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IP Multicast MIB

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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.

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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.

1.1. Terminology

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

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:

- This MIB module includes support for IPv6 addressing and the IPv6 scoped address architecture. [RFC2932] supported only IPv4.
- 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.
- 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.
- This MIB module includes a table of Source-Specific Multicast (SSM) address ranges to which SSM semantics [RFC3569] should be applied.
- This MIB module includes a table of local applications that are receiving multicast data.
- This MIB module includes a table of multicast scope zones.

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 [RFC2863], the INET-ADDRESS-MIB [RFC4001] and the IANA-RTPROTO-MIB.

5. IMPORTed MIB Modules and REFERENCE Clauses

The MIB modules defined in this document IMPORTs definitions normatively from the following MIB modules, beyond [RFC2578], [RFC2579], and [RFC2580]: HCNUM-TC [RFC2856], IF-MIB [RFC2863], IANA-RTPROTO-MIB, SNMP-FRAMEWORK-MIB [RFC3411], INET-ADDRESS-MIB [RFC4001], and LANGTAG-TC-MIB [RFC5131].

This MIB module also includes REFERENCE clauses that make normative references to Administratively Scoped IP Multicast [RFC2365], Unicast-Prefix-based IPv6 Multicast Addresses [RFC3306], IPv6 Scoped Address Architecture [RFC4007], and IPv6 Addressing Architecture [RFC4291].

Finally, this MIB module makes informative references to several RFCs in the text of DESCRIPTION clauses, including sysApplMIB [RFC2287], IP-MIB [RFC4293], Source-Specific Multicast [RFC3569], Protocol Independent Multicast-Sparse Mode version 2 (PIM-SMv2) Protocol Specification [RFC4601], Bidirectional Protocol Independent Multicast (BIDIR-PIM) [RFC5015], and Tags for Identifying Languages [RFC4646].

6. 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;    -- [RFC5131]

ipMcastMIB MODULE-IDENTITY
    LAST-UPDATED "200711090000Z" -- 9 November 2007
    ORGANIZATION "IETF MBONE Deployment (MBONED) Working Group"
    CONTACT-INFO "David McWalter
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    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 5132; see the RFC itself for full
            legal notices."
    REVISION     "200711090000Z" -- 9 November 2007
    DESCRIPTION  "Initial version, published as RFC 5132.

                 This MIB module obsoletes IPMROUTE-STD-MIB defined by
                 [RFC2932].  Changes 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."
    ::= { mib-2 168 }

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

ipMcast      OBJECT IDENTIFIER ::= { ipMcastMIB 1 }

ipMcastEnabled OBJECT-TYPE
    SYNTAX     TruthValue
    MAX-ACCESS read-write
    STATUS     current
    DESCRIPTION
            "The enabled status of IP Multicast function on this
            system.

            The storage type of this object is determined by
            ipMcastDeviceConfigStorageType."
    ::= { 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 }

ipMcastDeviceConfigStorageType OBJECT-TYPE
    SYNTAX      StorageType
    MAX-ACCESS  read-write
```

```
    STATUS      current
    DESCRIPTION
            "The storage type used for the global IP multicast
            configuration of this device, comprised of the objects
            listed below.  If this storage type takes the value
            'permanent', write-access to the listed objects need not be
            allowed.

            The objects described by this storage type are:
            ipMcastEnabled."
       DEFVAL { nonVolatile }
    ::= { ipMcast 11 }

--
--  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.

            Per-interface multicast forwarding statistics are also
            available in ipIfStatsTable."
    REFERENCE "RFC 4293 ipIfStatsTable"
    INDEX      { ipMcastInterfaceIPVersion,
                 ipMcastInterfaceIfIndex }
    ::= { ipMcastInterfaceTable 1 }

IpMcastInterfaceEntry ::= SEQUENCE {
    ipMcastInterfaceIPVersion         InetVersion,
    ipMcastInterfaceIfIndex           InterfaceIndex,
    ipMcastInterfaceTtl               Unsigned32,
    ipMcastInterfaceRateLimit         Unsigned32,
    ipMcastInterfaceStorageType       StorageType
}
```

```
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..256)
    MAX-ACCESS read-write
    STATUS     current
    DESCRIPTION
            "The datagram Time to Live (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.  A
            value of 256 means that no 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 }

ipMcastInterfaceStorageType OBJECT-TYPE
    SYNTAX      StorageType
    MAX-ACCESS  read-write
```

```
    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 }
    ::= { ipMcastInterfaceEntry 5 }

--
-- 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.

            Object Identifiers (OIDs) are limited to 128
            sub-identifiers, but this limit is not enforced by the
            syntax of this entry.  In practice, this does not present
            a problem, because IP address types allowed by conformance
            statements do not exceed this limit."
    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
    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 remaining address
            bits are set to 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
    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 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.

            OIDs are limited to 128 sub-identifiers, but this limit
            is not enforced by the syntax of this entry.  In practice,
            this does not present a problem, because IP address types
            allowed by conformance statements do not exceed this limit."
    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
    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 remaining address
            bits are set to 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
    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.

            The InetAddressType is given by
```

```
            ipMcastRouteGroupAddressType.  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."
    ::= { 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.

            A value of unknown(0) indicates a non-source-specific entry,
            corresponding to all sources in the group.  Otherwise, the
            value MUST be the same as the value of
            ipMcastRouteGroupType."
    ::= { ipMcastRouteEntry 4 }

ipMcastRouteSource OBJECT-TYPE
    SYNTAX     InetAddress
    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
            ipMcastRouteSourcePrefixLength bits.  The remaining address
            bits are set to 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
    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.

            The InetAddressType is given by
            ipMcastRouteSourceAddressType.  For the value 'unknown',
            this object must be zero.  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."
    ::= { 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 "RFC 5015"
    ::= { ipMcastRouteEntry 7 }

ipMcastRouteUpstreamNeighbor OBJECT-TYPE
    SYNTAX     InetAddress
    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 "RFC 5015"
    ::= { 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 information 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
    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
            ipMcastRouteRtPrefixLength bits.  The remaining address bits
            are set to 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
    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.

            The InetAddressType is given by ipMcastRouteRtAddressType.
            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."
    ::= { 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
            due (instead or in addition) 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 the Distance Vector Multicast
            Routing Protocol (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 that 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 that 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 that 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 that 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' paths; 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 RFC 5015"
    ::= { 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 RFC 5015"
    ::= { 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.

            OIDs are limited to 128 sub-identifiers, but this limit
            is not enforced by the syntax of this entry.  In practice,
            this does not present a problem, because IP address types
            allowed by conformance statements do not exceed this limit."
    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
    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 remaining
            address bits are set to 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
    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.

            The InetAddressType is given by
            ipMcastRouteNextHopGroupAddressType.  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."
    ::= { 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.

            A value of unknown(0) indicates a non-source-specific entry,
            corresponding to all sources in the group.  Otherwise, the
            value MUST be the same as the value of
            ipMcastRouteNextHopGroupType."
    ::= { ipMcastRouteNextHopEntry 4 }

ipMcastRouteNextHopSource OBJECT-TYPE
    SYNTAX     InetAddress
    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 remaining
            address bits are set to 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
    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.
```

```
            The InetAddressType is given by
            ipMcastRouteNextHopSourceAddressType.  For the value
            'unknown', this object must be zero.  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."
    ::= { 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
    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.  Non-Broadcast Multi-Access
            (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 information 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..256)
    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 that have a TTL (IPv4) or Hop Count (IPv6) less
            than this number of hops will not be forwarded to this
            next-hop.

            A value of 0 means all multicast datagrams are forwarded out
            the interface.  A value of 256 means that no multicast
            datagrams are forwarded out the interface.
```

```
            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 0."
    ::= { 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.

            OIDs are limited to 128 sub-identifiers, but this limit
            is not enforced by the syntax of this entry.  In practice,
            this does not present a problem, because IP address types
            allowed by conformance statements do not exceed this limit."
    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
    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 remaining
            address bits are set to 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."
    ::= { ipMcastBoundaryEntry 3 }

ipMcastBoundaryAddressPrefixLength OBJECT-TYPE
    SYNTAX     InetAddressPrefixLength
    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 values 'ipv4' and 'ipv4z', this object must be in the
            range 4..32.  For values 'ipv6' and 'ipv6z', this object
            must be set to 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 information 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.

            OIDs are limited to 128 sub-identifiers, but this limit
            is not enforced by the syntax of this entry.  In practice,
            this does not present a problem, because IP address types
            allowed by conformance statements do not exceed this limit."
    REFERENCE "RFC 4007 Section 4"
    INDEX      { ipMcastScopeNameAddressType,
                 ipMcastScopeNameAddress,
                 ipMcastScopeNameAddressPrefixLength,
                 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
    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 remaining
            address bits are set to 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."
    ::= { ipMcastScopeNameEntry 2 }

ipMcastScopeNameAddressPrefixLength OBJECT-TYPE
    SYNTAX     InetAddressPrefixLength
    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 values 'ipv4' and 'ipv4z', this object must be in the
            range 4..32.  For values 'ipv6' and 'ipv6z', this object
            must be set to 16."
    ::= { ipMcastScopeNameEntry 3 }
```

```
ipMcastScopeNameLanguage OBJECT-TYPE
    SYNTAX     LangTag
    MAX-ACCESS not-accessible
    STATUS     current
    DESCRIPTION
            "Language tag associated with the scope name."
    REFERENCE "RFC 4646"
    ::= { 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 be 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 be 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.
```

```
            OIDs are limited to 128 sub-identifiers, but this limit
            is not enforced by the syntax of this entry.  In practice,
            this does not present a problem, because IP address types
            allowed by conformance statements do not exceed this limit."
    INDEX      { ipMcastLocalListenerGroupAddressType,
                 ipMcastLocalListenerGroupAddress,
                 ipMcastLocalListenerSourceAddressType,
                 ipMcastLocalListenerSourceAddress,
                 ipMcastLocalListenerSourcePrefixLength,
                 ipMcastLocalListenerIfIndex,
                 ipMcastLocalListenerRunIndex }
    ::= { ipMcastLocalListenerTable 1 }

IpMcastLocalListenerEntry ::= SEQUENCE {
    ipMcastLocalListenerGroupAddressType    InetAddressType,
    ipMcastLocalListenerGroupAddress        InetAddress,
    ipMcastLocalListenerSourceAddressType   InetAddressType,
    ipMcastLocalListenerSourceAddress       InetAddress,
    ipMcastLocalListenerSourcePrefixLength  InetAddressPrefixLength,
    ipMcastLocalListenerIfIndex             InterfaceIndex,
    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
    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.

            A value of unknown(0) indicates a non-source-specific entry,
            corresponding to all sources in the group.  Otherwise, the
            value MUST be the same as the value of
            ipMcastLocalListenerGroupAddressType."
    ::= { ipMcastLocalListenerEntry 3 }

ipMcastLocalListenerSourceAddress OBJECT-TYPE
    SYNTAX     InetAddress
    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 remaining
            address bits are set to 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
    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.

            The InetAddressType is given by
            ipMcastLocalListenerSourceAddressType.  For the value
            'unknown', this object must be zero.  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."
    ::= { ipMcastLocalListenerEntry 5 }

ipMcastLocalListenerIfIndex OBJECT-TYPE
    SYNTAX     InterfaceIndex
    MAX-ACCESS not-accessible
    STATUS     current
    DESCRIPTION
            "The IfIndex value of the interface for which this entry
            specifies a local listener."
    ::= { ipMcastLocalListenerEntry 6 }

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 7 }

--
--  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
    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 remaining
            address bits are set to zero."
    REFERENCE "RFC 2365, RFC 3306 Section 4, RFC 4291 Section 2.7"
    ::= { ipMcastZoneEntry 4 }

ipMcastZoneScopeAddressPrefixLength OBJECT-TYPE
    SYNTAX     InetAddressPrefixLength
    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 ipMcastZoneScopeAddressType.
            For values 'ipv4' and 'ipv4z', this object must be in the
            range 4..32.  For values 'ipv6' and 'ipv6z', this object
            must be set to 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.

            Support for either InetAddressType ipv4 or ipv6 is
            mandatory; support for both InetAddressTypes ipv4 and ipv6
            is optional.  Support for types ipv4z and ipv6z is
            optional.

            -- OBJECT     ipMcastLocalListenerGroupAddressType
            -- SYNTAX     InetAddressType {unknown(0), ipv4(1), ipv6(2),
            --                             ipv4z(3), ipv6z(4)}
            -- DESCRIPTION
            --     This compliance requires support for ipv4 or ipv6.
            --
            -- OBJECT     ipMcastLocalListenerGroupAddress
            -- SYNTAX     InetAddress (SIZE (0|4|8|16|20))
            -- DESCRIPTION
            --     This compliance requires support for ipv4 or ipv6.
            --
            -- OBJECT     ipMcastLocalListenerSourceAddressType
            -- SYNTAX     InetAddressType {unknown(0), ipv4(1), ipv6(2),
            --                             ipv4z(3), ipv6z(4)}
            -- DESCRIPTION
            --     This compliance requires support for ipv4 or ipv6.
            --
            -- OBJECT     ipMcastLocalListenerSourceAddress
            -- SYNTAX     InetAddress (SIZE (0|4|8|16|20))
            -- DESCRIPTION
            --     This compliance requires support for ipv4 or ipv6."

    MODULE  -- this module
    MANDATORY-GROUPS { ipMcastMIBLocalListenerGroup,
```

```
                        ipMcastMIBBasicGroup }

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

      OBJECT     ipMcastDeviceConfigStorageType
      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        ipMcastMIBRouteDiagnosticsGroup
      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.

            Support for either InetAddressType ipv4 or ipv6 is
            mandatory; support for both InetAddressTypes ipv4 and ipv6
            is optional.  Support for types ipv4z and ipv6z is
            optional.

            -- OBJECT     ipMcastSsmRangeAddressType
            -- SYNTAX     InetAddressType {ipv4(1), ipv6(2), ipv4z(3),
            --                             ipv6z(4)}
```

```
            -- DESCRIPTION
            --     This compliance requires support for ipv4 or ipv6.
            --
            -- OBJECT     ipMcastSsmRangeAddress
            -- SYNTAX     InetAddress (SIZE (4|8|16|20))
            -- DESCRIPTION
            --     This compliance requires support for ipv4 or ipv6.
            --
            -- OBJECT     ipMcastRouteGroupAddressType
            -- SYNTAX     InetAddressType {unknown(0), ipv4(1), ipv6(2),
            --                             ipv4z(3), ipv6z(4)}
            -- DESCRIPTION
            --     This compliance requires support for unknown and
            --     either ipv4 or ipv6.
            --
            -- OBJECT     ipMcastRouteGroup
            -- SYNTAX     InetAddress (SIZE (0|4|8|16|20))
            -- DESCRIPTION
            --     This compliance requires support for unknown and
            --     either ipv4 or ipv6.
            --
            -- OBJECT     ipMcastRouteSourceAddressType
            -- SYNTAX     InetAddressType {unknown(0), ipv4(1), ipv6(2),
            --                             ipv4z(3), ipv6z(4)}
            -- DESCRIPTION
            --     This compliance requires support for unknown and
            --     either ipv4 or ipv6.
            --
            -- OBJECT     ipMcastRouteSource
            -- SYNTAX     InetAddress (SIZE (0|4|8|16|20))
            -- DESCRIPTION
            --     This compliance requires support for unknown and
            --     either ipv4 or ipv6.
            --
            -- OBJECT     ipMcastRouteNextHopGroupAddressType
            -- SYNTAX     InetAddressType {unknown(0), ipv4(1), ipv6(2),
            --                             ipv4z(3), ipv6z(4)}
            -- DESCRIPTION
            --     This compliance requires support for unknown and
            --     either ipv4 or ipv6.
            --
            -- OBJECT     ipMcastRouteNextHopGroup
            -- SYNTAX     InetAddress (SIZE (0|4|8|16|20))
            -- DESCRIPTION
            --     This compliance requires support for unknown and
            --     either ipv4 or ipv6.
            --
            -- OBJECT     ipMcastRouteNextHopSourceAddressType
```

```
            -- SYNTAX     InetAddressType {unknown(0), ipv4(1), ipv6(2),
            --                             ipv4z(3), ipv6z(4)}
            -- DESCRIPTION
            --     This compliance requires support for unknown and
            --     either ipv4 or ipv6.
            --
            -- OBJECT     ipMcastRouteNextHopSource
            -- SYNTAX     InetAddress (SIZE (0|4|8|16|20))
            -- DESCRIPTION
            --     This compliance requires support for unknown and
            --     either ipv4 or ipv6.
            --
            -- OBJECT     ipMcastRouteNextHopAddressType
            -- SYNTAX     InetAddressType {unknown(0), ipv4(1), ipv6(2),
            --                            ipv4z(3), ipv6z(4)}
            -- DESCRIPTION
            --     This compliance requires support for unknown and
            --     either ipv4 or ipv6.
            --
            -- OBJECT     ipMcastRouteNextHopAddress
            -- SYNTAX     InetAddress (SIZE (0|4|8|16|20))
            -- DESCRIPTION
            --     This compliance requires support for unknown and
            --     either ipv4 or ipv6."

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

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

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

        OBJECT     ipMcastRouteUpstreamNeighborType
        SYNTAX     InetAddressType { unknown(0), ipv4(1), ipv6(2),
                                     ipv4z(3), ipv6z(4) }
        DESCRIPTION
            "This compliance requires support for unknown and either ipv4
            or ipv6."

        OBJECT     ipMcastRouteUpstreamNeighbor
        SYNTAX     InetAddress (SIZE (0|4|8|16|20))
        DESCRIPTION
            "This compliance requires support for unknown and either ipv4
            or ipv6."

        OBJECT     ipMcastRouteRtAddressType
        SYNTAX     InetAddressType { unknown(0), ipv4(1), ipv6(2),
                                     ipv4z(3), ipv6z(4) }
        DESCRIPTION
            "This compliance requires support for unknown and either ipv4
            or ipv6."

        OBJECT     ipMcastRouteRtAddress
        SYNTAX     InetAddress (SIZE (0|4|8|16|20))
        DESCRIPTION
            "This compliance requires support for unknown and either ipv4
            or ipv6."

        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        ipMcastMIBRouteDiagnosticsGroup
        DESCRIPTION
            "This group is not mandatory, but SHOULD be supported where
            hardware permits."
```

```
      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.

            Support for either InetAddressType ipv4z or ipv6z is
            mandatory; support for both InetAddressTypes ipv4z and
            ipv6z is optional.

            -- OBJECT     ipMcastSsmRangeAddressType
            -- SYNTAX     InetAddressType {ipv4(1), ipv6(2), ipv4z(3),
            --                             ipv6z(4)}
            -- DESCRIPTION
            --     This compliance requires support for ipv4 or ipv6.
            --
            -- OBJECT     ipMcastSsmRangeAddress
            -- SYNTAX     InetAddress (SIZE (4|8|16|20))
```

```
            -- DESCRIPTION
            --     This compliance requires support for ipv4 or ipv6.
            --
            -- OBJECT     ipMcastRouteGroupAddressType
            -- SYNTAX     InetAddressType {unknown(0), ipv4(1), ipv6(2),
            --                             ipv4z(3), ipv6z(4)}
            -- DESCRIPTION
            --     This compliance requires support for unknown and
            --     either ipv4 or ipv6.
            --
            -- OBJECT     ipMcastRouteGroup
            -- SYNTAX     InetAddress (SIZE (0|4|8|16|20))
            -- DESCRIPTION
            --     This compliance requires support for unknown and
            --     either ipv4 and ipv4z or ipv6 and ipv6z.
            --
            -- OBJECT     ipMcastRouteSourceAddressType
            -- SYNTAX     InetAddressType {unknown(0), ipv4(1), ipv6(2),
            --                             ipv4z(3), ipv6z(4)}
            -- DESCRIPTION
            --     This compliance requires support for unknown and
            --     either ipv4 and ipv4z or ipv6 and ipv6z.
            --
            -- OBJECT     ipMcastRouteSource
            -- SYNTAX     InetAddress (SIZE (0|4|8|16|20))
            -- DESCRIPTION
            --     This compliance requires support for unknown and
            --     either ipv4 and ipv4z or ipv6 and ipv6z.
            --
            -- OBJECT     ipMcastRouteNextHopGroupAddressType
            -- SYNTAX     InetAddressType {unknown(0), ipv4(1), ipv6(2),
            --                             ipv4z(3), ipv6z(4)}
            -- DESCRIPTION
            --     This compliance requires support for unknown and
            --     either ipv4 and ipv4z or ipv6 and ipv6z.
            --
            -- OBJECT     ipMcastRouteNextHopGroup
            -- SYNTAX     InetAddress (SIZE (0|4|8|16|20))
            -- DESCRIPTION
            --     This compliance requires support for unknown and
            --     either ipv4 and ipv4z or ipv6 and ipv6z.
            --
            -- OBJECT     ipMcastRouteNextHopSourceAddressType
            -- SYNTAX     InetAddressType {unknown(0), ipv4(1), ipv6(2),
            --                             ipv4z(3), ipv6z(4)}
            -- DESCRIPTION
            --     This compliance requires support for unknown and
            --     either ipv4 and ipv4z or ipv6 and ipv6z.
```

```
            --
            -- OBJECT     ipMcastRouteNextHopSource
            -- SYNTAX     InetAddress (SIZE (0|4|8|16|20))
            -- DESCRIPTION
            --     This compliance requires support for unknown and
            --     either ipv4 and ipv4z or ipv6 and ipv6z.
            --
            -- OBJECT     ipMcastRouteNextHopAddressType
            -- SYNTAX     InetAddressType {unknown(0), ipv4(1), ipv6(2),
            --                             ipv4z(3), ipv6z(4)}
            -- DESCRIPTION
            --     This compliance requires support for unknown and
            --     either ipv4 and ipv4z or ipv6 and ipv6z.
            --
            -- OBJECT     ipMcastRouteNextHopAddress
            -- SYNTAX     InetAddress (SIZE (0|4|8|16|20))
            -- DESCRIPTION
            --     This compliance requires support for unknown and
            --     either ipv4 and ipv4z or ipv6 and ipv6z.
            --
            -- OBJECT     ipMcastBoundaryAddressType
            -- SYNTAX     InetAddressType {ipv4(1), ipv6(2)}
            -- DESCRIPTION
            --     This compliance requires support for ipv4 or ipv6.
            --
            -- OBJECT     ipMcastBoundaryAddress
            -- SYNTAX     InetAddress (SIZE (4|16)
            -- DESCRIPTION
            --     This compliance requires support for ipv4 or ipv6.
            --
            -- OBJECT     ipMcastScopeNameAddressType
            -- SYNTAX     InetAddressType {ipv4(1), ipv6(2)}
            -- DESCRIPTION
            --     This compliance requires support for ipv4 or ipv6.
            --
            -- OBJECT     ipMcastScopeNameAddress
            -- SYNTAX     InetAddress (SIZE (4|16)
            -- DESCRIPTION
            --     This compliance requires support for ipv4 or ipv6."

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

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

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

      OBJECT     ipMcastRouteUpstreamNeighborType
      SYNTAX     InetAddressType { unknown(0), ipv4(1), ipv6(2),
                                   ipv4z(3), ipv6z(4) }
      DESCRIPTION
          "This compliance requires support for unknown and either ipv4
          and ipv4z, or ipv6 and ipv6z."

      OBJECT     ipMcastRouteUpstreamNeighbor
      SYNTAX     InetAddress (SIZE (0|4|8|16|20))
      DESCRIPTION
          "This compliance requires support for unknown and either ipv4
          and ipv4z, or ipv6 and ipv6z."

      OBJECT     ipMcastRouteRtAddressType
      SYNTAX     InetAddressType { unknown(0), ipv4(1), ipv6(2),
                                   ipv4z(3), ipv6z(4) }
      DESCRIPTION
          "This compliance requires support for unknown and either ipv4
          and ipv4z, or ipv6 and ipv6z."

      OBJECT     ipMcastRouteRtAddress
      SYNTAX     InetAddress (SIZE (0|4|8|16|20))
      DESCRIPTION
```

```
        "This compliance requires support for unknown and either ipv4
        and ipv4z, or ipv6 and ipv6z."

    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        ipMcastMIBRouteDiagnosticsGroup
    DESCRIPTION
        "This group is not mandatory, but SHOULD be supported where
        hardware permits."

    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."

    OBJECT     ipMcastZoneScopeAddressType
    SYNTAX     InetAddressType { ipv4(1), ipv6(2) }
    DESCRIPTION
        "This compliance requires support for ipv4 or ipv6."

    OBJECT     ipMcastZoneScopeAddress
    SYNTAX     InetAddress (SIZE (4|16))
    DESCRIPTION
        "This compliance requires support for ipv4 or ipv6."
```

```
    ::= { ipMcastMIBCompliances 3 }

--
-- Units of conformance
--
ipMcastMIBBasicGroup OBJECT-GROUP
    OBJECTS { ipMcastEnabled,
              ipMcastRouteEntryCount,
              ipMcastDeviceConfigStorageType
            }
    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,
              ipMcastInterfaceStorageType,
              ipMcastRouteUpstreamNeighborType,
              ipMcastRouteUpstreamNeighbor,
              ipMcastRouteInIfIndex,
              ipMcastRouteTimeStamp,
              ipMcastRouteExpiryTime,
              ipMcastRouteNextHopState,
              ipMcastRouteNextHopTimeStamp,
              ipMcastRouteNextHopExpiryTime
            }
    STATUS  current
    DESCRIPTION
            "A collection of objects to support basic management of IP
            Multicast routing."
    ::= { ipMcastMIBGroups 3 }

ipMcastMIBRouteDiagnosticsGroup OBJECT-GROUP
    OBJECTS { ipMcastRoutePkts,
              ipMcastRouteTtlDropPackets,
              ipMcastRouteDifferentInIfPackets
```

```
            }
    STATUS  current
    DESCRIPTION
            "A collection of routing diagnostic packet counters."
    ::= { 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
```

7. Security Considerations

7.1. SNMPv3

SNMP versions prior to SNMPv3 did not include adequate security. Even if the network itself is secure (for example by using IPsec), even then, there is no control as to who on the secure network is allowed to access and GET/SET (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.

7.2. 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:

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

- 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.

ipMcastEnabled ipMcastDeviceConfigStorageType ipMcastInterfaceTtl ipMcastInterfaceRateLimit ipMcastInterfaceStorageType ipMcastSsmRangeRowStatus ipMcastSsmRangeStorageType ipMcastBoundaryStatus ipMcastBoundaryStorageType ipMcastScopeNameString ipMcastScopeNameDefault ipMcastScopeNameStatus ipMcastScopeNameStorageType

7.3. 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:

- 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.

- 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.

8. IANA Considerations

IPMCAST-MIB is rooted under the mib-2 subtree. IANA has assigned { mib-2 168 } to the IPMCAST-MIB module specified in this document.

9. Acknowledgements

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