddress,
     ipMcastRouteSourcePrefixLength   InetAddressPrefixLength,
     ipMcastRouteUpstreamNeighborType InetAddressType,
     ipMcastRouteUpstreamNeighbor   InetAddress,
     ipMcastRouteInIfIndex   InterfaceIndexOrZero,
     ipMcastRouteTimeStamp   TimeStamp,
     ipMcastRouteExpiryTime   TimeTicks,
     ipMcastRouteProtocol   IANAipMRouteProtocol,
     ipMcastRouteRtProtocol   IANAipRouteProtocol,
     ipMcastRouteRtAddressType   InetAddressType,
     ipMcastRouteRtAddress   InetAddress,
     ipMcastRouteRtPrefixLength   InetAddressPrefixLength,
     ipMcastRouteRtType   INTEGER,
     ipMcastRouteOctets   Counter64,
     ipMcastRoutePkts   Counter64,
     ipMcastRouteTtlDropOctets   Counter64,
     ipMcastRouteTtlDropPackets   Counter64,
     ipMcastRouteDifferentInIfOctets   Counter64,

    ipMcastRouteDifferentInIfPackets Counter64,
    ipMcastRouteBps   CounterBasedGauge64
}

ipMcastRouteGroupAddressType OBJECT-TYPE
    SYNTAX   InetAddressType
    MAX-ACCESS not-accessible
    STATUS   current
    DESCRIPTION
            "A value indicating the address family of the address
            contained in ipMcastRouteGroup. Legal values correspond to
            the subset of address families for which multicast
            forwarding is supported."
    ::= { ipMcastRouteEntry 1 }

ipMcastRouteGroup OBJECT-TYPE
    SYNTAX   InetAddress (SIZE (0|4|8|16|20))
    MAX-ACCESS not-accessible
    STATUS   current
    DESCRIPTION
            "The IP multicast group address which, when combined with
            the corresponding value specified in
            ipMcastRouteGroupPrefixLength, identifies the groups for
            which this entry contains multicast routing information.

            This address object is only significant up to
            ipMcastRouteGroupPrefixLength bits. The remainder of the
            address bits are zero. This is especially important for
            this index field, which is part of the index of this entry.
            Any non-zero bits would signify an entirely different
            entry.

            For addresses of type ipv4z or ipv6z, the appended zone
            index is significant even though it lies beyond the prefix
            length. The use of these address types indicate that this
            forwarding state applies only within the given zone. Zone
            index zero is not valid in this table."
    ::= { ipMcastRouteEntry 2 }

ipMcastRouteGroupPrefixLength OBJECT-TYPE
    SYNTAX   InetAddressPrefixLength (4..128)
    MAX-ACCESS not-accessible
    STATUS   current
    DESCRIPTION
            "The length in bits of the mask which, when combined with
            the corresponding value of ipMcastRouteGroup, identifies the
            groups for which this entry contains multicast routing
            information."

        ::= { ipMcastRouteEntry 3 }

ipMcastRouteSourceAddressType OBJECT-TYPE
    SYNTAX   InetAddressType
    MAX-ACCESS not-accessible
    STATUS   current
    DESCRIPTION
            "A value indicating the address family of the address
            contained in ipMcastRouteSource. The value MUST be the same
            as the value of ipMcastRouteGroupType."
    ::= { ipMcastRouteEntry 4 }

ipMcastRouteSource OBJECT-TYPE
    SYNTAX   InetAddress (SIZE (0|4|8|16|20))
    MAX-ACCESS not-accessible
    STATUS   current
    DESCRIPTION
            "The network address which, when combined with the
            corresponding value of ipMcastRouteSourcePrefixLength,
            identifies the sources for which this entry contains
            multicast routing information.

            This address object is only significant up to
            ipMcastRouteGroupPrefixLength bits. The remainder of the
            address bits are zero. This is especially important for
            this index field, which is part of the index of this entry.
            Any non-zero bits would signify an entirely different
            entry.

            For addresses of type ipv4z or ipv6z, the appended zone
            index is significant even though it lies beyond the prefix
            length. The use of these address types indicate that this
            source address applies only within the given zone. Zone
            index zero is not valid in this table."
    ::= { ipMcastRouteEntry 5 }

ipMcastRouteSourcePrefixLength OBJECT-TYPE
    SYNTAX   InetAddressPrefixLength (4..128)
    MAX-ACCESS not-accessible
    STATUS   current
    DESCRIPTION
            "The length in bits of the mask which, when combined with
            the corresponding value of ipMcastRouteSource, identifies
            the sources for which this entry contains multicast routing
            information."
    ::= { ipMcastRouteEntry 6 }

ipMcastRouteUpstreamNeighborType OBJECT-TYPE

```
     SYNTAX     InetAddressType
     MAX-ACCESS read-only
     STATUS     current
     DESCRIPTION
             "A value indicating the address family of the address
             contained in ipMcastRouteUpstreamNeighbor.

             An address type of unknown(0) indicates that the upstream
             neighbor is unknown, for example in BIDIR-PIM."
     REFERENCE "I-D.ietf-pim-bidir"
     ::= { ipMcastRouteEntry 7 }

ipMcastRouteUpstreamNeighbor OBJECT-TYPE
     SYNTAX     InetAddress (SIZE (0|4|8|16|20))
     MAX-ACCESS read-only
     STATUS     current
     DESCRIPTION
             "The address of the upstream neighbor (for example, RPF
             neighbor) from which IP datagrams from these sources to
             this multicast address are received."
     ::= { ipMcastRouteEntry 8 }

ipMcastRouteInIfIndex OBJECT-TYPE
     SYNTAX     InterfaceIndexOrZero
     MAX-ACCESS read-only
     STATUS     current
     DESCRIPTION
             "The value of ifIndex for the interface on which IP
             datagrams sent by these sources to this multicast address
             are received.  A value of 0 indicates that datagrams are not
             subject to an incoming interface check, but may be accepted
             on multiple interfaces (for example, in BIDIR-PIM)."
     REFERENCE "I-D.ietf-pim-bidir"
     ::= { ipMcastRouteEntry 9 }

ipMcastRouteTimeStamp OBJECT-TYPE
     SYNTAX     TimeStamp
     MAX-ACCESS read-only
     STATUS     current
     DESCRIPTION
             "The value of sysUpTime at which the multicast routing
             information represented by this entry was learned by the
             router.

             If this infomration was present at the most recent re-
             initialization of the local management subsystem, then this
             object contains a zero value."
     ::= { ipMcastRouteEntry 10 }
```

ipMcastRouteExpiryTime OBJECT-TYPE
    SYNTAX   TimeTicks
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
            "The minimum amount of time remaining before this entry will
            be aged out. The value 0 indicates that the entry is not
            subject to aging. If ipMcastRouteNextHopState is pruned(1),
            this object represents the remaining time until the prune
            expires. If this timer expires, state reverts to
            forwarding(2). Otherwise, this object represents the time
            until this entry is removed from the table."
    ::= { ipMcastRouteEntry 11 }

ipMcastRouteProtocol OBJECT-TYPE
    SYNTAX   IANAipMRouteProtocol
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
            "The multicast routing protocol via which this multicast
            forwarding entry was learned."
    ::= { ipMcastRouteEntry 12 }

ipMcastRouteRtProtocol OBJECT-TYPE
    SYNTAX   IANAipRouteProtocol
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
            "The routing mechanism via which the route used to find the
            upstream or parent interface for this multicast forwarding
            entry was learned."
    ::= { ipMcastRouteEntry 13 }

ipMcastRouteRtAddressType OBJECT-TYPE
    SYNTAX   InetAddressType
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
            "A value indicating the address family of the address
            contained in ipMcastRouteRtAddress."
    ::= { ipMcastRouteEntry 14 }

ipMcastRouteRtAddress OBJECT-TYPE
    SYNTAX   InetAddress (SIZE (0|4|8|16|20))
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
            "The address portion of the route used to find the upstream

            or parent interface for this multicast forwarding entry.

            This address object is only significant up to
            ipMcastRouteGroupPrefixLength bits. The remainder of the
            address bits are zero.

            For addresses of type ipv4z or ipv6z, the appended zone
            index is significant even though it lies beyond the prefix
            length. The use of these address types indicate that this
            forwarding state applies only within the given zone. Zone
            index zero is not valid in this table."
    ::= { ipMcastRouteEntry 15 }

ipMcastRouteRtPrefixLength OBJECT-TYPE
    SYNTAX   InetAddressPrefixLength (4..128)
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
            "The length in bits of the mask associated with the route
            used to find the upstream or parent interface for this
            multicast forwarding entry."
    ::= { ipMcastRouteEntry 16 }

ipMcastRouteRtType OBJECT-TYPE
    SYNTAX   INTEGER {
                unicast (1), -- Unicast route used in multicast RIB
                multicast (2) -- Multicast route
               }
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
            "The reason the given route was placed in the (logical)
            multicast Routing Information Base (RIB). A value of
            unicast means that the route would normally be placed only
            in the unicast RIB, but was placed in the multicast RIB
            (instead or in addition) due to local configuration, such as
            when running PIM over RIP. A value of multicast means that
            the route was explicitly added to the multicast RIB by the
            routing protocol, such as DVMRP or Multiprotocol BGP."
    ::= { ipMcastRouteEntry 17 }

ipMcastRouteOctets OBJECT-TYPE
    SYNTAX   Counter64
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
            "The number of octets contained in IP datagrams which were
            received from these sources and addressed to this multicast

               group address, and which were forwarded by this router.

               Discontinuities in this monotonically increasing value
               occur at re-initialization of the management system.
               Discontinuities can also occur as a result of routes being
               removed and replaced, which can be detected by observing
               the value of ipMcastRouteTimeStamp."
        ::= { ipMcastRouteEntry 18 }

ipMcastRoutePkts OBJECT-TYPE
    SYNTAX   Counter64
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
               "The number of packets routed using this multicast route
               entry.

               Discontinuities in this monotonically increasing value
               occur at re-initialization of the management system.
               Discontinuities can also occur as a result of routes being
               removed and replaced, which can be detected by observing
               the value of ipMcastRouteTimeStamp."
        ::= { ipMcastRouteEntry 19 }

ipMcastRouteTtlDropOctets OBJECT-TYPE
    SYNTAX   Counter64
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
               "The number of octets contained in IP datagrams which this
               router has received from these sources and addressed to this
               multicast group address, which were dropped because the TTL
               (IPv4) or Hop Limit (IPv6) was decremented to zero, or to a
               value less than ipMcastInterfaceTtl for all next hops.

               Discontinuities in this monotonically increasing value
               occur at re-initialization of the management system.
               Discontinuities can also occur as a result of routes being
               removed and replaced, which can be detected by observing
               the value of ipMcastRouteTimeStamp."
        ::= { ipMcastRouteEntry 20 }

ipMcastRouteTtlDropPackets OBJECT-TYPE
    SYNTAX   Counter64
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
               "The number of packets which this router has received from

these sources and addressed to this multicast group address,
which were dropped because the TTL (IPv4) or Hop Limit
(IPv6) was decremented to zero, or to a value less than
ipMcastInterfaceTtl for all next hops.

Discontinuities in this monotonically increasing value
occur at re-initialization of the management system.
Discontinuities can also occur as a result of routes being
removed and replaced, which can be detected by observing
the value of ipMcastRouteTimeStamp."
    ::= { ipMcastRouteEntry 21 }

ipMcastRouteDifferentInIfOctets OBJECT-TYPE
    SYNTAX   Counter64
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
            "The number of octets contained in IP datagrams which this
            router has received from these sources and addressed to this
            multicast group address, which were dropped because they
            were received on an unexpected interface.

            For RPF checking protocols (such as PIM-SM), these packets
            arrived on interfaces other than ipMcastRouteInIfIndex, and
            were dropped because of this failed RPF check. (RPF paths
            are 'Reverse Path Forwarding' path; the unicast routes to
            the expected origin of multicast data flows).

            Other protocols may drop packets on an incoming interface
            check for different reasons (for example, BIDIR-PIM performs
            a DF check on receipt of packets). All packets dropped as a
            result of an incoming interface check are counted here.

            If this counter increases rapidly, this indicates a problem.
            A significant quantity of multicast data is arriving at this
            router on unexpected interfaces, and is not being forwarded.

            For guidance, if the rate of increase of this counter
            exceeds 1% of the rate of increase of ipMcastRouteOctets,
            then there are multicast routing problems that require
            investigation.

            Discontinuities in this monotonically increasing value
            occur at re-initialization of the management system.
            Discontinuities can also occur as a result of routes being
            removed and replaced, which can be detected by observing
            the value of ipMcastRouteTimeStamp."
    REFERENCE "RFC 4601 and I-D.ietf-pim-bidir"

     ::= { ipMcastRouteEntry 22 }

ipMcastRouteDifferentInIfPackets OBJECT-TYPE
    SYNTAX   Counter64
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
            "The number of packets which this router has received from
            these sources and addressed to this multicast group address,
            which were dropped because they were received on an
            unexpected interface.

            For RPF checking protocols (such as PIM-SM), these packets
            arrived on interfaces other than ipMcastRouteInIfIndex, and
            were dropped because of this failed RPF check. (RPF paths
            are 'Reverse Path Forwarding' path; the unicast routes to
            the expected origin of multicast data flows).

            Other protocols may drop packets on an incoming interface
            check for different reasons (for example, BIDIR-PIM performs
            a DF check on receipt of packets). All packets dropped as a
            result of an incoming interface check are counted here.

            If this counter increases rapidly, this indicates a problem.
            A significant quantity of multicast data is arriving at this
            router on unexpected interfaces, and is not being forwarded.

            For guidance, if the rate of increase of this counter
            exceeds 1% of the rate of increase of ipMcastRoutePkts, then
            there are multicast routing problems that require
            investigation.

            Discontinuities in this monotonically increasing value
            occur at re-initialization of the management system.
            Discontinuities can also occur as a result of routes being
            removed and replaced, which can be detected by observing
            the value of ipMcastRouteTimeStamp."
    REFERENCE "RFC 4601 and I-D.ietf-pim-bidir"
    ::= { ipMcastRouteEntry 23 }

ipMcastRouteBps OBJECT-TYPE
    SYNTAX   CounterBasedGauge64
    UNITS   "bits per second"
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
            "Bits per second forwarded by this router using this
            multicast routing entry.

            This value is a sample; it is the number of bits forwarded
            during the last whole 1 second sampling period. The value
            during the current 1 second sampling period is not made
            available until the period is completed.

            The quantity being sampled is the same as that measured by
            ipMcastRouteOctets. The units and the sampling method are
            different."
    ::= { ipMcastRouteEntry 24 }
--
-- The IP Multicast Routing Next Hop Table
--

ipMcastRouteNextHopTable OBJECT-TYPE
    SYNTAX   SEQUENCE OF IpMcastRouteNextHopEntry
    MAX-ACCESS not-accessible
    STATUS   current
    DESCRIPTION
            "The (conceptual) table containing information on the
            next-hops on outgoing interfaces for routing IP multicast
            datagrams. Each entry is one of a list of next-hops on
            outgoing interfaces for particular sources sending to a
            particular multicast group address."
    ::= { ipMcast 6 }

ipMcastRouteNextHopEntry OBJECT-TYPE
    SYNTAX   IpMcastRouteNextHopEntry
    MAX-ACCESS not-accessible
    STATUS   current
    DESCRIPTION
            "An entry (conceptual row) in the list of next-hops on
            outgoing interfaces to which IP multicast datagrams from
            particular sources to an IP multicast group address are
            routed."
    INDEX   { ipMcastRouteNextHopGroupAddressType,
                  ipMcastRouteNextHopGroup,
                  ipMcastRouteNextHopGroupPrefixLength,
                  ipMcastRouteNextHopSourceAddressType,
                  ipMcastRouteNextHopSource,
                  ipMcastRouteNextHopSourcePrefixLength,
                  ipMcastRouteNextHopIfIndex,
                  ipMcastRouteNextHopAddressType,
                  ipMcastRouteNextHopAddress }
    ::= { ipMcastRouteNextHopTable 1 }

IpMcastRouteNextHopEntry ::= SEQUENCE {
    ipMcastRouteNextHopGroupAddressType   InetAddressType,
    ipMcastRouteNextHopGroup   InetAddress,

```
    ipMcastRouteNextHopGroupPrefixLength   InetAddressPrefixLength,
    ipMcastRouteNextHopSourceAddressType   InetAddressType,
    ipMcastRouteNextHopSource              InetAddress,
    ipMcastRouteNextHopSourcePrefixLength  InetAddressPrefixLength,
    ipMcastRouteNextHopIfIndex             InterfaceIndex,
    ipMcastRouteNextHopAddressType         InetAddressType,
    ipMcastRouteNextHopAddress             InetAddress,
    ipMcastRouteNextHopState               INTEGER,
    ipMcastRouteNextHopTimeStamp           TimeStamp,
    ipMcastRouteNextHopExpiryTime          TimeTicks,
    ipMcastRouteNextHopClosestMemberHops   Unsigned32,
    ipMcastRouteNextHopProtocol            IANAipMRouteProtocol,
    ipMcastRouteNextHopOctets              Counter64,
    ipMcastRouteNextHopPkts                Counter64
}

ipMcastRouteNextHopGroupAddressType OBJECT-TYPE
    SYNTAX     InetAddressType
    MAX-ACCESS not-accessible
    STATUS     current
    DESCRIPTION
            "A value indicating the address family of the address
            contained in ipMcastRouteNextHopGroup.  Legal values
            correspond to the subset of address families for which
            multicast forwarding is supported."
    ::= { ipMcastRouteNextHopEntry 1 }

ipMcastRouteNextHopGroup OBJECT-TYPE
    SYNTAX     InetAddress (SIZE (0|4|8|16|20))
    MAX-ACCESS not-accessible
    STATUS     current
    DESCRIPTION
            "The IP multicast group address which, when combined with
            the corresponding value specified in
            ipMcastRouteNextHopGroupPrefixLength, identifies the groups
            for which this entry contains multicast forwarding
            information.

            This address object is only significant up to
            ipMcastRouteNextHopGroupPrefixLength bits.  The remainder of
            the address bits are zero.  This is especially important for
            this index field, which is part of the index of this entry.
            Any non-zero bits would signify an entirely different
            entry.

            For addresses of type ipv4z or ipv6z, the appended zone
            index is significant even though it lies beyond the prefix
            length.  The use of these address types indicate that this
```

              forwarding state applies only within the given zone. Zone
              index zero is not valid in this table."
      ::= { ipMcastRouteNextHopEntry 2 }

ipMcastRouteNextHopGroupPrefixLength OBJECT-TYPE
      SYNTAX   InetAddressPrefixLength (4..128)
      MAX-ACCESS not-accessible
      STATUS   current
      DESCRIPTION
              "The length in bits of the mask which, when combined with
              the corresponding value of ipMcastRouteGroup, identifies the
              groups for which this entry contains multicast routing
              information."
      ::= { ipMcastRouteNextHopEntry 3 }

ipMcastRouteNextHopSourceAddressType OBJECT-TYPE
      SYNTAX   InetAddressType
      MAX-ACCESS not-accessible
      STATUS   current
      DESCRIPTION
              "A value indicating the address family of the address
              contained in ipMcastRouteNextHopSource. The value MUST be
              the same as the value of ipMcastRouteNextHopGroupType."
      ::= { ipMcastRouteNextHopEntry 4 }

ipMcastRouteNextHopSource OBJECT-TYPE
      SYNTAX   InetAddress (SIZE (0|4|8|16|20))
      MAX-ACCESS not-accessible
      STATUS   current
      DESCRIPTION
              "The network address which, when combined with the
              corresponding value of the mask specified in
              ipMcastRouteNextHopSourcePrefixLength, identifies the
              sources for which this entry specifies a next-hop on an
              outgoing interface.

              This address object is only significant up to
              ipMcastRouteNextHopSourcePrefixLength bits. The remainder
              of the address bits are zero. This is especially important
              for this index field, which is part of the index of this
              entry. Any non-zero bits would signify an entirely
              different entry.

              For addresses of type ipv4z or ipv6z, the appended zone
              index is significant even though it lies beyond the prefix
              length. The use of these address types indicate that this
              source address applies only within the given zone. Zone
              index zero is not valid in this table."

        ::= { ipMcastRouteNextHopEntry 5 }

ipMcastRouteNextHopSourcePrefixLength OBJECT-TYPE
    SYNTAX   InetAddressPrefixLength (4..128)
    MAX-ACCESS not-accessible
    STATUS   current
    DESCRIPTION
            "The length in bits of the mask which, when combined with
            the corresponding value specified in
            ipMcastRouteNextHopSource, identifies the sources for which
            this entry specifies a next-hop on an outgoing interface."
    ::= { ipMcastRouteNextHopEntry 6 }

ipMcastRouteNextHopIfIndex OBJECT-TYPE
    SYNTAX   InterfaceIndex
    MAX-ACCESS not-accessible
    STATUS   current
    DESCRIPTION
            "The ifIndex value of the interface for the outgoing
            interface for this next-hop."
    ::= { ipMcastRouteNextHopEntry 7 }

ipMcastRouteNextHopAddressType OBJECT-TYPE
    SYNTAX   InetAddressType
    MAX-ACCESS not-accessible
    STATUS   current
    DESCRIPTION
            "A value indicating the address family of the address
            contained in ipMcastRouteNextHopAddress."
    ::= { ipMcastRouteNextHopEntry 8 }

ipMcastRouteNextHopAddress OBJECT-TYPE
    SYNTAX   InetAddress (SIZE (0|4|8|16|20))
    MAX-ACCESS not-accessible
    STATUS   current
    DESCRIPTION
            "The address of the next-hop specific to this entry. For
            most interfaces, this is identical to
            ipMcastRouteNextHopGroup. NBMA interfaces, however, may
            have multiple next-hop addresses out a single outgoing
            interface."
    ::= { ipMcastRouteNextHopEntry 9 }

ipMcastRouteNextHopState OBJECT-TYPE
    SYNTAX   INTEGER { pruned(1), forwarding(2) }
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION

            "An indication of whether the outgoing interface and next-
            hop represented by this entry is currently being used to
            forward IP datagrams. The value 'forwarding' indicates it
            is currently being used; the value 'pruned' indicates it is
            not."
    ::= { ipMcastRouteNextHopEntry 10 }

ipMcastRouteNextHopTimeStamp OBJECT-TYPE
    SYNTAX   TimeStamp
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
            "The value of sysUpTime at which the multicast routing
            information represented by this entry was learned by the
            router.

            If this infomration was present at the most recent re-
            initialization of the local management subsystem, then this
            object contains a zero value."
    ::= { ipMcastRouteNextHopEntry 11 }

ipMcastRouteNextHopExpiryTime OBJECT-TYPE
    SYNTAX   TimeTicks
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
            "The minimum amount of time remaining before this entry will
            be aged out. If ipMcastRouteNextHopState is pruned(1), the
            remaining time until the prune expires and the state reverts
            to forwarding(2). Otherwise, the remaining time until this
            entry is removed from the table. The time remaining may be
            copied from ipMcastRouteExpiryTime if the protocol in use
            for this entry does not specify next-hop timers. The value
            0 indicates that the entry is not subject to aging."
    ::= { ipMcastRouteNextHopEntry 12 }

ipMcastRouteNextHopClosestMemberHops OBJECT-TYPE
    SYNTAX   Unsigned32 (0..255)
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
            "The minimum number of hops between this router and any
            member of this IP multicast group reached via this next-hop
            on this outgoing interface. Any IP multicast datagrams for
            the group which have a TTL (IPv4) or Hop Count (IPv6) less
            than this number of hops will not be forwarded to this
            next-hop.

            This is an optimization applied by multicast routing
            protocols that explicitly track hop counts to downstream
            listeners. Multicast protocols that are not aware of hop
            counts to downstream listeners set this object to zero."
    ::= { ipMcastRouteNextHopEntry 13 }

ipMcastRouteNextHopProtocol OBJECT-TYPE
    SYNTAX   IANAipMRouteProtocol
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
            "The routing mechanism via which this next-hop was learned."
    ::= { ipMcastRouteNextHopEntry 14 }

ipMcastRouteNextHopOctets OBJECT-TYPE
    SYNTAX   Counter64
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
            "The number of octets of multicast packets that have been
            forwarded using this route.

            Discontinuities in this monotonically increasing value
            occur at re-initialization of the management system.
            Discontinuities can also occur as a result of routes being
            removed and replaced, which can be detected by observing
            the value of ipMcastRouteNextHopTimeStamp."
    ::= { ipMcastRouteNextHopEntry 15 }

ipMcastRouteNextHopPkts OBJECT-TYPE
    SYNTAX   Counter64
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
            "The number of packets which have been forwarded using this
            route.

            Discontinuities in this monotonically increasing value
            occur at re-initialization of the management system.
            Discontinuities can also occur as a result of routes being
            removed and replaced, which can be detected by observing
            the value of ipMcastRouteNextHopTimeStamp."
    ::= { ipMcastRouteNextHopEntry 16 }

--
-- The IP Multicast Scope Boundary Table
--

```
ipMcastBoundaryTable OBJECT-TYPE
    SYNTAX     SEQUENCE OF IpMcastBoundaryEntry
    MAX-ACCESS not-accessible
    STATUS     current
    DESCRIPTION
            "The (conceptual) table listing the system's multicast scope
            zone boundaries."
    REFERENCE "RFC 4007 section 5"
    ::= { ipMcast 7 }

ipMcastBoundaryEntry OBJECT-TYPE
    SYNTAX     IpMcastBoundaryEntry
    MAX-ACCESS not-accessible
    STATUS     current
    DESCRIPTION
            "An entry (conceptual row) describing one of this device's
            multicast scope zone boundaries."
    REFERENCE "RFC 2365 section 5, RFC 4007 section 5"
    INDEX     { ipMcastBoundaryIfIndex,
                ipMcastBoundaryAddressType,
                ipMcastBoundaryAddress,
                ipMcastBoundaryAddressPrefixLength }
    ::= { ipMcastBoundaryTable 1 }

IpMcastBoundaryEntry ::= SEQUENCE {
    ipMcastBoundaryIfIndex               InterfaceIndex,
    ipMcastBoundaryAddressType           InetAddressType,
    ipMcastBoundaryAddress               InetAddress,
    ipMcastBoundaryAddressPrefixLength   InetAddressPrefixLength,
    ipMcastBoundaryTimeStamp             TimeStamp,
    ipMcastBoundaryDroppedMcastOctets    Counter64,
    ipMcastBoundaryDroppedMcastPkts      Counter64,
    ipMcastBoundaryStatus                RowStatus,
    ipMcastBoundaryStorageType           StorageType
}

ipMcastBoundaryIfIndex OBJECT-TYPE
    SYNTAX     InterfaceIndex
    MAX-ACCESS not-accessible
    STATUS     current
    DESCRIPTION
            "The IfIndex value for the interface to which this boundary
            applies.  Packets with a destination address in the
            associated address/mask range will not be forwarded over
            this interface.

            For IPv4, zone boundaries cut through links.  Therefore this
            is an external interface.  This may be either a physical or
```

            virtual interface (tunnel, encapsulation, and so forth.)

            For IPv6, zone boundaries cut through nodes. Therefore this
            is a virtual interface within the node. This is not an
            external interface, either real or virtual. Packets
            crossing this interface neither arrive at nor leave the
            node, but only move between zones within the node."
    REFERENCE "RFC 2365 section 5, RFC 4007 section 5"
    ::= { ipMcastBoundaryEntry 1 }

ipMcastBoundaryAddressType OBJECT-TYPE
    SYNTAX   InetAddressType
    MAX-ACCESS not-accessible
    STATUS   current
    DESCRIPTION
            "A value indicating the address family of the address
            contained in ipMcastBoundaryAddress. Legal values
            correspond to the subset of address families for which
            multicast forwarding is supported."
    ::= { ipMcastBoundaryEntry 2 }

ipMcastBoundaryAddress OBJECT-TYPE
    SYNTAX   InetAddress (SIZE (0|4|8|16|20))
    MAX-ACCESS not-accessible
    STATUS   current
    DESCRIPTION
            "The group address which, when combined with the
            corresponding value of ipMcastBoundaryAddressPrefixLength,
            identifies the group range for which the scoped boundary
            exists. Scoped IPv4 multicast address ranges must be
            prefixed by 239.0.0.0/8. Scoped IPv6 multicast address
            ranges are FF0x::/16, where x is a valid RFC 4291 multicast
            scope.

            An IPv6 address prefixed by FF1x::/16 is a non-permanently-
            assigned address. An IPv6 address prefixed by FF3x::/16 is
            a unicast-prefix-based multicast addresses. A zone boundary
            for FF0x::/16 implies an identical boundary for these other
            prefixes. No separate FF1x::/16 or FF3x::/16 entries exist
            in this table.

            This address object is only significant up to
            ipMcastBoundaryAddressPrefixLength bits. The remainder of
            the address bits are zero. This is especially important for
            this index field, which is part of the index of this entry.
            Any non-zero bits would signify an entirely different
            entry.

                    For addresses of type ipv4z or ipv6z, the appended zone
                    index is significant even though it lies beyond the prefix
                    length. Zone index zero is not valid in this table."
          REFERENCE "RFC 2365, RFC 3306 section 4, RFC 4291 section 2.7"
          ::= { ipMcastBoundaryEntry 3 }

ipMcastBoundaryAddressPrefixLength OBJECT-TYPE
     SYNTAX   InetAddressPrefixLength (4..32)
     MAX-ACCESS not-accessible
     STATUS   current
     DESCRIPTION
                    "The length in bits of the mask which when, combined with
                    the corresponding value of ipMcastBoundaryAddress,
                    identifies the group range for which the scoped boundary
                    exists.

                    The InetAddressType is given by ipMcastBoundaryAddressType.
                    For 'ipv4' this object must be in the range 4..32. For
                    'ipv6', this object must be 16."
          ::= { ipMcastBoundaryEntry 4 }

ipMcastBoundaryTimeStamp OBJECT-TYPE
     SYNTAX   TimeStamp
     MAX-ACCESS read-only
     STATUS   current
     DESCRIPTION
                    "The value of sysUpTime at which the multicast boundary
                    information represented by this entry was learned by the
                    router.

                    If this infomration was present at the most recent re-
                    initialization of the local management subsystem, then this
                    object contains a zero value."
          ::= { ipMcastBoundaryEntry 5 }

ipMcastBoundaryDroppedMcastOctets OBJECT-TYPE
     SYNTAX   Counter64
     MAX-ACCESS read-only
     STATUS   current
     DESCRIPTION
                    "The number of octets of multicast packets that have been
                    dropped as a result of this zone boundary configuration.

                    Discontinuities in this monotonically increasing value
                    occur at re-initialization of the management system.
                    Discontinuities can also occur as a result of boundary
                    configuration being removed and replaced, which can be
                    detected by observing the value of

```
             ipMcastBoundaryTimeStamp."
     ::= { ipMcastBoundaryEntry 6 }


ipMcastBoundaryDroppedMcastPkts OBJECT-TYPE
     SYNTAX      Counter64
     MAX-ACCESS read-only
     STATUS      current
     DESCRIPTION
             "The number of multicast packets that have been dropped as a
             result of this zone boundary configuration.

             Discontinuities in this monotonically increasing value
             occur at re-initialization of the management system.
             Discontinuities can also occur as a result of boundary
             configuration being removed and replaced, which can be
             detected by observing the value of
             ipMcastBoundaryTimeStamp."
     ::= { ipMcastBoundaryEntry 7 }


ipMcastBoundaryStatus OBJECT-TYPE
     SYNTAX      RowStatus
     MAX-ACCESS read-create
     STATUS      current
     DESCRIPTION
             "The status of this row, by which rows in this table can
             be created and destroyed.

             This status object can be set to active(1) without setting
             any other columnar objects in this entry.

             All writeable objects in this entry can be modified when the
             status of this entry is active(1)."
     ::= { ipMcastBoundaryEntry 8 }

ipMcastBoundaryStorageType OBJECT-TYPE
     SYNTAX       StorageType
     MAX-ACCESS  read-create
     STATUS       current
     DESCRIPTION
            "The storage type for this row.  Rows having the value
            'permanent' need not allow write-access to any columnar
            objects in the row."
       DEFVAL { nonVolatile }
     ::= { ipMcastBoundaryEntry 9 }

--
--  The IP Multicast Scope Name Table
--
```

ipMcastScopeNameTable OBJECT-TYPE
    SYNTAX   SEQUENCE OF IpMcastScopeNameEntry
    MAX-ACCESS not-accessible
    STATUS   current
    DESCRIPTION
            "The (conceptual) table listing multicast scope names."
    REFERENCE "RFC 4007 section 4"
    ::= { ipMcast 8 }

ipMcastScopeNameEntry OBJECT-TYPE
    SYNTAX   IpMcastScopeNameEntry
    MAX-ACCESS not-accessible
    STATUS   current
    DESCRIPTION
            "An entry (conceptual row) that names a multicast address
            scope."
    REFERENCE "RFC 4007 section 4"
    INDEX   { ipMcastScopeNameAddressType,
                  ipMcastScopeNameAddress,
                  ipMcastScopeNameAddressPrefixLength,
                  IMPLIED ipMcastScopeNameLanguage }
    ::= { ipMcastScopeNameTable 1 }

IpMcastScopeNameEntry ::= SEQUENCE {
    ipMcastScopeNameAddressType   InetAddressType,
    ipMcastScopeNameAddress   InetAddress,
    ipMcastScopeNameAddressPrefixLength InetAddressPrefixLength,
    ipMcastScopeNameLanguage   LangTag,
    ipMcastScopeNameString   SnmpAdminString,
    ipMcastScopeNameDefault   TruthValue,
    ipMcastScopeNameStatus   RowStatus,
    ipMcastScopeNameStorageType   StorageType
}

ipMcastScopeNameAddressType OBJECT-TYPE
    SYNTAX   InetAddressType
    MAX-ACCESS not-accessible
    STATUS   current
    DESCRIPTION
            "A value indicating the address family of the address
            contained in ipMcastScopeNameAddress. Legal values
            correspond to the subset of address families for which
            multicast forwarding is supported."
    ::= { ipMcastScopeNameEntry 1 }

ipMcastScopeNameAddress OBJECT-TYPE
    SYNTAX   InetAddress (SIZE (0|4|8|16|20))
    MAX-ACCESS not-accessible

      STATUS   current
      DESCRIPTION
              "The group address which, when combined with the
              corresponding value of ipMcastScopeNameAddressPrefixLength,
              identifies the group range associated with the multicast
              scope. Scoped IPv4 multicast address ranges must be
              prefixed by 239.0.0.0/8. Scoped IPv6 multicast address
              ranges are FF0x::/16, where x is a valid RFC 4291 multicast
              scope.

              An IPv6 address prefixed by FF1x::/16 is a non-permanently-
              assigned address. An IPv6 address prefixed by FF3x::/16 is
              a unicast-prefix-based multicast addresses. A scope
              FF0x::/16 implies an identical scope name for these other
              prefixes. No separate FF1x::/16 or FF3x::/16 entries exist
              in this table.

              This address object is only significant up to
              ipMcastScopeNameAddressPrefixLength bits. The remainder of
              the address bits are zero. This is especially important for
              this index field, which is part of the index of this entry.
              Any non-zero bits would signify an entirely different
              entry.

              For addresses of type ipv4z or ipv6z, the appended zone
              index is significant even though it lies beyond the prefix
              length. Zone index zero is not valid in this table."
      REFERENCE "RFC 2365, RFC 3306 section 4, RFC 4291 section 2.7"
      ::= { ipMcastScopeNameEntry 2 }

ipMcastScopeNameAddressPrefixLength OBJECT-TYPE
      SYNTAX   InetAddressPrefixLength (4..32)
      MAX-ACCESS not-accessible
      STATUS   current
      DESCRIPTION
              "The length in bits of the mask which, when combined with
              the corresponding value of ipMcastScopeNameAddress,
              identifies the group range associated with the multicast
              scope.

              The InetAddressType is given by ipMcastScopeNameAddressType.
              For 'ipv4' this object must be in the range 4..32. For
              'ipv6', this object must be 16."
      ::= { ipMcastScopeNameEntry 3 }

ipMcastScopeNameLanguage OBJECT-TYPE
      SYNTAX   LangTag
      MAX-ACCESS not-accessible

```
       STATUS      current
       DESCRIPTION
               "Language tag associated with the scope name."
       REFERENCE "RFC 3283"
       ::= { ipMcastScopeNameEntry 4 }

ipMcastScopeNameString OBJECT-TYPE
       SYNTAX      SnmpAdminString
       MAX-ACCESS read-create
       STATUS      current
       DESCRIPTION
               "The textual name associated with the multicast scope.  The
               value of this object should be suitable for displaying to
               end-users, such as when allocating a multicast address in
               this scope.

               When no name is specified, the default value of this object
               for IPv4 should is the string 239.x.x.x/y with x and y
               replaced with decimal values to describe the address and
               mask length associated with the scope.

               When no name is specified, the default value of this object
               for IPv6 should is the string FF0x::/16, with x replaced by
               the hexadecimal value for the RFC 4291 multicast scope.

               An IPv6 address prefixed by FF1x::/16 is a non-permanently-
               assigned address.  An IPv6 address prefixed by FF3x::/16 is
               a unicast-prefix-based multicast addresses.  A scope
               FF0x::/16 implies an identical scope name for these other
               prefixes.  No separate FF1x::/16 or FF3x::/16 entries exist
               in this table."
       REFERENCE "RFC 2365, RFC 3306 section 4, RFC 4291 section 2.7"
       ::= { ipMcastScopeNameEntry 5 }

ipMcastScopeNameDefault OBJECT-TYPE
       SYNTAX      TruthValue
       MAX-ACCESS read-create
       STATUS      current
       DESCRIPTION
               "If true, indicates a preference that the name in the
               following language should be used by applications if no name
               is available in a desired language."
       DEFVAL { false }
       ::= { ipMcastScopeNameEntry 6 }

ipMcastScopeNameStatus OBJECT-TYPE
       SYNTAX      RowStatus
       MAX-ACCESS read-create
```

        STATUS   current
        DESCRIPTION
                "The status of this row, by which rows in this table can
                be created and destroyed. Before the row can be activated,
                the object ipMcastScopeNameString must be set to a valid
                value. All writeable objects in this entry can be modified
                when the status is active(1)."
        ::= { ipMcastScopeNameEntry 7 }

ipMcastScopeNameStorageType OBJECT-TYPE
        SYNTAX   StorageType
        MAX-ACCESS read-create
        STATUS   current
        DESCRIPTION
                "The storage type for this row. Rows having the value
                'permanent' need not allow write-access to any columnar
                objects in the row."
          DEFVAL { nonVolatile }
        ::= { ipMcastScopeNameEntry 8 }

--
-- The Multicast Listeners Table
--

ipMcastLocalListenerTable OBJECT-TYPE
        SYNTAX   SEQUENCE OF IpMcastLocalListenerEntry
        MAX-ACCESS not-accessible
        STATUS   current
        DESCRIPTION
                "The (conceptual) table listing local applications or
                services that have joined multicast groups as listeners.

                Entries exist for all addresses in the multicast range for
                all applications and services as they are classified on this
                device."
        ::= { ipMcast 9 }

ipMcastLocalListenerEntry OBJECT-TYPE
        SYNTAX   IpMcastLocalListenerEntry
        MAX-ACCESS not-accessible
        STATUS   current
        DESCRIPTION
                "An entry (conceptual row) identifying a local application
                or service that has joined a multicast group as a listener."
        INDEX   { ipMcastLocalListenerGroupAddressType,
                       ipMcastLocalListenerGroupAddress,
                       ipMcastLocalListenerSourceAddressType,
                       ipMcastLocalListenerSourceAddress,

```
                    ipMcastLocalListenerSourcePrefixLength,
                    ipMcastLocalListenerRunIndex }
       ::= { ipMcastLocalListenerTable 1 }

IpMcastLocalListenerEntry ::= SEQUENCE {
    ipMcastLocalListenerGroupAddressType    InetAddressType,
    ipMcastLocalListenerGroupAddress        InetAddress,
    ipMcastLocalListenerSourceAddressType   InetAddressType,
    ipMcastLocalListenerSourceAddress       InetAddress,
    ipMcastLocalListenerSourcePrefixLength  InetAddressPrefixLength,
    ipMcastLocalListenerRunIndex            Unsigned32
}

ipMcastLocalListenerGroupAddressType OBJECT-TYPE
    SYNTAX     InetAddressType
    MAX-ACCESS not-accessible
    STATUS     current
    DESCRIPTION
            "A value indicating the address family of the address
            contained in ipMcastLocalListenerGroupAddress.  Legal values
            correspond to the subset of address families for which
            multicast is supported."
    ::= { ipMcastLocalListenerEntry 1 }

ipMcastLocalListenerGroupAddress OBJECT-TYPE
    SYNTAX     InetAddress (SIZE (0|4|8|16|20))
    MAX-ACCESS not-accessible
    STATUS     current
    DESCRIPTION
            "The IP multicast group for which this entry specifies
            locally joined applications or services."
    ::= { ipMcastLocalListenerEntry 2 }

ipMcastLocalListenerSourceAddressType OBJECT-TYPE
    SYNTAX     InetAddressType
    MAX-ACCESS not-accessible
    STATUS     current
    DESCRIPTION
            "A value indicating the address family of the address
            contained in ipMcastLocalListenerSource.  The value MUST be
            the same as the value of ipMcastLocalListenerAddressType."
    ::= { ipMcastLocalListenerEntry 3 }

ipMcastLocalListenerSourceAddress OBJECT-TYPE
    SYNTAX     InetAddress (SIZE (0|4|8|16|20))
    MAX-ACCESS not-accessible
    STATUS     current
    DESCRIPTION
```

            "The network address which, when combined with the
            corresponding value of the mask specified in
            ipMcastLocalListenerSourcePrefixLength, identifies the
            sources for which this entry specifies a local listener.

            This address object is only significant up to
            ipMcastLocalListenerSourcePrefixLength bits. The remainder
            of the address bits are zero. This is especially important
            for this index field, which is part of the index of this
            entry. Any non-zero bits would signify an entirely
            different entry.

            For addresses of type ipv4z or ipv6z, the appended zone
            index is significant even though it lies beyond the prefix
            length. The use of these address types indicate that this
            listener address applies only within the given zone. Zone
            index zero is not valid in this table."
    ::= { ipMcastLocalListenerEntry 4 }

ipMcastLocalListenerSourcePrefixLength OBJECT-TYPE
    SYNTAX   InetAddressPrefixLength (4..128)
    MAX-ACCESS not-accessible
    STATUS   current
    DESCRIPTION
            "The length in bits of the mask which, when combined with
            the corresponding value specified in
            ipMcastLocalListenerSource, identifies the sources for which
            this entry specifies a local listener. A mask length of
            zero corresponds to all sources within the group."
    ::= { ipMcastLocalListenerEntry 5 }

ipMcastLocalListenerRunIndex OBJECT-TYPE
    SYNTAX   Unsigned32 (0..2147483647)
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
            "A unique value corresponding to a piece of software running
            on this router or host system. Where possible, this should
            be the system's native, unique identification number.

            This identifier is platform-specific. It may correspond to
            a process ID or application instance number.

            A value of zero indicates that the application instance(s)
            cannot be identified. A value of zero indicates that one or
            more unidentified applications have joined the specified
            multicast groups (for the specified sources) as listeners."
    REFERENCE "RFC 2287 sysApplRunIndex"

     ::= { ipMcastLocalListenerEntry 6 }

--
-- The Multicast Zone Table
--

ipMcastZoneTable OBJECT-TYPE
    SYNTAX   SEQUENCE OF IpMcastZoneEntry
    MAX-ACCESS not-accessible
    STATUS   current
    DESCRIPTION
            "The (conceptual) table listing scope zones on this device."
    REFERENCE "RFC 4007 section 5"
    ::= { ipMcast 10 }

ipMcastZoneEntry OBJECT-TYPE
    SYNTAX   IpMcastZoneEntry
    MAX-ACCESS not-accessible
    STATUS   current
    DESCRIPTION
            "An entry (conceptual row) describing a scope zone on this
            device."
    REFERENCE "RFC 4007 section 5"
    INDEX   { ipMcastZoneIndex }
    ::= { ipMcastZoneTable 1 }

IpMcastZoneEntry ::= SEQUENCE {
    ipMcastZoneIndex   InetZoneIndex,
    ipMcastZoneScopeDefaultZoneIndex   InetZoneIndex,
    ipMcastZoneScopeAddressType   InetAddressType,
    ipMcastZoneScopeAddress   InetAddress,
    ipMcastZoneScopeAddressPrefixLength InetAddressPrefixLength
}

ipMcastZoneIndex OBJECT-TYPE
    SYNTAX   InetZoneIndex (1..4294967295)
    MAX-ACCESS not-accessible
    STATUS   current
    DESCRIPTION
            "This zone index uniquely identifies a zone on a device.

            Each zone is for a given scope. Scope-level information in
            this table is for the unique scope that corresponds to this
            zone.

            Zero is a special value used to request the default zone for
            a given scope. Zero is not a valid value for this object.

                To test whether ipMcastZoneIndex is the default zone for
                this scope, test whether ipMcastZoneIndex is equal to
                ipMcastZoneScopeDefaultZoneIndex."
        ::= { ipMcastZoneEntry 1 }

ipMcastZoneScopeDefaultZoneIndex OBJECT-TYPE
        SYNTAX   InetZoneIndex (1..4294967295)
        MAX-ACCESS read-only
        STATUS   current
        DESCRIPTION
                "The default zone index for this scope. This is the zone
                that this device will use if the default (zero) zone is
                requested for this scope.

                Zero is not a valid value for this object."
        ::= { ipMcastZoneEntry 2 }

ipMcastZoneScopeAddressType OBJECT-TYPE
        SYNTAX   InetAddressType
        MAX-ACCESS read-only
        STATUS   current
        DESCRIPTION
                "The IP address type for which this scope zone exists."
        ::= { ipMcastZoneEntry 3 }

ipMcastZoneScopeAddress OBJECT-TYPE
        SYNTAX   InetAddress (SIZE (4|16))
        MAX-ACCESS read-only
        STATUS   current
        DESCRIPTION
                "The multicast group address which, when combined with
                ipMcastZoneScopeAddressPrefixLength, gives the multicast
                address range for this scope. The InetAddressType is given
                by ipMcastZoneScopeAddressType.

                Scoped IPv4 multicast address ranges are prefixed by
                239.0.0.0/8. Scoped IPv6 multicast address ranges are
                FF0x::/16, where x is a valid RFC 4291 multicast scope.

                An IPv6 address prefixed by FF1x::/16 is a non-permanently-
                assigned address. An IPv6 address prefixed by FF3x::/16 is
                a unicast-prefix-based multicast addresses. A scope
                FF0x::/16 implies an identical scope for these other
                prefixes. No separate FF1x::/16 or FF3x::/16 entries exist
                in this table.

                This address object is only significant up to
                ipMcastZoneScopeAddressPrefixLength bits. The remainder of

            the address bits are zero."
    REFERENCE "RFC 2365, RFC 3306 section 4, RFC 4291 section 2.7"
    ::= { ipMcastZoneEntry 4 }

ipMcastZoneScopeAddressPrefixLength OBJECT-TYPE
    SYNTAX   InetAddressPrefixLength (4..32)
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
            "The length in bits of the mask which, when combined
            with ipMcastZoneScopeAddress, gives the multicast address
            prefix for this scope.

            The InetAddressType is given by ipMcastZoneAddressType.
            For 'ipv4' this object must be in the range 4..32. For
            'ipv6', this object must be 16."
    ::= { ipMcastZoneEntry 5 }

--
-- Conformance information
--

ipMcastMIBConformance
                OBJECT IDENTIFIER ::= { ipMcastMIB 2 }
ipMcastMIBCompliances
                OBJECT IDENTIFIER ::= { ipMcastMIBConformance 1 }
ipMcastMIBGroups OBJECT IDENTIFIER ::= { ipMcastMIBConformance 2 }

--
-- Compliance statements
--

ipMcastMIBComplianceHost MODULE-COMPLIANCE
    STATUS current
    DESCRIPTION
            "The compliance statement for hosts supporting IPMCAST-MIB."
    MODULE -- this module
    MANDATORY-GROUPS { ipMcastMIBLocalListenerGroup,
                       ipMcastMIBBasicGroup }

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

      GROUP   ipMcastMIBSsmGroup
      DESCRIPTION
          "This group is optional."

```
     GROUP        ipMcastMIBRouteGroup
     DESCRIPTION
         "This group is optional."

     GROUP        ipMcastMIBIfPktsGroup
     DESCRIPTION
         "This group is optional."

     GROUP        ipMcastMIBBoundaryIfGroup
     DESCRIPTION
         "This group is optional."

     GROUP        ipMcastMIBScopeNameGroup
     DESCRIPTION
         "This group is optional."

    ::= { ipMcastMIBCompliances 1 }

ipMcastMIBComplianceRouter MODULE-COMPLIANCE
    STATUS   current
    DESCRIPTION
            "The compliance statement for routers supporting
             IPMCAST-MIB."

    MODULE  -- this module
    MANDATORY-GROUPS { ipMcastMIBRouteProtoGroup,
                       ipMcastMIBBasicGroup,
                       ipMcastMIBSsmGroup,
                       ipMcastMIBRouteGroup }

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

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

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

      OBJECT    ipMcastSsmRangeRowStatus
      MIN-ACCESS read-only
      DESCRIPTION
```

```
         "Write access is not required."

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

    GROUP       ipMcastMIBIfPktsGroup
    DESCRIPTION
        "This group is optional."

    GROUP       ipMcastMIBPktsOutGroup
    DESCRIPTION
        "This group is optional."

    GROUP       ipMcastMIBHopCountGroup
    DESCRIPTION
        "This group is optional."

    GROUP       ipMcastMIBRouteOctetsGroup
    DESCRIPTION
        "This group is optional."

    GROUP       ipMcastMIBRouteBpsGroup
    DESCRIPTION
        "This group is optional."

    GROUP       ipMcastMIBLocalListenerGroup
    DESCRIPTION
        "This group is optional."

    GROUP       ipMcastMIBBoundaryIfGroup
    DESCRIPTION
        "This group is optional."

    GROUP       ipMcastMIBScopeNameGroup
    DESCRIPTION
        "This group is optional."

    ::= { ipMcastMIBCompliances 2 }

ipMcastMIBComplianceBorderRouter MODULE-COMPLIANCE
    STATUS  current
    DESCRIPTION
            "The compliance statement for routers on scope
            boundaries supporting IPMCAST-MIB."
    MODULE  -- this module
    MANDATORY-GROUPS { ipMcastMIBRouteProtoGroup,
```

```
                        ipMcastMIBBasicGroup,
                        ipMcastMIBSsmGroup,
                        ipMcastMIBRouteGroup,
                        ipMcastMIBBoundaryIfGroup,
                        ipMcastMIBScopeNameGroup }

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

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

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

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

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

    GROUP       ipMcastMIBIfPktsGroup
    DESCRIPTION
        "This group is optional."

    GROUP       ipMcastMIBPktsOutGroup
    DESCRIPTION
        "This group is optional."

    GROUP       ipMcastMIBHopCountGroup
    DESCRIPTION
        "This group is optional."

    GROUP       ipMcastMIBRouteOctetsGroup
    DESCRIPTION
        "This group is optional."

    GROUP       ipMcastMIBRouteBpsGroup
```

          DESCRIPTION
              "This group is optional."

          GROUP   ipMcastMIBLocalListenerGroup
          DESCRIPTION
              "This group is optional."

      ::= { ipMcastMIBCompliances 3 }

--
-- Units of conformance
--
ipMcastMIBBasicGroup OBJECT-GROUP
    OBJECTS { ipMcastEnable, ipMcastRouteEntryCount
            }
    STATUS current
    DESCRIPTION
            "A collection of objects to support basic management of IP
            Multicast protocols."
    ::= { ipMcastMIBGroups 1 }

ipMcastMIBSsmGroup OBJECT-GROUP
    OBJECTS { ipMcastSsmRangeRowStatus,
              ipMcastSsmRangeStorageType }
    STATUS current
    DESCRIPTION
            "A collection of objects to support management of Source-
            Specific Multicast routing."
    ::= { ipMcastMIBGroups 2 }

ipMcastMIBRouteGroup OBJECT-GROUP
    OBJECTS { ipMcastInterfaceTtl,
              ipMcastInterfaceRateLimit,
              ipMcastInterfaceInMcastOctets,
              ipMcastInterfaceOutMcastOctets,
              ipMcastInterfaceDiscontinuityTime,
              ipMcastRouteUpstreamNeighborType,
              ipMcastRouteUpstreamNeighbor,
              ipMcastRouteInIfIndex,
              ipMcastRouteTimeStamp,
              ipMcastRouteExpiryTime,
              ipMcastRoutePkts,
              ipMcastRouteTtlDropPackets,
              ipMcastRouteDifferentInIfPackets,
              ipMcastRouteNextHopState,
              ipMcastRouteNextHopTimeStamp,
              ipMcastRouteNextHopExpiryTime
            }

```
            STATUS  current
            DESCRIPTION
                    "A collection of objects to support basic management of IP
                    Multicast routing."
            ::= { ipMcastMIBGroups 3 }


    ipMcastMIBIfPktsGroup OBJECT-GROUP
            OBJECTS { ipMcastInterfaceInMcastPkts,
                        ipMcastInterfaceOutMcastPkts,
                        ipMcastInterfaceDiscontinuityTime }
            STATUS  current
            DESCRIPTION
                    "A collection of objects to support management of packet
                    counters for each interface entry."
            ::= { ipMcastMIBGroups 4 }


    ipMcastMIBPktsOutGroup OBJECT-GROUP
            OBJECTS { ipMcastRouteNextHopTimeStamp,
                        ipMcastRouteNextHopPkts }
            STATUS  current
            DESCRIPTION
                    "A collection of objects to support management of packet
                    counters for each outgoing interface entry of a route."
            ::= { ipMcastMIBGroups 5 }


    ipMcastMIBHopCountGroup OBJECT-GROUP
            OBJECTS { ipMcastRouteNextHopClosestMemberHops }
            STATUS  current
            DESCRIPTION
                    "A collection of objects to support management of the use of
                    hop counts in IP Multicast routing."
            ::= { ipMcastMIBGroups 6 }


    ipMcastMIBRouteOctetsGroup OBJECT-GROUP
            OBJECTS { ipMcastRouteTimeStamp,
                        ipMcastRouteOctets,
                        ipMcastRouteTtlDropOctets,
                        ipMcastRouteDifferentInIfOctets,
                        ipMcastRouteNextHopTimeStamp,
                        ipMcastRouteNextHopOctets }
            STATUS  current
            DESCRIPTION
                    "A collection of objects to support management of octet
                    counters for each forwarding entry."
            ::= { ipMcastMIBGroups 7 }


    ipMcastMIBRouteBpsGroup OBJECT-GROUP
            OBJECTS { ipMcastRouteBps }
```

        STATUS current
        DESCRIPTION
                "A collection of objects to support sampling of data rate
                in bits per second for each forwarding entry."
        ::= { ipMcastMIBGroups 8 }

ipMcastMIBRouteProtoGroup OBJECT-GROUP
        OBJECTS { ipMcastRouteProtocol, ipMcastRouteRtProtocol,
                  ipMcastRouteRtAddressType, ipMcastRouteRtAddress,
                  ipMcastRouteRtPrefixLength, ipMcastRouteRtType,
                  ipMcastRouteNextHopProtocol }
        STATUS current
        DESCRIPTION
                "A collection of objects providing information on the
                relationship between multicast routing information and the
                IP Forwarding Table."
        ::= { ipMcastMIBGroups 9 }

ipMcastMIBLocalListenerGroup OBJECT-GROUP
        OBJECTS { ipMcastLocalListenerRunIndex }
        STATUS current
        DESCRIPTION
                "A collection of objects to support management of local
                listeners on hosts or routers."
        ::= { ipMcastMIBGroups 10 }

ipMcastMIBBoundaryIfGroup OBJECT-GROUP
        OBJECTS { ipMcastBoundaryTimeStamp,
                  ipMcastBoundaryDroppedMcastOctets,
                  ipMcastBoundaryDroppedMcastPkts,
                  ipMcastBoundaryStatus,
                  ipMcastBoundaryStorageType,
                  ipMcastZoneScopeDefaultZoneIndex,
                  ipMcastZoneScopeAddressType,
                  ipMcastZoneScopeAddress,
                  ipMcastZoneScopeAddressPrefixLength
                }
        STATUS current
        DESCRIPTION
                "A collection of objects to support management of multicast
                scope zone boundaries."
        ::= { ipMcastMIBGroups 11 }

ipMcastMIBScopeNameGroup OBJECT-GROUP
        OBJECTS { ipMcastScopeNameString, ipMcastScopeNameDefault,
                  ipMcastScopeNameStatus, ipMcastScopeNameStorageType }
        STATUS current
        DESCRIPTION

          "A collection of objects to support management of multicast
          address scope names."
    ::= { ipMcastMIBGroups 12 }

END

6. Security Considerations

6.1 SNMPv2

   SNMP versions prior to SNMPv3 did not include adequate security.
   Even if the network itself is secured (for example by using IPSec),
   there is still no control over whom on the secure network is allowed
   to access (read/change/create/delete) the objects in this MIB module.

   It is RECOMMENDED that implementers consider the security features as
   provided by the SNMPv3 framework (see [RFC3410], section 8),
   including full support for the SNMPv3 cryptographic mechanisms (for
   authentication and privacy).

   Further, deployment of SNMP versions prior to SNMPv3 is NOT
   RECOMMENDED. Instead, it is RECOMMENDED to deploy SNMPv3 and to
   enable cryptographic security. It is then a customer/operator
   responsibility to ensure that the SNMP entity giving access to an
   instance of this MIB module is properly configured to give access to
   the objects only to those principals (users) that have legitimate
   rights to access (read/change/create/delete) them.

6.2 Writeable objects

   There are a number of management objects defined in this MIB module
   with a MAX-ACCESS clause of read-write and/or read-create. This
   section discusses and lists these elements.

   Such objects may be considered sensitive or vulnerable in some
   network environments. The support for SET operations in a non-secure
   environment without proper protection can have a negative effect on
   network operations.

   In this MIB module, possible effects that can be induced by SET
   operations on writeable objects include:

   o Modifications to multicast routing behavior that prevent or
      disrupt services provided by the network, including (but not
      limited to) multicast data traffic delivery.

   o Modifications to multicast routing behavior that allow
      interception or subversion of information that is carried by the
      network. For example, attacks can be envisaged that would pass
      nominated multicast data streams through a nominated location,
      without the sources or listeners becoming aware of this
      subversion.

   The following are the read-write and read-create objects defined in
   this MIB module.

   ipMcastEnable
   ipMcastInterfaceTtl
   ipMcastInterfaceRateLimit
   ipMcastSsmRangeRowStatus
   ipMcastSsmRangeStorageType
   ipMcastBoundaryStatus
   ipMcastBoundaryStorageType
   ipMcastScopeNameTable
   ipMcastScopeNameString
   ipMcastScopeNameDefault
   ipMcastScopeNameStatus
   ipMcastScopeNameStorageType

6.3 Readable objects

   As well as the writeable objects discussed above, there are a number
   of readable objects (i.e., objects with a MAX-ACCESS other than not-
   accessible) that may be considered sensitive or vulnerable in some
   network environments. It is thus important to control even GET
   and/or NOTIFY access to these objects and possibly to even encrypt
   the values of these objects when sending them over the network via
   SNMP.

   In this MIB module, possible effects that can be induced by GET
   and/or NOTIFY operations include:

   o Determination of the topology, disposition, and composition of the
      network. This information may be commercially sensitive, and may
      also be used in preparation for attacks, including any of the
      attacks described above.

   o Determinion of whether multicast data is flowing in the network,
      or has flowed recently, as well as the locations of senders and
      recipients. An attacker can apply 'traffic analysis' to this
      data. In some cases, the information revealed by traffic analyses
      can be as damaging as full knowledge of the data being
      transported.

7. IANA Considerations

   IP-MCAST-MIB should be rooted under the mib-2 subtree. IANA is
   requested to assign { mib-2 XXX } to the IP-MCAST-MIB module
   specified in this document.

8. Acknowledgements

   This MIB module is based on the original work in [RFC2932] by K.
   McCloghrie, D. Farinacci and D. Thaler.

   Suggested IPv6 multicast MIBs by R. Sivaramu and R. Raghunarayan have
   been used for comparison while editing this MIB module.

   The authors are also grateful to Bill Fenner for fine ideas, and to
   Bharat Joshi for input and several corrections.

9. References

9.1 Normative References

   [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate
              Requirement Levels", BCP 14, RFC 2119, March 1997.

   [RFC2365] Meyer, D., "Administratively Scoped IP Multicast", BCP 23,
              RFC 2365, July 1998.

   [RFC2434] Narten, T. and H. Alvestrand, "Guidelines for Writing an
              IANA Considerations Section in RFCs", BCP 26, RFC 2434,
              October 1998.

   [RFC2578] McCloghrie, K., Ed., Perkins, D., Ed., and J.
              Schoenwaelder, Ed., "Structure of Management Information
              Version 2 (SMIv2)", STD 58, RFC 2578, April 1999.

   [RFC2579] McCloghrie, K., Ed., Perkins, D., Ed., and J.
              Schoenwaelder, Ed., "Textual Conventions for SMIv2",
              STD 58, RFC 2579, April 1999.

   [RFC2580] McCloghrie, K., Perkins, D., and J. Schoenwaelder,
              "Conformance Statements for SMIv2", STD 58, RFC 2580,
              April 1999.

   [RFC2856] Bierman, A., McCloghrie, K., and R. Presuhn, "Textual
              Conventions for Additional High Capacity Data Types",
              RFC 2856, June 2000.

   [RFC2863] McCloghrie, K. and F. Kastenholz, "The Interfaces Group

              MIB", RFC 2863, June 2000.

   [RFC3306] Haberman, B. and D. Thaler, "Unicast-Prefix-based IPv6
              Multicast Addresses", RFC 3306, August 2002.

   [RFC3411] Harrington, D., Presuhn, R., and B. Wijnen, "An
              Architecture for Describing Simple Network Management
              Protocol (SNMP) Management Frameworks", STD 62, RFC 3411,
              December 2002.

   [RFC4001] Daniele, M., Haberman, B., Routhier, S., and J.
              Schoenwaelder, "Textual Conventions for Internet Network
              Addresses", RFC 4001, February 2005.

   [RFC4007] Deering, S., Haberman, B., Jinmei, T., Nordmark, E., and
              B. Zill, "IPv6 Scoped Address Architecture", RFC 4007,
              March 2005.

   [RFC4291] Hinden, R. and S. Deering, "IP Version 6 Addressing
              Architecture", RFC 4291, February 2006.

   [RFC4293] Routhier, S., "Management Information Base for the
              Internet Protocol (IP)", RFC 4293, April 2006.

   [I-D.mcwalter-langtag-mib]
              McWalter, D., "Language Tag MIB",
              draft-mcwalter-langtag-mib-02 (work in progress), I-D
              Status active, March 2007.

9.2 Informative References

   [RFC1075] Waitzman, D., Partridge, C., and S. Deering, "Distance
              Vector Multicast Routing Protocol", RFC 1075,
              November 1988.

   [RFC1584] Moy, J., "Multicast Extensions to OSPF", RFC 1584,
              March 1994.

   [RFC2189] Ballardie, T., "Core Based Trees (CBT version 2) Multicast
              Routing -- Protocol Specification --", RFC 2189,
              September 1997.

   [RFC2287] Krupczak, C. and J. Saperia, "Definitions of System-Level
              Managed Objects for Applications", RFC 2287,
              February 1998.

   [RFC2932] McCloghrie, K., Farinacci, D., and D. Thaler, "IPv4
              Multicast Routing MIB", RFC 2932, October 2000.

   [RFC2934] McCloghrie, K., Farinacci, D., Thaler, D., and B. Fenner,
              "Protocol Independent Multicast MIB for IPv4", RFC 2934,
              October 2000.

   [RFC3410] Case, J., Mundy, R., Partain, D., and B. Stewart,
              "Introduction and Applicability Statements for Internet-
              Standard Management Framework", RFC 3410, December 2002.

   [RFC3569] Bhattacharyya, S., "An Overview of Source-Specific
              Multicast (SSM)", RFC 3569, July 2003.

   [RFC4601] Fenner, B., Handley, M., Holbrook, H., and I. Kouvelas,
              "Protocol Independent Multicast - Sparse Mode (PIM-SM):
              Protocol Specification (Revised)", RFC 4601, August 2006.

   [I-D.ietf-pim-bidir]
              Handley, M., Kouvelas, I., Speakman, T., and L. Vicisano,
              "Bi-directional Protocol Independent Multicast (BIDIR-
              PIM)", draft-ietf-pim-bidir-09 (work in progress),
              February 2007.

Authors' Addresses

   David McWalter
   Data Connection Ltd
   100 Church Street
   Enfield EN2 6BQ
   UK

   Email: dmcw@dataconnection.com

   Dave Thaler
   Microsoft Corporation
   One Microsoft Way
   Redmond WA 98052-6399
   USA

   Email: dthaler@windows.microsoft.com

Andrew Kessler
Cisco Systems
425 E. Tasman Drive
San Jose CA 95134
USA

Email: kessler@cisco.com

Intellectual Property Statement

Disclaimer of Validity

Copyright Statement

Acknowledgment