Protocol Independent Multicast MIB

Status of This Memo

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

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 managed objects used for managing the Protocol Independent Multicast (PIM) protocols: PIM-SM (Sparse Mode), BIDIR-PIM (Bidirectional), and PIM-DM (Dense Mode). This document is part of work in progress to obsolete RFC 2934, and is to be preferred where the two documents overlap. This document does not obsolete RFC 2934.

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1. Introduction

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 managed objects used for managing the Protocol Independent Multicast (PIM) protocols (PIM-SM [RFC4601], BIDIR-PIM [RFC5015], and PIM-DM [RFC3973]).

This document is part of work in progress to obviate RFC 2934 [RFC2934]. RFC 2934 defined an experimental MIB module for managing the PIM protocols. The MIB module defined by this document is a reworking of the MIB module from RFC 2934, with major changes that include the following.

- This MIB module is independent of IP version, whereas RFC 2934 only supported IPv4.
- This MIB module includes support for managing BIDIR-PIM.
- This MIB module retains limited support for managing PIM-DM [RFC3973], but that is no longer its primary purpose.
- This MIB module does not include support for managing PIM-SM v1.
- This MIB module does not depend on the IPv4 Multicast Routing MIB defined in RFC 2932 [RFC2932].
- This MIB module includes support for configuring static Rendezvous Points (RPs).
- This MIB module includes support for configuring anycast RPs [RFC4610].

2. 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 RFC 2119 [RFC2119].

3. The Internet-Standard Management Framework

For a detailed overview of the documents that describe the current Internet-Standard Management Framework, please refer to section 7 of RFC 3410 [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, RFC 2578 [RFC2578], STD 58, RFC 2579 [RFC2579] and STD 58, RFC 2580 [RFC2580].

4. Overview

This MIB module contains the following tables.

1. The PIM Interface Table, which contains one row per IP version for each interface of the router which is running PIM.

2. The PIM Neighbor Table, which contains one row for each of the router’s PIM neighbors.

3. The PIM Neighbor Secondary Address Table, which contains one row for each secondary address advertised by each of the router’s PIM neighbors.

4. The PIM (*,G) State Table, which contains one row for each group for which PIM has (*,G) state.

5. The PIM (*,G,I) State Table, which contains one row for each group and interface for which PIM has interface-specific (*,G) state.

6. The PIM (S,G) State Table, which contains one row for each source and group for which PIM has (S,G) state.

7. The PIM (S,G,I) State Table, which contains one row for each source, group, and interface for which PIM has interface-specific (S,G) state.

8. The PIM (S,G,rpt) State Table, which contains one row for each source and group for which PIM has (S,G,rpt) state.

9. The PIM (S,G,rpt,I) State Table, which contains one row for each source, group, and interface for which PIM has interface-specific (S,G,rpt) state.

10. The PIM Bidir DF-Election Table, which contains one row per interface for each Rendezvous Point (RP) for which Bidirectional-PIM Designated Forwarder (DF) election state is maintained.
11. The PIM Static RP Table, which contains one row per range of multicast group addresses for which a particular configured RP should be used.

12. The PIM Group Mapping Table, which contains one row for each mapping from a multicast group address prefix to the PIM mode and RP address to use for groups within that group prefix, regardless of the source of the group mapping information.

13. The PIM Anycast-RP Set Table, which contains one row for each RP within each Anycast-RP set of which the local router is a member.

This MIB module uses textual conventions defined in the IF-MIB [RFC2863], the INET-ADDRESS-MIB [RFC4001], and the IANA-RTPROTO-MIB [RTPROTO]. This MIB module REFERENCES [RFC3376], [RFC3569], [RFC3618], [RFC3810], [RFC3956], [RFC3973], [RFC4601], [RFC4610], [RFC5015], [RFC5059], and [IPMCAST-MIB].

5. Definitions

PIM-STD-MIB DEFINITIONS ::= BEGIN

IMPORTS
MODULE-IDENTITY, OBJECT-TYPE, mib-2,
NOTIFICATION-TYPE, Unsigned32,
Counter32, Counter64, Gauge32,
TimeTicks                        FROM SNMPv2-SMI        -- [RFC2578]
TEXTUAL-CONVENTION,
RowStatus, TruthValue,
StorageType                      FROM SNMPv2-TC         -- [RFC2579]
MODULE-COMPLIANCE, OBJECT-GROUP,
NOTIFICATION-GROUP               FROM SNMPv2-CONF       -- [RFC2580]
InterfaceIndexOrZero,
InterfaceIndex                   FROM IF-MIB            -- [RFC2863]
InetAddressType,
InetAddressPrefixLength,
InetAddress, InetVersion         FROM INET-ADDRESS-MIB  -- [RFC4001]
IANAipRouteProtocol              FROM IANA-RTPROTO-MIB; -- [RTPROTO]

pimStdMIB MODULE-IDENTITY
LAST-UPDATED "200711020000Z" -- 2 November 2007
ORGANIZATION
"IETF Protocol Independent Multicast (PIM) Working Group"
CONTACT-INFO
"Email: pim@ietf.org
WG charter:
DESCRIPTION
"The MIB module for management of PIM routers.

Copyright (C) The IETF Trust (2007). This version of this
MIB module is part of
RFC 5060; see the RFC itself for full
legal notices."

REVISION     "200711020000Z" -- 2 November 2007
DESCRIPTION  "Initial version, published as RFC 5060."
::= { mib-2 157 }

--
-- Textual Conventions
--

PimMode ::= TEXTUAL-CONVENTION
  STATUS   current
  DESCRIPTION
"The PIM mode in which a group is operating.

  none(1)         The group is not using PIM, which may be the
                  case if, for example, it is a link-local or
                  unroutable group address.

  ssm(2)          Source-Specific Multicast (SSM) with PIM Sparse
                  Mode.

  asm(3)          Any Source Multicast (ASM) with PIM Sparse
                  Mode.

  bidir(4)        Bidirectional PIM.

  dm(5)           PIM Dense Mode.

  other(6)        Any other PIM mode."

SYNTAX     INTEGER {
  none(1),
  ssm(2),
  asm(3),
  bidir(4),
  dm(5),
  other(6)
}

PimGroupMappingOriginType ::= TEXTUAL-CONVENTION
  STATUS   current
  DESCRIPTION
"The mechanism by which a PIM group mapping was learned.

fixed(1)  Link-local or unroutable group mappings.
configRp(2)  Local static RP configuration.
configSsm(3)  Local SSM Group configuration.
bsr(4)  The PIM Bootstrap Router (BSR) mechanism.
autoRp(5)  Cisco’s Auto-RP mechanism.
embedded(6)  The Embedded-RP mechanism where the RP address is embedded in the multicast group address.
other(7)  Any other mechanism."

REFERENCE "RFC 3569, RFC 3956, and RFC 5059"

SYNTAX  INTEGER {
    fixed(1),
    configRp(2),
    configSsm(3),
    bsr(4),
    autoRp(5),
    embedded(6),
    other(7)
}

--
-- Top-level structure
--

pimNotifications OBJECT IDENTIFIER ::= { pim StdMIB 0 }
pim OBJECT IDENTIFIER ::= { pim StdMIB 1 }
pimKeepalivePeriod OBJECT-TYPE
SYNTAX  Unsigned32 (0..65535)
UNITS "seconds"
MAX-ACCESS read-write
STATUS  current
DESCRIPTION
"The duration of the Keepalive Timer. This is the period during which the PIM router will maintain (S,G) state in the absence of explicit (S,G) local membership or (S,G) join messages received to maintain it. This timer period is called the Keepalive_Period in the PIM-SM specification. It is called the SourceLifetime in the PIM-DM specification."
pimRegisterSuppressionTime OBJECT-TYPE
SYNTAX     Unsigned32 (0..65535)
UNITS      "seconds"
MAX-ACCESS read-write
STATUS     current
DESCRIPTION
"The duration of the Register Suppression Timer. This is
the period during which a PIM Designated Router (DR) stops
sending Register-encapsulated data to the Rendezvous Point
(RP) after receiving a Register-Stop message. This object
is used to run timers both at the DR and at the RP. This
timer period is called the Register_Suppression_Time in the
PIM-SM specification.

The storage type of this object is determined by
pimDeviceConfigStorageType."
REFERENCE "RFC 4601 section 4.11"
DEFVAL { 60 }
 ::= { pim 15 }

pimStarGEntries OBJECT-TYPE
SYNTAX     Gauge32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The number of entries in the pimStarGTable."
 ::= { pim 16 }

pimStarGIEntries OBJECT-TYPE
SYNTAX     Gauge32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The number of entries in the pimStarGITable."
 ::= { pim 17 }

pimSGEntries OBJECT-TYPE
SYNTAX     Gauge32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The number of entries in the pimSGTable."
::= { pim 18 }

pimSGIEntries OBJECT-TYPE
SYNTAX Gauge32
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The number of entries in the pimSGITable."
::= { pim 19 }

pimSGRptEntries OBJECT-TYPE
SYNTAX Gauge32
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The number of entries in the pimSGRptTable."
::= { pim 20 }

pimSGRptIEntries OBJECT-TYPE
SYNTAX Gauge32
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The number of entries in the pimSGRptITable."
::= { pim 21 }

pimOutAsserts OBJECT-TYPE
SYNTAX Counter64
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The number of Asserts sent by this router.
Discontinuities in the value of this counter can occur at
re-initialization of the management system, for example,
when the device is rebooted."
REFERENCE "RFC 4601 section 4.6"
::= { pim 22 }

pimInAsserts OBJECT-TYPE
SYNTAX Counter64
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The number of Asserts received by this router. Asserts
are multicast to all routers on a network. This counter is
incremented by all routers that receive an assert, not only
those routers that are contesting the assert."
Discontinuities in the value of this counter can occur at re-initialization of the management system, for example, when the device is rebooted.

REFERENCE "RFC 4601 section 4.6"

::= { pim 23 }

pimLastAssertInterface OBJECT-TYPE
SYNTAX InterfaceIndexOrZero
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The interface on which this router most recently sent or received an assert, or zero if this router has not sent or received an assert."

REFERENCE "RFC 4601 section 4.6"

::= { pim 24 }

pimLastAssertGroupAddressType OBJECT-TYPE
SYNTAX InetAddressType
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The address type of the multicast group address in the most recently sent or received assert. If this router has not sent or received an assert, then this object is set to unknown(0)."

::= { pim 25 }

pimLastAssertGroupAddress OBJECT-TYPE
SYNTAX InetAddress (SIZE (0|4|8|16|20))
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The multicast group address in the most recently sent or received assert. The InetAddressType is given by the pimLastAssertGroupAddressType object."

::= { pim 26 }

pimLastAssertSourceAddressType OBJECT-TYPE
SYNTAX InetAddressType
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The address type of the source address in the most recently sent or received assert. If the most recent assert was (*,G), or if this router has not sent or received an assert, then this object is set to unknown(0)."

::= { pim 27 }
pimLastAssertSourceAddress OBJECT-TYPE
SYNTAX InetAddress (SIZE (0|4|8|16|20))
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The source address in the most recently sent or received
assert. The InetAddressType is given by the
pimLastAssertSourceAddressType object."
 ::= { pim 28 }

pimNeighborLossNotificationPeriod OBJECT-TYPE
SYNTAX Unsigned32 (0..65535)
UNITS "seconds"
MAX-ACCESS read-write
STATUS current
DESCRIPTION "The minimum time that must elapse between pimNeighborLoss
notifications originated by this router. The maximum value
65535 represents an ‘infinite’ time, in which case, no
pimNeighborLoss notifications are ever sent.

The storage type of this object is determined by
pimDeviceConfigStorageType."
DEFVAL { 0 }
 ::= { pim 29 }

pimNeighborLossCount OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The number of neighbor loss events that have occurred.

This counter is incremented when the neighbor timer expires,
and the router has no other neighbors on the same interface
with the same IP version and a lower IP address than itself.

This counter is incremented whenever a pimNeighborLoss
notification would be generated.

Discontinuities in the value of this counter can occur at
re-initialization of the management system, for example,
when the device is rebooted."
REFERENCE "RFC 4601 section 4.3.2"
 ::= { pim 30 }

pimInvalidRegisterNotificationPeriod OBJECT-TYPE
SYNTAX Unsigned32 (10..65535)
UNITS "seconds"
MAX-ACCESS read-write
STATUS current
DESCRIPTION "The minimum time that must elapse between
pimInvalidRegister notifications originated by this router.
The default value of 65535 represents an ‘infinite’ time, in
which case, no pimInvalidRegister notifications are ever
sent.

The non-zero minimum allowed value provides resilience
against propagation of denial-of-service attacks from the
data and control planes to the network management plane.

The storage type of this object is determined by
pimDeviceConfigStorageType."
DEFVAL { 65535 }
 ::= { pim 31 }
pimInvalidRegisterMsgsRcvd OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The number of invalid PIM Register messages that have been
received by this device.

A PIM Register message is invalid if either

 o the destination address of the Register message does not
   match the Group to RP mapping on this device, or

 o this device believes the group address to be within an
   SSM address range, but this Register implies ASM usage.

These conditions can occur transiently while RP mapping
changes propagate through the network. If this counter is
incremented repeatedly over several minutes, then there is a
persisting configuration error that requires correction.

The active Group to RP mapping on this device is specified
by the object pimGroupMappingPimMode. If there is no such
mapping, then the object pimGroupMappingPimMode is absent.
The RP address contained in the invalid Register is
pimInvalidRegisterRp.

Multicast data carried by invalid Register messages is
discarded. The discarded data is from a source directly
connected to pimInvalidRegisterOrigin, and is addressed to pimInvalidRegisterGroup.

Discontinuities in the value of this counter can occur at re-initialization of the management system, for example, when the device is rebooted.

REFERENCE "RFC 4601 section 4.4.2, RFC 3569, and 'IP Multicast MIB' (August 2007) ipMcastSsmRangeTable"
::= {pim 32}

pimInvalidRegisterAddressType OBJECT-TYPE
SYNTAX InetAddressType
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The address type stored in pimInvalidRegisterOrigin, pimInvalidRegisterGroup, and pimInvalidRegisterRp.

If no invalid Register messages have been received, then this object is set to unknown(0)."
::= {pim 33}

pimInvalidRegisterOrigin OBJECT-TYPE
SYNTAX InetAddress (SIZE (0|4|8|16|20))
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The source address of the last invalid Register message received by this device."
::= {pim 34}

pimInvalidRegisterGroup OBJECT-TYPE
SYNTAX InetAddress (SIZE (0|4|8|16|20))
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The IP multicast group address to which the last invalid Register message received by this device was addressed."
::= {pim 35}

pimInvalidRegisterRp OBJECT-TYPE
SYNTAX InetAddress (SIZE (0|4|8|16|20))
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The RP address to which the last invalid Register message received by this device was delivered."
::= {pim 36}
pimInvalidJoinPruneNotificationPeriod OBJECT-TYPE
SYNTAX        Unsigned32 (10..65535)
UNITS         "seconds"
MAX-ACCESS    read-write
STATUS        current
DESCRIPTION
  "The minimum time that must elapse between
  pimInvalidJoinPrune notifications originated by this router.
  The default value of 65535 represents an 'infinite' time, in
  which case, no pimInvalidJoinPrune notifications are ever
  sent.

  The non-zero minimum allowed value provides resilience
  against propagation of denial-of-service attacks from the
  control plane to the network management plane.

  The storage type of this object is determined by
  pimDeviceConfigStorageType."
DEFVAL { 65535 }
::= { pim 37 }

pimInvalidJoinPruneMsgsRcvd OBJECT-TYPE
SYNTAX        Counter32
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
  "The number of invalid PIM Join/Prune messages that have
  been received by this device.

  A PIM Join/Prune message is invalid if either

  o the Group to RP mapping specified by this message does not
    match the Group to RP mapping on this device, or

  o this device believes the group address to be within an
    SSM address range, but this Join/Prune (*,G) or (S,G,rpt)
    implies ASM usage.

  These conditions can occur transiently while RP mapping
  changes propagate through the network.  If this counter is
  incremented repeatedly over several minutes, then there is a
  persisting configuration error that requires correction.

  The active Group to RP mapping on this device is specified
  by the object pimGroupMappingPimMode.  If there is no such
  mapping, then the object pimGroupMappingPimMode is absent.
  The RP address contained in the invalid Join/Prune is
  pimInvalidJoinPruneRp."
Invalid Join/Prune messages are discarded. This may result in loss of multicast data affecting listeners downstream of pimInvalidJoinPruneOrigin, for multicast data addressed to pimInvalidJoinPruneGroup.

Discontinuities in the value of this counter can occur at re-initialization of the management system, for example, when the device is rebooted.

REFERENCE "RFC 4601 section 4.5.2, RFC 3569, and 'IP Multicast MIB' (August 2007) ipMcastSsmRangeTable"

::= { pim 38 }

pimInvalidJoinPruneAddressType OBJECT-TYPE
SYNTAX InetAddressType
MAX-ACCESS read-only
STATUS current

If no invalid Join/Prune messages have been received, this object is set to unknown(0)."

::= { pim 39 }

pimInvalidJoinPruneOrigin OBJECT-TYPE
SYNTAX InetAddress (SIZE (0|4|8|16|20))
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The source address of the last invalid Join/Prune message received by this device."

::= { pim 40 }

pimInvalidJoinPruneGroup OBJECT-TYPE
SYNTAX InetAddress (SIZE (0|4|8|16|20))
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The IP multicast group address carried in the last invalid Join/Prune message received by this device."

::= { pim 41 }

pimInvalidJoinPruneRp OBJECT-TYPE
SYNTAX InetAddress (SIZE (0|4|8|16|20))
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The RP address carried in the last invalid Join/Prune
message received by this device."
 ::= { pim 42 }

pimRPMappingNotificationPeriod OBJECT-TYPE
SYNTAX     Unsigned32 (0..65535)
UNITS      "seconds"
MAX-ACCESS read-write
STATUS     current
DESCRIPTION
"The minimum time that must elapse between
pimRPMappingChange notifications originated by this router. The default value of 65535 represents an 'infinite' time, in
which case, no pimRPMappingChange notifications are ever
sent.

The storage type of this object is determined by
pimDeviceConfigStorageType."
DEFVAL { 65535 }
 ::= { pim 43 }

pimRPMappingChangeCount OBJECT-TYPE
SYNTAX     Counter32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The number of changes to active RP mappings on this device.

Information about active RP mappings is available in
pimGroupMappingTable. Only changes to active mappings cause
this counter to be incremented. That is, changes that
modify the pimGroupMappingEntry with the highest precedence
for a group (lowest value of pimGroupMappingPrecedence).

Such changes may result from manual configuration of this
device, or from automatic RP mapping discovery methods
including the PIM Bootstrap Router (BSR) mechanism.

Discontinuities in the value of this counter can occur at
re-initialization of the management system, for example,
when the device is rebooted."
REFERENCE "RFC 5059"
 ::= { pim 44 }

pimInterfaceElectionNotificationPeriod OBJECT-TYPE
SYNTAX     Unsigned32 (0..65535)
UNITS      "seconds"
MAX-ACCESS read-write
STATUS     current
DESCRIPTION
"The minimum time that must elapse between
pimInterfaceElection notifications originated by this
router. The default value of 65535 represents an 'infinite'
time, in which case, no pimInterfaceElection notifications
are ever sent.

The storage type of this object is determined by
pimDeviceConfigStorageType."
DEFVAL { 65535 }
::= { pim 45 }

pimInterfaceElectionWinCount OBJECT-TYPE
SYNTAX     Counter32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The number of times this device has been elected DR or DF
on any interface.

Elections occur frequently on newly-active interfaces, as
triggered Hellos establish adjacencies. This counter is not
incremented for elections on an interface until the first
periodic Hello has been sent. If this router is the DR or
DF at the time of sending the first periodic Hello after
interface activation, then this counter is incremented
(once) at that time.

Discontinuities in the value of this counter can occur at
re-initialization of the management system, for example,
when the device is rebooted."
REFERENCE "RFC 4601 section 4.3.2 and RFC 5015 section 3.5.2"
::= { pim 46 }

pimRefreshInterval OBJECT-TYPE
SYNTAX     Unsigned32 (0..65535)
UNITS      "seconds"
MAX-ACCESS read-write
STATUS     current
DESCRIPTION
"The interval between successive State Refresh messages sent
by an Originator. This timer period is called the
RefreshInterval in the PIM-DM specification. This object is
used only by PIM-DM.

The storage type of this object is determined by
pimDeviceConfigStorageType."
REFERENCE "RFC 3973 section 4.8"
pimDeviceConfigStorageType OBJECT-TYPE
SYNTAX StorageType
MAX-ACCESS read-write
STATUS current
DESCRIPTION
"The storage type used for the global PIM 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:
pimKeepalivePeriod, pimRegisterSuppressionTime,
pimNeighborLossNotificationPeriod,
pimInvalidRegisterNotificationPeriod,
pimInvalidJoinPruneNotificationPeriod,
pimRPMappingNotificationPeriod,
pimInterfaceElectionNotificationPeriod, and
pimRefreshInterval."
DEFVAL { nonVolatile }
 ::= { pim 48 }

--
-- The PIM Interface Table
--

pimInterfaceTable OBJECT-TYPE
SYNTAX SEQUENCE OF PimInterfaceEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"The (conceptual) table listing the router’s PIM interfaces.
PIM is enabled on all interfaces listed in this table."
 ::= { pim 1 }

pimInterfaceEntry OBJECT-TYPE
SYNTAX PimInterfaceEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"An entry (conceptual row) in the pimInterfaceTable. This
entry is preserved on agent restart."
INDEX { pimInterfaceIfIndex,
pimInterfaceIPvVersion }
 ::= { pimInterfaceTable 1 }
PimInterfaceEntry ::= SEQUENCE {
    pimInterfaceIfIndex              InterfaceIndex,
    pimInterfaceIPVersion            InetVersion,
    pimInterfaceAddressType          InetAddressType,
    pimInterfaceAddress              InetAddress,
    pimInterfaceGenerationIDValue    Unsigned32,
    pimInterfaceDR                   InetAddress,
    pimInterfaceDRPriority           Unsigned32,
    pimInterfaceDRPriorityEnabled    TruthValue,
    pimInterfaceHelloInterval        Unsigned32,
    pimInterfaceTrigHelloInterval    Unsigned32,
    pimInterfaceHelloHoldtime        Unsigned32,
    pimInterfaceJoinPruneInterval    Unsigned32,
    pimInterfaceJoinPruneHoldtime    Unsigned32,
    pimInterfaceDFElectionRobustness Unsigned32,
    pimInterfaceLanDelayEnabled      TruthValue,
    pimInterfacePropagationDelay     Unsigned32,
    pimInterfaceOverrideInterval     Unsigned32,
    pimInterfaceEffectPropagDelay    Unsigned32,
    pimInterfaceEffectOverrideIvl    Unsigned32,
    pimInterfaceSuppressionEnabled   TruthValue,
    pimInterfaceBidirCapable         TruthValue,
    pimInterfaceDomainBorder         TruthValue,
    pimInterfaceStubInterface        TruthValue,
    pimInterfacePruneLimitInterval   Unsigned32,
    pimInterfaceGraftRetryInterval   Unsigned32,
    pimInterfaceSRPriorityEnabled    TruthValue,
    pimInterfaceStatus               RowStatus,
    pimInterfaceStorageType          StorageType
}

pimInterfaceIfIndex OBJECT-TYPE
SYNTAX     InterfaceIndex
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
    "The ifIndex value of this PIM interface."
 ::= { pimInterfaceEntry 1 }

pimInterfaceIPVersion OBJECT-TYPE
SYNTAX     InetVersion
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
    "The IP version of this PIM interface. A physical interface
may be configured in multiple modes concurrently, e.g., IPv4
and IPv6; however, the traffic is considered to be logically
separate."
::= { pimInterfaceEntry 2 }

pimInterfaceAddressType OBJECT-TYPE
SYNTAX InetAddressType
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The address type of this PIM interface."
::= { pimInterfaceEntry 3 }

pimInterfaceAddress OBJECT-TYPE
SYNTAX InetAddress (SIZE (0|4|8|16|20))
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The primary IP address of this router on this PIM interface. The InetAddressType is given by the pimInterfaceAddressType object."
REFERENCE "RFC 4601 sections 4.1.6, 4.3.1-4.3.4, and 4.5.1"
::= { pimInterfaceEntry 4 }

pimInterfaceGenerationIDValue OBJECT-TYPE
SYNTAX Unsigned32
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The value of the Generation ID this router inserted in the last PIM Hello message it sent on this interface."
REFERENCE "RFC 4601 section 4.3.1"
::= { pimInterfaceEntry 5 }

pimInterfaceDR OBJECT-TYPE
SYNTAX InetAddress (SIZE (0|4|8|16|20))
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The primary IP address of the Designated Router on this PIM interface. The InetAddressType is given by the pimInterfaceAddressType object."
REFERENCE "RFC 4601 section 4.3"
::= { pimInterfaceEntry 6 }

pimInterfaceDRPriority OBJECT-TYPE
SYNTAX Unsigned32
MAX-ACCESS read-create
STATUS current
DESCRIPTION "The Designated Router Priority value inserted into the DR
Priority option in PIM Hello messages transmitted on this interface. Numerically higher values for this object indicate higher priorities."
REFERENCE "RFC 4601 section 4.3.2"
DEFVAL { 1 }
::= { pimInterfaceEntry 7 }

pimInterfaceDRPriorityEnabled OBJECT-TYPE
SYNTAX     TruthValue
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"Evaluates to TRUE if all routers on this interface are using the DR Priority option."
REFERENCE "RFC 4601 section 4.3.2"
::= { pimInterfaceEntry 8 }

pimInterfaceHelloInterval OBJECT-TYPE
SYNTAX     Unsigned32 (0..18000)
UNITS      "seconds"
MAX-ACCESS read-create
STATUS     current
DESCRIPTION
"The frequency at which PIM Hello messages are transmitted on this interface. This object corresponds to the 'Hello_Period' timer value defined in the PIM-SM specification. A value of zero represents an 'infinite' interval, and indicates that periodic PIM Hello messages should not be sent on this interface."
REFERENCE "RFC 4601 section 9"
DEFVAL { 30 }
::= { pimInterfaceEntry 9 }

pimInterfaceTrigHelloInterval OBJECT-TYPE
SYNTAX     Unsigned32 (0..60)
UNITS      "seconds"
MAX-ACCESS read-create
STATUS     current
DESCRIPTION
"The maximum time before this router sends a triggered PIM Hello message on this interface. This object corresponds to the 'Trigered_Hello_Delay' timer value defined in the PIM-SM specification. A value of zero has no special meaning and indicates that triggered PIM Hello messages should always be sent immediately."
REFERENCE "RFC 4601 section 4.11"
DEFVAL { 5 }
::= { pimInterfaceEntry 10 }
pimInterfaceHelloHoldtime OBJECT-TYPE
SYNTAX     Unsigned32 (0..65535)
UNITS      "seconds"
MAX-ACCESS read-create
STATUS     current
DESCRIPTION
"The value set in the Holdtime field of PIM Hello messages
transmitted on this interface. A value of 65535 represents
an 'infinite' holdtime. Implementations are recommended
to use a holdtime that is 3.5 times the value of
pimInterfaceHelloInterval, or 65535 if
pimInterfaceHelloInterval is set to zero."
REFERENCE "RFC 4601 sections 4.3.2 and 4.9.2"
DEFVAL { 105 }
 ::= { pimInterfaceEntry 11 }

pimInterfaceJoinPruneInterval OBJECT-TYPE
SYNTAX     Unsigned32 (0..18000)
UNITS      "seconds"
MAX-ACCESS read-create
STATUS     current
DESCRIPTION
"The frequency at which this router sends PIM Join/Prune
messages on this PIM interface. This object corresponds to
the 't_periodic' timer value defined in the PIM-SM
specification. A value of zero represents an 'infinite'
interval, and indicates that periodic PIM Join/Prune
messages should not be sent on this interface."
REFERENCE "RFC 4601 section 4.11"
DEFVAL { 60 }
 ::= { pimInterfaceEntry 12 }

pimInterfaceJoinPruneHoldtime OBJECT-TYPE
SYNTAX     Unsigned32 (0..65535)
UNITS      "seconds"
MAX-ACCESS read-create
STATUS     current
DESCRIPTION
"The value inserted into the Holdtime field of a PIM
Join/Prune message sent on this interface. A value of 65535
represents an 'infinite' holdtime. Implementations are
recommended to use a holdtime that is 3.5 times the value of
pimInterfaceJoinPruneInterval, or 65535 if
pimInterfaceJoinPruneInterval is set to zero. PIM-DM
implementations are recommended to use the value of
pimInterfacePruneLimitInterval."
REFERENCE "RFC 4601 sections 4.5.3 and 4.9.5"
DEFVAL { 210 }
pimInterfaceDFElectionRobustness OBJECT-TYPE
SYNTAX Unsigned32
MAX-ACCESS read-create
STATUS current
DESCRIPTION "The minimum number of PIM DF-Election messages that must be lost in order for DF election on this interface to fail."
DEFVAL { 3 }
::= { pimInterfaceEntry 13 }

pimInterfaceLanDelayEnabled OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-only
STATUS current
DESCRIPTION "Evaluates to TRUE if all routers on this interface are using the LAN Prune Delay option."
REFERENCE "RFC 4601 sections 4.3.3 and 4.9.2"
::= { pimInterfaceEntry 14 }

pimInterfacePropagationDelay OBJECT-TYPE
SYNTAX Unsigned32 (0..32767)
UNITS "milliseconds"
MAX-ACCESS read-create
STATUS current
DESCRIPTION "The expected propagation delay between PIM routers on this network or link.

This router inserts this value into the Propagation_Delay field of the LAN Prune Delay option in the PIM Hello messages sent on this interface. Implementations SHOULD enforce a lower bound on the permitted values for this object to allow for scheduling and processing delays within the local router."
DEFVAL { 500 }
::= { pimInterfaceEntry 15 }

pimInterfaceOverrideInterval OBJECT-TYPE
SYNTAX Unsigned32 (0..65535)
UNITS "milliseconds"
MAX-ACCESS read-create
STATUS current
DESCRIPTION "The value this router inserts into the Override_Interval field of the LAN Prune Delay option in the PIM Hello
messages it sends on this interface.

When overriding a prune, PIM routers pick a random timer duration up to the value of this object. The more PIM routers that are active on a network, the more likely it is that the prune will be overridden after a small proportion of this time has elapsed.

The more PIM routers are active on this network, the larger this object should be to obtain an optimal spread of prune override latencies."

REFERENCE "RFC 4601 section 4.3.3"
DEFVAL { 2500 }
 ::= { pimInterfaceEntry 17 }

pimInterfaceEffectPropagDelay OBJECT-TYPE
SYNTAX     Unsigned32 (0..32767)
UNITS      "milliseconds"
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
 "The Effective Propagation Delay on this interface. This object is always 500 if pimInterfaceLanDelayEnabled is FALSE."
REFERENCE "RFC 4601 section 4.3.3"
 ::= { pimInterfaceEntry 18 }

pimInterfaceEffectOverrideIvl OBJECT-TYPE
SYNTAX     Unsigned32 (0..65535)
UNITS      "milliseconds"
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
 "The Effective Override Interval on this interface. This object is always 2500 if pimInterfaceLanDelayEnabled is FALSE."
REFERENCE "RFC 4601 section 4.3.3"
 ::= { pimInterfaceEntry 19 }

pimInterfaceSuppressionEnabled OBJECT-TYPE
SYNTAX     TruthValue
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
 "Whether join suppression is enabled on this interface. This object is always TRUE if pimInterfaceLanDelayEnabled is FALSE."
REFERENCE "RFC 4601 section 4.3.3"
pimInterfaceBidirCapable OBJECT-TYPE
   SYNTAX     TruthValue
   MAX-ACCESS read-only
   STATUS     current
   DESCRIPTION
     "Evaluates to TRUE if all routers on this interface are
     using the Bidirectional-PIM Capable option."
   REFERENCE "RFC 5015 section 3.2 and 3.7.4"

pimInterfaceDomainBorder OBJECT-TYPE
   SYNTAX     TruthValue
   MAX-ACCESS read-create
   STATUS     current
   DESCRIPTION
     "Whether or not this interface is a PIM domain border. This
     includes acting as a border for PIM Bootstrap Router (BSR)
     messages, if the BSR mechanism is in use."
   DEFVAL { false }

pimInterfaceStubInterface OBJECT-TYPE
   SYNTAX     TruthValue
   MAX-ACCESS read-create
   STATUS     current
   DESCRIPTION
     "Whether this interface is a 'stub interface'. If this
     object is set to TRUE, then no PIM packets are sent out this
     interface, and any received PIM packets are ignored.

     Setting this object to TRUE is a security measure for
     interfaces towards untrusted hosts. This allows an
     interface to be configured for use with IGMP (Internet Group
     Management Protocol) or MLD (Multicast Listener Discovery)
     only, which protects the PIM router from forged PIM messages
     on the interface.

     To communicate with other PIM routers using this interface,
     this object must remain set to FALSE.

     Changing the value of this object while the interface is
     operational causes PIM to be disabled and then re-enabled on
     this interface."
   REFERENCE "RFC 3376, RFC 3810"
   DEFVAL { false }

::= { pimInterfaceEntry 20 }
::= { pimInterfaceEntry 21 }
::= { pimInterfaceEntry 22 }
::= { pimInterfaceEntry 23 }
pimInterfacePruneLimitInterval OBJECT-TYPE
SYNTAX       Unsigned32 (0..65535)
UNITS        "seconds"
MAX-ACCESS   read-create
STATUS       current
DESCRIPTION  
"The minimum interval that must transpire between two successive Prunes sent by a router. This object corresponds to the ‘t_limit’ timer value defined in the PIM-DM specification. This object is used only by PIM-DM."
REFERENCE    "RFC 3973 section 4.8"
DEFVAL       { 60 }
 ::= { pimInterfaceEntry 24 }

pimInterfaceGraftRetryInterval OBJECT-TYPE
SYNTAX       Unsigned32 (0..65535)
UNITS        "seconds"
MAX-ACCESS   read-create
STATUS       current
DESCRIPTION  
"The minimum interval that must transpire between two successive Grafts sent by a router. This object corresponds to the ‘Graft_Retry_Period’ timer value defined in the PIM-DM specification. This object is used only by PIM-DM."
REFERENCE    "RFC 3973 section 4.8"
DEFVAL       { 3 }
 ::= { pimInterfaceEntry 25 }

pimInterfaceSRPriorityEnabled OBJECT-TYPE
SYNTAX       TruthValue
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION  
"Evaluates to TRUE if all routers on this interface are using the State Refresh option. This object is used only by PIM-DM."
 ::= { pimInterfaceEntry 26 }

pimInterfaceStatus OBJECT-TYPE
SYNTAX       RowStatus
MAX-ACCESS   read-create
STATUS       current
DESCRIPTION  
"The status of this entry. Creating the entry enables PIM on the interface; destroying the entry disables PIM on the interface.

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).

 ::= { pimInterfaceEntry 27 }

pimInterfaceStorageType 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 }
 ::= { pimInterfaceEntry 28 }

--
-- The PIM Neighbor Table
--

pimNeighborTable OBJECT-TYPE
SYNTAX     SEQUENCE OF PimNeighborEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
 "The (conceptual) table listing the router’s PIM neighbors."
 ::= { pim 2 }

pimNeighborEntry OBJECT-TYPE
SYNTAX     PimNeighborEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
 "An entry (conceptual row) in the pimNeighborTable."
INDEX      { pimNeighborIfIndex,
             pimNeighborAddressType,
             pimNeighborAddress } 
 ::= { pimNeighborTable 1 }

PimNeighborEntry ::= SEQUENCE {
   pimNeighborIfIndex InterfaceIndex,
   pimNeighborAddressType InetAddressType,
   pimNeighborAddress InetAddress,
   pimNeighborGenerationIDPresent TruthValue,
   pimNeighborGenerationIDValue Unsigned32,
   pimNeighborUpTime TimeTicks,
   pimNeighborExpiryTime TimeTicks,

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pimNeighborDRPriorityPresent    TruthValue,
pimNeighborDRPriority           Unsigned32,
pimNeighborLANPruneDelayPresent TruthValue,
pimNeighborTBit                 TruthValue,
pimNeighborPropagationDelay    Unsigned32,
pimNeighborOverrideInterval     Unsigned32,
pimNeighborBidirCapable         TruthValue,
pimNeighborSRCapable            TruthValue

}  

pimNeighborIfIndex OBJECT-TYPE
SYNTAX     InterfaceIndex
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"The value of ifIndex for the interface used to reach this
PIM neighbor."
 ::= { pimNeighborEntry 1 }

pimNeighborAddressType OBJECT-TYPE
SYNTAX     InetAddressType
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"The address type of this PIM neighbor."
 ::= { pimNeighborEntry 2 }

pimNeighborAddress OBJECT-TYPE
SYNTAX     InetAddress (SIZE (4|8|16|20))
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"The primary IP address of this PIM neighbor. The
InetAddressType is given by the pimNeighborAddressType
object."
 ::= { pimNeighborEntry 3 }

pimNeighborGenerationIDPresent OBJECT-TYPE
SYNTAX     TruthValue
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"Evaluates to TRUE if this neighbor is using the Generation
ID option."
REFERENCE "RFC 4601 section 4.3.1"
 ::= { pimNeighborEntry 4 }

pimNeighborGenerationIDValue OBJECT-TYPE

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SYNTAX     Unsigned32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION "The value of the Generation ID from the last PIM Hello message received from this neighbor. This object is always zero if pimNeighborGenerationIDPresent is FALSE."
REFERENCE "RFC 4601 section 4.3.1"
 ::= { pimNeighborEntry 5 }

pimNeighborUpTime OBJECT-TYPE
SYNTAX     TimeTicks
MAX-ACCESS read-only
STATUS     current
DESCRIPTION "The time since this PIM neighbor (last) became a neighbor of the local router."
 ::= { pimNeighborEntry 6 }

pimNeighborExpiryTime OBJECT-TYPE
SYNTAX     TimeTicks
MAX-ACCESS read-only
STATUS     current
DESCRIPTION "The minimum time remaining before this PIM neighbor will time out. The value zero indicates that this PIM neighbor will never time out."
 ::= { pimNeighborEntry 7 }

pimNeighborDRPriorityPresent OBJECT-TYPE
SYNTAX     TruthValue
MAX-ACCESS read-only
STATUS     current
DESCRIPTION "Evaluates to TRUE if this neighbor is using the DR Priority option."
REFERENCE "RFC 4601 section 4.3.2"
 ::= { pimNeighborEntry 8 }

pimNeighborDRPriority OBJECT-TYPE
SYNTAX     Unsigned32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION "The value of the Designated Router Priority from the last PIM Hello message received from this neighbor. This object is always zero if pimNeighborDRPriorityPresent is FALSE."
REFERENCE "RFC 4601 section 4.3.2"
::= { pimNeighborEntry 9 }

pimNeighborLanPruneDelayPresent OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Evaluates to TRUE if this neighbor is using the LAN Prune Delay option."
REFERENCE "RFC 4601 section 4.3.3"
::= { pimNeighborEntry 10 }

pimNeighborTBit OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Whether the T bit was set in the LAN Prune Delay option received from this neighbor. The T bit specifies the ability of the neighbor to disable join suppression. This object is always TRUE if pimNeighborLanPruneDelayPresent is FALSE."
REFERENCE "RFC 4601 section 4.3.3"
::= { pimNeighborEntry 11 }

pimNeighborPropagationDelay OBJECT-TYPE
SYNTAX Unsigned32 (0..32767)
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The value of the Propagation_Delay field of the LAN Prune Delay option received from this neighbor. This object is always zero if pimNeighborLanPruneDelayPresent is FALSE."
REFERENCE "RFC 4601 section 4.3.3"
::= { pimNeighborEntry 12 }

pimNeighborOverrideInterval OBJECT-TYPE
SYNTAX Unsigned32 (0..65535)
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The value of the Override_Interval field of the LAN Prune Delay option received from this neighbor. This object is always zero if pimNeighborLanPruneDelayPresent is FALSE."
REFERENCE "RFC 4601 section 4.3.3"
::= { pimNeighborEntry 13 }

pimNeighborBidirCapable OBJECT-TYPE
SYNTAX     TruthValue
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
  "Evaluates to TRUE if this neighbor is using the
  Bidirectional-PIM Capable option."
REFERENCE "RFC 5015 section 3.2 and 3.7.4"
::= { pimNeighborEntry 14 }

pimNeighborSRCapable OBJECT-TYPE
SYNTAX     TruthValue
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
  "Evaluates to TRUE if this neighbor is using the State
  Refresh Capable option. This object is used only by
  PIM-DM."
REFERENCE "RFC 3973 section 4.3.4"
::= { pimNeighborEntry 15 }

--
-- The PIM Neighbor Secondary Address Table
--

pimNbrSecAddressTable OBJECT-TYPE
SYNTAX     SEQUENCE OF PimNbrSecAddressEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
  "The (conceptual) table listing the secondary addresses
  advertised by each PIM neighbor (on a subset of the rows of
  the pimNeighborTable defined above)."
REFERENCE "RFC 4601 section 4.3.4"
::= { pim 3 }

pimNbrSecAddressEntry OBJECT-TYPE
SYNTAX     PimNbrSecAddressEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
  "An entry (conceptual row) in the pimNbrSecAddressTable."
INDEX      { pimNbrSecAddressIfIndex,
            pimNbrSecAddressType,
            pimNbrSecAddressPrimary,
            pimNbrSecAddress }
::= { pimNbrSecAddressTable 1 }

PimNbrSecAddressEntry ::= SEQUENCE {
pimNbrSecAddressIfIndex  InterfaceIndex,
pimNbrSecAddressType   InetAddressType,
pimNbrSecAddressPrimary InetAddress,
pimNbrSecAddress     InetAddress
}

pimNbrSecAddressIfIndex OBJECT-TYPE
SYNTAX     InterfaceIndex
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
    "The value of ifIndex for the interface used to reach this
    PIM neighbor."
::= { pimNbrSecAddressEntry 1 }

pimNbrSecAddressType OBJECT-TYPE
SYNTAX     InetAddressType
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
    "The address type of this PIM neighbor."
::= { pimNbrSecAddressEntry 2 }

pimNbrSecAddressPrimary OBJECT-TYPE
SYNTAX     InetAddress (SIZE (4|8|16|20))
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
    "The primary IP address of this PIM neighbor. The
    InetAddressType is given by the pimNbrSecAddressType
    object."
::= { pimNbrSecAddressEntry 3 }

pimNbrSecAddress OBJECT-TYPE
SYNTAX     InetAddress (SIZE (4|8|16|20))
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
    "The secondary IP address of this PIM neighbor. The
    InetAddressType is given by the pimNbrSecAddressType
    object."
::= { pimNbrSecAddressEntry 4 }

--
-- The PIM (*,G) State Table
--

pimStarGTable OBJECT-TYPE
SYNTAX     SEQUENCE OF PimStarGEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION   "The (conceptual) table listing the non-interface specific
(*,G) state that PIM has."
REFERENCE "RFC 4601 section 4.1.3"
 ::= { pim 4 }

pimStarGEntry OBJECT-TYPE
SYNTAX     PimStarGEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION   "An entry (conceptual row) in the pimStarGTable."
INDEX      { pimStarGAddressType,
pimStarGGrpAddress } ::= { pimStarGTable 1 }

PimStarGEntry ::= SEQUENCE {
pimStarGAddressType             InetAddressType,
pimStarGGrpAddress              InetAddress,
pimStarGUpTime                  TimeTicks,
pimStarGpimMode                 PimMode,
pimStarGRPAddressType           InetAddressType,
pimStarGRPAddress              InetAddress,
pimStarGpimModeOrigin           PimGroupMappingOriginType,
pimStarGRPIsLocal               TruthValue,
pimStarGUpstreamJoinState       INTEGER,
pimStarGUpstreamJoinTimer       TimeTicks,
pimStarGUpstreamNeighborType    InetAddressType,
pimStarGUpstreamNeighbor        InetAddress,
pimStarGRPFIfIndex              InterfaceIndexOrZero,
pimStarGRPFNextHopType          InetAddressType,
pimStarGRPFNextHop              InetAddress,
pimStarGRPFRouteProtocol        IANAipRouteProtocol,
pimStarGRPFRouteAddress         InetAddress,
pimStarGRPFRoutePrefixLength    InetAddressPrefixLength,
pimStarGRPFRouteMetricPref      Unsigned32,
pimStarGRPFRouteMetric          Unsigned32
}

pimStarGAddressType OBJECT-TYPE
SYNTAX     InetAddressType
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION   "The address type of this multicast group."
::= { pimStarGEntry 1 }

pimStarGGrpAddress OBJECT-TYPE
SYNTAX     InetAddress (SIZE (4, 8, 16, 20))
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
   "The multicast group address. The InetAddressType is given
   by the pimStarGAddressType object."
::= { pimStarGEntry 2 }

pimStarGUpTime OBJECT-TYPE
SYNTAX     TimeTicks
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
   "The time since this entry was created by the local router."
::= { pimStarGEntry 3 }

pimStarGPimMode OBJECT-TYPE
SYNTAX     PimMode { asm(3), bidir(4) }
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
   "Whether this entry represents an ASM (Any Source Multicast,
   used with PIM-SM) or BIDIR-PIM group."
::= { pimStarGEntry 4 }

pimStarGRPAddressType OBJECT-TYPE
SYNTAX     InetAddressType
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
   "The address type of the Rendezvous Point (RP), or
   unknown(0) if the RP address is unknown."
::= { pimStarGEntry 5 }

pimStarGRPAAddress OBJECT-TYPE
SYNTAX     InetAddress (SIZE (0, 4, 8, 16, 20))
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
   "The address of the Rendezvous Point (RP) for the group.
   The InetAddressType is given by the pimStarGRPAAddressType."
::= { pimStarGEntry 6 }

pimStarGPimModeOrigin OBJECT-TYPE
SYNTAX     PimGroupMappingOriginType
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The mechanism by which the PIM mode and RP for the group were learned."
 ::= { pimStarGEntry 7 }

pimStarGRPIsLocal OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Whether the local router is the RP for the group."
 ::= { pimStarGEntry 8 }

pimStarGUpstreamJoinState OBJECT-TYPE
SYNTAX INTEGER {
  notJoined (1),
  joined (2)
}
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Whether the local router should join the RP tree for the group. This corresponds to the state of the upstream (*,G) state machine in the PIM-SM specification."
REFERENCE "RFC 4601 section 4.5.6"
 ::= { pimStarGEntry 9 }

pimStarGUpstreamJoinTimer OBJECT-TYPE
SYNTAX TimeTicks
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The time remaining before the local router next sends a periodic (*,G) Join message on pimStarGRPFIfIndex. This timer is called the (*,G) Upstream Join Timer in the PIM-SM specification. This object is zero if the timer is not running."
REFERENCE "RFC 4601 section 4.10"
 ::= { pimStarGEntry 10 }

pimStarGUpstreamNeighborType OBJECT-TYPE
SYNTAX InetAddressType
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The primary address type of the upstream neighbor, or
unknown(0) if the upstream neighbor address is unknown or is not a PIM neighbor."
::= { pimStarGEntry 11 }

pimStarGUpstreamNeighbor OBJECT-TYPE
SYNTAX     InetAddress (SIZE (0|4|8|16|20))
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
    "The primary address of the neighbor on pimStarGRPFIfIndex
    that the local router is sending periodic (*,G) Join
    messages to.  The InetAddressType is given by the
    pimStarGUpstreamNeighborType object.  This address is called
    RPF'(*,G) in the PIM-SM specification."
REFERENCE "RFC 4601 section 4.1.6"
::= { pimStarGEntry 12 }

pimStarGRPFIfIndex OBJECT-TYPE
SYNTAX     InterfaceIndexOrZero
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
    "The value of ifIndex for the Reverse Path Forwarding
    (RPF) interface towards the RP, or zero if the RPF
    interface is unknown."
::= { pimStarGEntry 13 }

pimStarGRPFNextHopType OBJECT-TYPE
SYNTAX     InetAddressType
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
    "The address type of the RPF next hop towards the RP, or
    unknown(0) if the RPF next hop is unknown."
::= { pimStarGEntry 14 }

pimStarGRPFNextHop OBJECT-TYPE
SYNTAX     InetAddress (SIZE (0|4|8|16|20))
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
    "The address of the RPF next hop towards the RP.  The
    InetAddressType is given by the pimStarGRPFNextHopType
    object.  This address is called MRIB.next_hop(RP(G))
    in the PIM-SM specification."
REFERENCE "RFC 4601 section 4.5.5"
::= { pimStarGEntry 15 }
pimStarGRPFRouteProtocol OBJECT-TYPE
SYNTAX     IANAipRouteProtocol
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
 "The routing mechanism via which the route used to find the 
 RPF interface towards the RP was learned."
 ::= { pimStarGEntry 16 }

pimStarGRPFRouteAddress OBJECT-TYPE
SYNTAX     InetAddress (SIZE (0|4|8|16|20))
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
 "The IP address that, when combined with the corresponding
 value of pimStarGRPFRoutePrefixLength, identifies the route
 used to find the RPF interface towards the RP. The
 InetAddressType is given by the pimStarGRPFNextHopType
 object.

 This address object is only significant up to
 pimStarGRPFRoutePrefixLength bits. The remainder of the
 address bits are zero."
 ::= { pimStarGEntry 17 }

pimStarGRPFRoutePrefixLength OBJECT-TYPE
SYNTAX     InetAddressPrefixLength
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
 "The prefix length that, when combined with the
 corresponding value of pimStarGRPFRouteAddress, identifies
 the route used to find the RPF interface towards the RP.
 The InetAddressType is given by the pimStarGRPFNextHopType
 object."
 ::= { pimStarGEntry 18 }

pimStarGRPFRouteMetricPref OBJECT-TYPE
SYNTAX     Unsigned32 (0..2147483647)
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
 "The metric preference of the route used to find the RPF
 interface towards the RP."
 ::= { pimStarGEntry 19 }

pimStarGRPFRouteMetric OBJECT-TYPE
SYNTAX     Unsigned32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The routing metric of the route used to find the RPF interface towards the RP."
::= { pimStarGEntry 20 }

--
-- The PIM (*,G,I) State Table
--

pimStarGITable OBJECT-TYPE
SYNTAX     SEQUENCE OF PimStarGIEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"The (conceptual) table listing the interface-specific (*,G) state that PIM has."
REFERENCE "RFC 4601 section 4.1.3"
::= { pim 5 }

pimStarGIEntry OBJECT-TYPE
SYNTAX     PimStarGIEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"An entry (conceptual row) in the pimStarGITable."
INDEX      { pimStarGAddressType,
                 pimStarGGrpAddress,
                 pimStarGIIfIndex }
::= { pimStarGITable 1 }

PimStarGIEntry ::= SEQUENCE {
pimStarGIIfIndex             InterfaceIndex,
pimStarGIUpTime              TimeTicks,
pimStarGILocalMembership      TruthValue,
pimStarGIJoinPruneState       INTEGER,
pimStarGIPrunePendingTimer    TimeTicks,
pimStarGIJoinExpiryTimer      TimeTicks,
pimStarGIAssertState          INTEGER,
pimStarGIAssertTimer          TimeTicks,
pimStarGIAssertWinnerAddressType InetAddressType,
pimStarGIAssertWinnerAddress  InetAddress,
pimStarGIAssertWinnerMetricPref Unsigned32,
pimStarGIAssertWinnerMetric   Unsigned32
}

pimStarGIIfIndex OBJECT-TYPE
SYNTAX InterfaceIndex
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "The ifIndex of the interface that this entry corresponds to."
::= { pimStarGIEntry 1 }

pimStarGIUpTime OBJECT-TYPE
SYNTAX TimeTicks
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The time since this entry was created by the local router."
::= { pimStarGIEntry 2 }

pimStarGILocalMembership OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-only
STATUS current
DESCRIPTION "Whether the local router has (*,G) local membership on this interface (resulting from a mechanism such as IGMP or MLD). This corresponds to local_receiver_include(*,G,I) in the PIM-SM specification."
REFERENCE "RFC 3376, RFC 3810, and RFC 4601 section 4.1.6"
::= { pimStarGIEntry 3 }

pimStarGIJoinPruneState OBJECT-TYPE
SYNTAX INTEGER {
    noInfo (1),
    join (2),
    prunePending (3)
}
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The state resulting from (*,G) Join/Prune messages received on this interface. This corresponds to the state of the downstream per-interface (*,G) state machine in the PIM-SM specification."
REFERENCE "RFC 4601 section 4.5.2"
::= { pimStarGIEntry 4 }

pimStarGIPrunePendingTimer OBJECT-TYPE
SYNTAX TimeTicks
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The time remaining before the local router acts on a (*,G) Prune message received on this interface, during which the router is waiting to see whether another downstream router will override the Prune message. This timer is called the (*,G) Prune-Pending Timer in the PIM-SM specification. This object is zero if the timer is not running."

REFERENCE "RFC 4601 section 4.5.1"
::= { pimStarGIEntry 5 }

pimStarGIJoinExpiryTimer OBJECT-TYPE
SYNTAX TimeTicks
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The time remaining before (*,G) Join state for this interface expires. This timer is called the (*,G) Join Expiry Timer in the PIM-SM specification. This object is zero if the timer is not running. A value of 'FFFFFFFF'h indicates an infinite expiry time."

REFERENCE "RFC 4601 section 4.10"
::= { pimStarGIEntry 6 }

pimStarGIAssertState OBJECT-TYPE
SYNTAX INTEGER {
   noInfo (1),
   iAmAssertWinner (2),
   iAmAssertLoser (3)
}
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The (*,G) Assert state for this interface. This corresponds to the state of the per-interface (*,G) Assert state machine in the PIM-SM specification. If pimStarGPimMode is 'bidir', this object must be 'noInfo'."

REFERENCE "RFC 4601 section 4.6.2"
::= { pimStarGIEntry 7 }

pimStarGIAssertTimer OBJECT-TYPE
SYNTAX TimeTicks
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"If pimStarGIAssertState is 'iAmAssertWinner', this is the time remaining before the local router next sends a (*,G) Assert message on this interface. If pimStarGIAssertState is 'iAmAssertLoser', this is the time remaining before the
(*) Assert state expires. If pimStarGIAssertState is 'noInfo', this is zero. This timer is called the (*) Assert Timer in the PIM-SM specification.

REFERENCE "RFC 4601 section 4.6.2"
::= { pimStarGIEntry 8 }
pimSGTable OBJECT-TYPE
   SYNTAX     SEQUENCE OF PimSGEntry
   MAX-ACCESS not-accessible
   STATUS     current
   DESCRIPTION "The (conceptual) table listing the non-interface specific (S,G) state that PIM has."
   REFERENCE "RFC 4601 section 4.1.4"
   ::= { pim 6 }

pimSGEntry OBJECT-TYPE
   SYNTAX     PimSGEntry
   MAX-ACCESS not-accessible
   STATUS     current
   DESCRIPTION "An entry (conceptual row) in the pimSGTable."
   INDEX      { pimSGAddressType, pimSGGrpAddress, pimSGSrcAddress }
   ::= { pimSGTable 1 }

PimSGEntry ::= SEQUENCE {
   pimSGAddressType               InetAddressType,
   pimSGGrpAddress                InetAddress,
   pimSGSrcAddress                InetAddress,
   pimSGUpTime                    TimeTicks,
   pimSGPimMode                   PimMode,
   pimSGUpstreamJoinState         INTEGER,
   pimSGUpstreamJoinTimer         TimeTicks,
   pimSGUpstreamNeighbor          InetAddress,
   pimSGRPFIfIndex                InterfaceIndexOrZero,
   pimSGRPFNextHopType            InetAddressType,
   pimSGRPFNextHop                InetAddress,
   pimSGRPFRouteProtocol          IANAipRouteProtocol,
   pimSGRPFRouteAddress           InetAddress,
   pimSGRPFRoutePrefixLength      InetAddressPrefixLength,
   pimSGRPFRouteMetricPref        Unsigned32,
   pimSGRPFRouteMetric            Unsigned32,
   pimSGSPTBit                    TruthValue,
   pimSGKeepaliveTimer            TimeTicks,
   pimSGDRRegisterState           INTEGER,
   pimSGDRRegisterStopTimer       TimeTicks,
   pimSGPRegisterPMBRAddressType  InetAddressType,
   pimSGPRegisterPMBRAddress      InetAddress,
   pimSGUpstreamPruneState        INTEGER,
   pimSGUpstreamPruneLimitTimer   TimeTicks,
pimSGOriginatorState INTEGER,
pimSGSourceActiveTimer TimeTicks,
pimSGStateRefreshTimer TimeTicks
}

pimSGAddressType OBJECT-TYPE
SYNTAX   InetAddressType
MAX-ACCESS not-accessible
STATUS   current
DESCRIPTION "The address type of the source and multicast group for this entry."
::= { pimSGEntry 1 }

pimSGGrpAddress OBJECT-TYPE
SYNTAX   InetAddress (SIZE (4|8|16|20))
MAX-ACCESS not-accessible
STATUS   current
DESCRIPTION "The multicast group address for this entry. The InetAddressType is given by the pimSGAddressType object."
::= { pimSGEntry 2 }

pimSGSrcAddress OBJECT-TYPE
SYNTAX   InetAddress (SIZE (4|8|16|20))
MAX-ACCESS not-accessible
STATUS   current
DESCRIPTION "The source address for this entry. The InetAddressType is given by the pimSGAddressType object."
::= { pimSGEntry 3 }

pimSGUpTime OBJECT-TYPE
SYNTAX   TimeTicks
MAX-ACCESS read-only
STATUS   current
DESCRIPTION "The time since this entry was created by the local router."
::= { pimSGEntry 4 }

pimSGPimMode OBJECT-TYPE
SYNTAX   PimMode { ssm(2), asm(3) }
MAX-ACCESS read-only
STATUS   current
DESCRIPTION "Whether pimSGGrpAddress is an SSM (Source Specific Multicast, used with PIM-SM) or ASM (Any Source Multicast, used with PIM-SM) group."
REFERENCE "RFC 4601 section 4.5.2, RFC 3569, and 'IP Multicast MIB' (August 2007) ipMcastSsmRangeTable"
::= { pimSGEntry 5 }

pimSGUpstreamJoinState OBJECT-TYPE
SYNTAX INTEGER {
  notJoined (1),
  joined (2)
}
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Whether the local router should join the shortest-path tree for the source and group represented by this entry. This corresponds to the state of the upstream (S,G) state machine in the PIM-SM specification."
REFERENCE "RFC 4601 section 4.5.7"
::= { pimSGEntry 6 }

pimSGUpstreamJoinTimer OBJECT-TYPE
SYNTAX TimeTicks
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The time remaining before the local router next sends a periodic (S,G) Join message on pimSGRPFIfIndex. This timer is called the (S,G) Upstream Join Timer in the PIM-SM specification. This object is zero if the timer is not running."
REFERENCE "RFC 4601 sections 4.10 and 4.11"
::= { pimSGEntry 7 }

pimSGUpstreamNeighbor OBJECT-TYPE
SYNTAX InetAddress (SIZE (4|8|16|20))
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The primary address of the neighbor on pimSGRPFIfIndex that the local router is sending periodic (S,G) Join messages to. This is zero if the RPF next hop is unknown or is not a PIM neighbor. The InetAddressType is given by the pimSGAddressType object. This address is called RPF'(S,G) in the PIM-SM specification."
REFERENCE "RFC 4601 section 4.1.6"
::= { pimSGEntry 8 }

pimSGRPFIfIndex OBJECT-TYPE
SYNTAX InterfaceIndexOrZero
MAX-ACCESS read-only  
STATUS     current  
DESCRIPTION   
"The value of ifIndex for the RPF interface towards the source, or zero if the RPF interface is unknown."  
::= { pimSGEntry 9 }  

pimSGRPFNextHopType OBJECT-TYPE  
SYNTAX     InetAddressType  
MAX-ACCESS read-only  
STATUS     current  
DESCRIPTION   
"The address type of the RPF next hop towards the source, or unknown(0) if the RPF next hop is unknown."  
::= { pimSGEntry 10 }  

pimSGRPFNextHop OBJECT-TYPE  
SYNTAX     InetAddress (SIZE (0|4|8|16|20))  
MAX-ACCESS read-only  
STATUS     current  
DESCRIPTION   
"The address of the RPF next hop towards the source. The InetAddressType is given by the pimSGRPFNextHopType. This address is called MRIB.next_hop(S) in the PIM-SM specification."  
REFERENCE "RFC 4601 section 4.5.5"  
::= { pimSGEntry 11 }  

pimSGRPFRouteProtocol OBJECT-TYPE  
SYNTAX     IANAipRouteProtocol  
MAX-ACCESS read-only  
STATUS     current  
DESCRIPTION   
"The routing mechanism via which the route used to find the RPF interface towards the source was learned."  
::= { pimSGEntry 12 }  

pimSGRPFRouteAddress OBJECT-TYPE  
SYNTAX     InetAddress (SIZE (0|4|8|16|20))  
MAX-ACCESS read-only  
STATUS     current  
DESCRIPTION   
"The IP address that, when combined with the corresponding value of pimSGRPFRoutePrefixLength, identifies the route used to find the RPF interface towards the source. The InetAddressType is given by the pimSGRPFNextHopType object. This address object is only significant up to
pimSGRPFRoutePrefixLength bits. The remainder of the address bits are zero.

::= { pimSGEntry 13 }

pimSGRPFRoutePrefixLength OBJECT-TYPE
SYNTAX     InetAddressPrefixLength
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The prefix length that, when combined with the corresponding value of pimSGRPFRouteAddress, identifies the route used to find the RPF interface towards the source. The InetAddressType is given by the pimSGRPFNextHopType object."

::= { pimSGEntry 14 }

pimSGRPFRouteMetricPref OBJECT-TYPE
SYNTAX     Unsigned32 (0..2147483647)
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The metric preference of the route used to find the RPF interface towards the source."

::= { pimSGEntry 15 }

pimSGRPFRouteMetric OBJECT-TYPE
SYNTAX     Unsigned32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The routing metric of the route used to find the RPF interface towards the source."

::= { pimSGEntry 16 }

pimSGSPTBit OBJECT-TYPE
SYNTAX     TruthValue
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"Whether the SPT bit is set; and therefore whether forwarding is taking place on the shortest-path tree."

::= { pimSGEntry 17 }

pimSGKeepaliveTimer OBJECT-TYPE
SYNTAX     TimeTicks
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
""
"The time remaining before this (S,G) state expires, in the absence of explicit (S,G) local membership or (S,G) Join messages received to maintain it. This timer is called the (S,G) Keepalive Timer in the PIM-SM specification."

REFERENCE "RFC 4601 section 4.1.4"
::= { pimSGEntry 18 }

pimSGDRRegisterState OBJECT-TYPE
SYNTAX     INTEGER {
    noInfo (1),
    join (2),
    joinPending (3),
    prune (4)
}
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"Whether the local router should encapsulate (S,G) data packets in Register messages and send them to the RP. This corresponds to the state of the per-(S,G) Register state machine in the PIM-SM specification. This object is always 'noInfo' unless pimSGPimMode is 'asm'."

REFERENCE "RFC 4601 section 4.4.1"
::= { pimSGEntry 19 }

pimSGDRRegisterStopTimer OBJECT-TYPE
SYNTAX     TimeTicks
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"If pimSGDRRegisterState is 'prune', this is the time remaining before the local router sends a Null-Register message to the RP. If pimSGDRRegisterState is 'joinPending', this is the time remaining before the local router resumes encapsulating data packets and sending them to the RP. Otherwise, this is zero. This timer is called the Register-Stop Timer in the PIM-SM specification."

REFERENCE "RFC 4601 section 4.4"
::= { pimSGEntry 20 }

pimSGRPRegisterPMBRAddressType OBJECT-TYPE
SYNTAX     InetAddressType
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The address type of the first PIM Multicast Border Router to send a Register message with the Border bit set. This
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object is unknown(0) if the local router is not the RP for the group.

::= { pimSGEntry 21 }

pimSGRPRegisterPMBRAddress OBJECT-TYPE
SYNTAX InetAddress (SIZE (0|4|8|16|20))
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The IP address of the first PIM Multicast Border Router to send a Register message with the Border bit set. The InetAddressType is given by the pimSGRPRegisterPMBRAddressType object."

::= { pimSGEntry 22 }

pimSGUpstreamPruneState OBJECT-TYPE
SYNTAX INTEGER { forwarding (1), ackpending (2), pruned (3) }
MAX-ACCESS read-only
STATUS current
DESCRIPTION "Whether the local router has pruned itself from the tree. This corresponds to the state of the upstream prune (S,G) state machine in the PIM-DM specification. This object is used only by PIM-DM."
REFERENCE "RFC 3973 section 4.4.1"

::= { pimSGEntry 23 }

pimSGUpstreamPruneLimitTimer OBJECT-TYPE
SYNTAX TimeTicks
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The time remaining before the local router may send a (S,G) Prune message on pimSGRPFFifIndex. This timer is called the (S,G) Prune Limit Timer in the PIM-DM specification. This object is zero if the timer is not running. This object is used only by PIM-DM."
REFERENCE "RFC 2973 section 4.8"

::= { pimSGEntry 24 }

pimSGOriginatorState OBJECT-TYPE
SYNTAX INTEGER {
    notOriginator (1),
    originator (2)
DESCRIPTION
"Whether the router is an originator for an (S,G) message flow. This corresponds to the state of the per-(S,G)
Originator state machine in the PIM-DM specification. This object is used only by PIM-DM."
REFERENCE "RFC 3973 section 4.5.2"

::= { pimSGEntry 25 }

pimSGSourceActiveTimer OBJECT-TYPE
SYNTAX     TimeTicks
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"If pimSGOriginatorState is 'originator', this is the time remaining before the local router reverts to a notOriginator state. Otherwise, this is zero. This timer is called the Source Active Timer in the PIM-DM specification. This object is used only by PIM-DM."
REFERENCE "RFC 3973 section 4.8"

::= { pimSGEntry 26 }

pimSGStateRefreshTimer OBJECT-TYPE
SYNTAX     TimeTicks
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"If pimSGOriginatorState is 'originator', this is the time remaining before the local router sends a State Refresh message. Otherwise, this is zero. This timer is called the State Refresh Timer in the PIM-DM specification. This object is used only by PIM-DM."
REFERENCE "RFC 3973 section 4.8"

::= { pimSGEntry 27 }

--
-- The PIM (S,G,I) State Table
--

pimSGITable OBJECT-TYPE
SYNTAX     SEQUENCE OF PimSGIEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"The (conceptual) table listing the interface-specific (S,G) state that PIM has."
REFERENCE "RFC 4601 section 4.1.4"
::= { pim 7 }

pimSGIEntry OBJECT-TYPE
SYNTAX PimSGIEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "An entry (conceptual row) in the pimSGITable."
INDEX { pimSGAddressType, pimSGGrpAddress, pimSGSrcAddress, pimSGIIfIndex }
::= { pimSGITable 1 }

PimSGIEntry ::= SEQUENCE {
  pimSGIIfIndex InterfaceIndex,  
pimSGIUpTime TimeTicks,  
pimSGILocalMembership TruthValue,  
pimSIGJoinPruneState INTEGER,  
pimSIGPrunePendingTimer TimeTicks,  
pimSIGJoinExpireTime TimeTicks,  
pimSIGAssertState INTEGER,  
pimSIGAssertTimer TimeTicks,  
pimSIGAssertWinnerAddressType InetAddressType,  
pimSIGAssertWinnerAddress InetAddress,  
pimSIGAssertWinnerMetricPref Unsigned32,  
pimSIGAssertWinnerMetric Unsigned32
}

pimSGIIfIndex OBJECT-TYPE
SYNTAX InterfaceIndex
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "The ifIndex of the interface that this entry corresponds to."
::= { pimSGIEntry 1 }

pimSIGIUpTime OBJECT-TYPE
SYNTAX TimeTicks
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The time since this entry was created by the local router."
::= { pimSGIEntry 2 }

pimSIGILocalMembership OBJECT-TYPE
SYNTAX     TruthValue
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"Whether the local router has (S,G) local membership on this
interface (resulting from a mechanism such as IGMP or MLD).
This corresponds to local_receiver_include(S,G,I) in the
PIM-SM specification."
REFERENCE "RFC 3376, RFC 3810, RFC 4601 sections 4.1.6, 4.6.1, and
4.6.2"
::= { pimSGIEntry 3 }

pimSGIJoinPruneState OBJECT-TYPE
SYNTAX     INTEGER {
    noInfo (1),
    join (2),
    prunePending (3)
}
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The state resulting from (S,G) Join/Prune messages
received on this interface. This corresponds to the state
of the downstream per-interface (S,G) state machine in the
PIM-SM and PIM-DM specification."
REFERENCE "RFC 4601 section 4.5.3 and RFC 3973 section 4.4.2"
::= { pimSGIEntry 4 }

pimSGIPrunePendingTimer OBJECT-TYPE
SYNTAX     TimeTicks
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The time remaining before the local router acts on an (S,G)
Prune message received on this interface, during which the
router is waiting to see whether another downstream router
will override the Prune message. This timer is called the
(S,G) Prune-Pending Timer in the PIM-SM specification. This
object is zero if the timer is not running."
REFERENCE "RFC 4601 sections 4.5.3 and 4.5.4"
::= { pimSGIEntry 5 }

pimSGIJoinExpiryTimer OBJECT-TYPE
SYNTAX     TimeTicks
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The time remaining before (S,G) Join state for this
interface expires. This timer is called the (S,G) Join
Expiry Timer in the PIM-SM specification. This object is
zero if the timer is not running. A value of ’FFFFFFFF’h
indicates an infinite expiry time. This timer is called the
(S,G) Prune Timer in the PIM-DM specification.”
REFERENCE "RFC 4601 section 4.10 and RFC 3973 section 4.8"
::= { pimSGIEntry 6 }

pimSGIAssertState OBJECT-TYPE
SYNTAX     INTEGER {
    noInfo (1),
    iAmAssertWinner (2),
    iAmAssertLoser (3)
}
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The (S,G) Assert state for this interface. This
corresponds to the state of the per-interface (S,G) Assert
state machine in the PIM-SM specification.”
REFERENCE "RFC 4601 section 4.6.1"
::= { pimSGIEntry 7 }

pimSGIAssertTimer OBJECT-TYPE
SYNTAX     TimeTicks
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"If pimSGIAssertState is ‘iAmAssertWinner’, this is the time
remaining before the local router next sends a (S,G) Assert
message on this interface. If pimSGIAssertState is
‘iAmAssertLoser’, this is the time remaining before the
(S,G) Assert state expires. If pimSGIAssertState is
‘noInfo’, this is zero. This timer is called the (S,G)
Assert Timer in the PIM-SM specification.”
REFERENCE "RFC 4601 section 4.6.1"
::= { pimSGIEntry 8 }

pimSGIAssertWinnerAddressType OBJECT-TYPE
SYNTAX     InetAddressType
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"If pimSGIAssertState is ‘iAmAssertLoser’, this is the
address type of the assert winner; otherwise, this object is
unknown(0).”
::= { pimSGIEntry 9 }
pimSGIAssertWinnerAddress OBJECT-TYPE
SYNTAX     InetAddress (SIZE (0\ |4\ |8\ |16\ |20))
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"If pimSGIAssertState is 'iAmAssertLoser', this is the address of the assert winner. The InetAddressType is given by the pimSGIAssertWinnerAddressType object."
::= { pimSGIEntry 10 }

pimSGIAssertWinnerMetricPref OBJECT-TYPE
SYNTAX     Unsigned32 (0..2147483647)
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"If pimSGIAssertState is 'iAmAssertLoser', this is the metric preference of the route to the source advertised by the assert winner; otherwise, this object is zero."
::= { pimSGIEntry 11 }

pimSGIAssertWinnerMetric OBJECT-TYPE
SYNTAX     Unsigned32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"If pimSGIAssertState is 'iAm AssertLoser', this is the routing metric of the route to the source advertised by the assert winner; otherwise, this object is zero."
::= { pimSGIEntry 12 }

--
-- The PIM (S,G,rpt) State Table
--

pimSGRptTable OBJECT-TYPE
SYNTAX     SEQUENCE OF PimSGRptEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"The (conceptual) table listing the non-interface specific (S,G,rpt) state that PIM has."
REFERENCE "RFC 4601 section 4.1.5"
::= { pim 8 }

pimSGRptEntry OBJECT-TYPE
SYNTAX     PimSGRptEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION

"An entry (conceptual row) in the pimSGRptTable."

INDEX      { pimStarGAddressType,
               pimStarGGrpAddress,
               pimSGRptSrcAddress }
 ::= { pimSGRptTable 1 }

PimSGRptEntry ::= SEQUENCE {
    pimSGRptSrcAddress             InetAddress,
    pimSGRptUpTime                 TimeTicks,
    pimSGRptUpstreamPruneState     INTEGER,
    pimSGRptUpstreamOverrideTimer  TimeTicks
}

pimSGRptSrcAddress OBJECT-TYPE
SYNTAX     InetAddress (SIZE (4|8|16|20))
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"The source address for this entry.  The InetAddressType is
given by the pimStarGAddressType object."
 ::= { pimSGRptEntry 1 }

pimSGRptUpTime OBJECT-TYPE
SYNTAX     TimeTicks
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The time since this entry was created by the local router."
 ::= { pimSGRptEntry 2 }

pimSGRptUpstreamPruneState OBJECT-TYPE
SYNTAX     INTEGER {
            rptNotJoined (1),
            pruned (2),
            notPruned (3)
         }
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"Whether the local router should prune the source off the RP
tree.  This corresponds to the state of the upstream
(S,G,rpt) state machine for triggered messages in the PIM-SM
specification."
REFERENCE "RFC 4601 section 4.5.9"
 ::= { pimSGRptEntry 3 }

pimSGRptUpstreamOverrideTimer OBJECT-TYPE
SYNTAX     TimeTicks
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
  "The time remaining before the local router sends a
  triggered (S,G,rpt) Join message on pimStarGRPFIfIndex.
  This timer is called the (S,G,rpt) Upstream Override Timer
  in the PIM-SM specification. This object is zero if the
  timer is not running."
REFERENCE "RFC 4601 section 4.5.9"
 ::= { pimSGRptEntry 4 }  

-- The PIM (S,G,rpt,I) State Table --  

pimSGRptITable OBJECT-TYPE
SYNTAX     SEQUENCE OF PimSGRptIEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
  "The (conceptual) table listing the interface-specific
  (S,G,rpt) state that PIM has."
REFERENCE "RFC 4601 section 4.1.5"
 ::= { pim 9 }

pimSGRptIEntry OBJECT-TYPE
SYNTAX     PimSGRptIEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
  "An entry (conceptual row) in the pimSGRptITable."
INDEX      { pimStarGAddressType,
                    pimStarGGrpAddress,
                    pimSGRptSrcAddress,
                    pimSGRptIIfIndex }
 ::= { pimSGRptITable 1 }

PimSGRptIEntry ::= SEQUENCE {
  pimSGRptIIfIndex            InterfaceIndex,  
  pimSGRptITime              TimeTicks,  
  pimSGRptILocalMembership   TruthValue,  
  pimSGRptIJoinPruneState    INTEGER,  
  pimSGRptIPrunePendingTimer TimeTicks,  
  pimSGRptIPruneExpiryTimer  TimeTicks  
}

pimSGRptIIfIndex OBJECT-TYPE
SYNTAX     InterfaceIndex
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION "The ifIndex of the interface that this entry corresponds
to."
 ::= { pimSGRptIEntry 1 }

pimSGRptIUptime OBJECT-TYPE
SYNTAX     TimeTicks
MAX-ACCESS read-only
STATUS     current
DESCRIPTION "The time since this entry was created by the local router."
 ::= { pimSGRptIEntry 2 }

pimSGRptILocalMembership OBJECT-TYPE
SYNTAX     TruthValue
MAX-ACCESS read-only
STATUS     current
DESCRIPTION "Whether the local router has both (*,G) include local
membership and (S,G) exclude local membership on this
interface (resulting from a mechanism such as IGMP or MLD).
This corresponds to local_receiver_exclude(S,G,I) in the
PIM-SM specification."
REFERENCE "RFC 3376, RFC 3810, RFC 4601 section 4.1.6"
 ::= { pimSGRptIEntry 3 }

pimSGRptIJoinPruneState OBJECT-TYPE
SYNTAX     INTEGER {
    noInfo (1),
    prune (2),
    prunePending (3)
}
MAX-ACCESS read-only
STATUS     current
DESCRIPTION "The state resulting from (S,G,rpt) Join/Prune messages
received on this interface. This corresponds to the state
of the downstream per-interface (S,G,rpt) state machine in
the PIM-SM specification."
REFERENCE "RFC 4601 section 4.5.4"
 ::= { pimSGRptIEntry 4 }

pimSGRptIPrunePendingTimer OBJECT-TYPE
SYNTAX     TimeTicks
MAX-ACCESS read-only
pimSGRptIPruneExpiryTimer OBJECT-TYPE
SYNTAX     TimeTicks
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The time remaining before (S,G,rpt) Prune state for this
interface expires.  This timer is called the (S,G,rpt)
Prune Expiry Timer in the PIM-SM specification.  This object
is zero if the timer is not running.  A value of 'FFFFFFFF'h
indicates an infinite expiry time."
REFERENCE "RFC 4601 section 4.5.4"
::= { pimSGRptIEntry 6 }

--
-- The PIM Bidir DF-Election Table
--

pimBidirDFElectionTable OBJECT-TYPE
SYNTAX     SEQUENCE OF PimBidirDFElectionEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"The (conceptual) table listing the per-RP Designated
Forwarder (DF) Election state for each interface for all the
RPs in BIDIR mode."
REFERENCE "RFC 5015 section 3.5"
::= { pim 10 }

pimBidirDFElectionEntry OBJECT-TYPE
SYNTAX     PimBidirDFElectionEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"An entry (conceptual row) in the pimBidirDFElectionTable."
INDEX     { pimBidirDFElectionAddressType,
             pimBidirDFElectionRPAddress,
             pimBidirDFElectionIfIndex }  ::= { pimBidirDFElectionTable 1 }
PimBidirDFElectionEntry ::= SEQUENCE {
  pimBidirDFElectionAddressType       InetAddressType,
  pimBidirDFElectionRPAddress         InetAddress,
  pimBidirDFElectionIfIndex           InterfaceIndex,
  pimBidirDFElectionWinnerAddressType InetAddressType,
  pimBidirDFElectionWinnerAddress    InetAddress,
  pimBidirDFElectionWinnerUpTime      TimeTicks,
  pimBidirDFElectionWinnerMetricPref  Unsigned32,
  pimBidirDFElectionWinnerMetric      Unsigned32,
  pimBidirDFElectionState             INTEGER,
  pimBidirDFElectionStateTimer        TimeTicks
}

pimBidirDFElectionAddressType OBJECT-TYPE
SYNTAX     InetAddressType
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
  "The address type of the RP for which the DF state is being
  maintained."
::= { pimBidirDFElectionEntry 1 }

pimBidirDFElectionRPAddress OBJECT-TYPE
SYNTAX     InetAddress (SIZE (4|8|16|20))
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
  "The IP address of the RP for which the DF state is being
  maintained. The InetAddressType is given by the
  pimBidirDFElectionAddressType object."
::= { pimBidirDFElectionEntry 2 }

pimBidirDFElectionIfIndex OBJECT-TYPE
SYNTAX     InterfaceIndex
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
  "The value of ifIndex for the interface for which the DF
  state is being maintained."
::= { pimBidirDFElectionEntry 3 }

pimBidirDFElectionWinnerAddressType OBJECT-TYPE
SYNTAX     InetAddressType
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
  "The primary address type of the winner of the DF Election
  process. A value of unknown(0) indicates there is currently

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::= { pimBidirDFElectionEntry 4 }

pimBidirDFElectionWinnerAddress OBJECT-TYPE
SYNTAX     InetAddress (SIZE (0|4|8|16|20))
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The primary IP address of the winner of the DF Election
process. The InetAddressType is given by the
pimBidirDFElectionWinnerAddressType object."
::= { pimBidirDFElectionEntry 5 }

pimBidirDFElectionWinnerUpTime OBJECT-TYPE
SYNTAX     TimeTicks
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The time since the current winner (last) became elected as
the DF for this RP."
::= { pimBidirDFElectionEntry 6 }

pimBidirDFElectionWinnerMetricPref OBJECT-TYPE
SYNTAX     Unsigned32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The metric preference advertised by the DF Winner, or zero
if there is currently no DF."
::= { pimBidirDFElectionEntry 7 }

pimBidirDFElectionWinnerMetric OBJECT-TYPE
SYNTAX     Unsigned32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The metric advertised by the DF Winner, or zero if there is
currently no DF."
::= { pimBidirDFElectionEntry 8 }

pimBidirDFElectionState OBJECT-TYPE
SYNTAX     INTEGER {
    dfOffer(1),
    dfLose(2),
    dfWinner(3),
    dfBackoff(4)
}
MAX-ACCESS read-only
pimBidirDFElectionStateTimer OBJECT-TYPE
SYNTAX     TimeTicks
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The minimum time remaining after which the local router
will expire the current DF state represented by
pimBidirDFElectionState."
::= { pimBidirDFElectionEntry 10 }

--
-- The PIM Static RP Table
--

pimStaticRPTable OBJECT-TYPE
SYNTAX     SEQUENCE OF PimStaticRPEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"This table is used to manage static configuration of RPs.

If the group prefixes configured for two or more rows in
this table overlap, the row with the greatest value of
pimStaticRPGrpPrefixLength is used for the overlapping
range."
REFERENCE "RFC 4601 section 3.7"
::= { pim 11 }

pimStaticRPEntry OBJECT-TYPE
SYNTAX     PimStaticRPEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"An entry (conceptual row) in the pimStaticRPTable. This
entry is preserved on agent restart."
INDEX      { pimStaticRPAddressType,
pimStaticRPGrpAddress,
pimStaticRPGrpPrefixLength }
::= { pimStaticRPTable 1 }
PimStaticRPEntry ::= SEQUENCE {
  pimStaticRPAddressType InetAddressType,
pimStaticRPGrpAddress InetAddress,
pimStaticRPGrpPrefixLength InetAddressPrefixLength,
pimStaticRPGrpAddress InetAddress,
pimStaticRPGrpMode PimMode,
pimStaticRPOverrideDynamic TruthValue,
pimStaticRPPrecedence Unsigned32,
pimStaticRPRowStatus RowStatus,
pimStaticRPStorageType StorageType
}

pimStaticRPAddressType OBJECT-TYPE
SYNTAX InetAddressType
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "The address type of this entry."
::= { pimStaticRPEntry 1 }

pimStaticRPGrpAddress OBJECT-TYPE
SYNTAX InetAddress (SIZE (4|8|16|20))
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "The multicast group address that, when combined with
pimStaticRPGrpPrefixLength, gives the group prefix for this
entry. The InetAddressType is given by the
pimStaticRPAddressType object.

This address object is only significant up to
pimStaticRPGrpPrefixLength bits. The remainder of the
address bits are zero. This is especially important for
this index field, which is part of the index of this entry.
Any non-zero bits would signify an entirely different
entry."
::= { pimStaticRPEntry 2 }

pimStaticRPGrpPrefixLength OBJECT-TYPE
SYNTAX InetAddressPrefixLength (4..128)
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "The multicast group prefix length that, when combined
with pimStaticRPGrpAddress, gives the group prefix for this
entry. The InetAddressType is given by the
pimStaticRPAddressType object. If pimStaticRPAddressType is
‘ipv4’ or ‘ipv4z’, this object must be in the range 4..32."
If pimStaticRPGrpAddressType is 'ipv6' or 'ipv6z', this object must be in the range 8..128.

::= { pimStaticRPEntry 3 }

pimStaticRPRPAddress OBJECT-TYPE
SYNTAX     InetAddress (SIZE (4|8|16|20))
MAX-ACCESS read-create
STATUS     current
DESCRIPTION  "The IP address of the RP to be used for groups within this group prefix. The InetAddressType is given by the pimStaticRPAddressType object."
::= { pimStaticRPEntry 4 }

pimStaticRPPimMode OBJECT-TYPE
SYNTAX     PimMode { ssm(2), asm(3), bidir(4) }
MAX-ACCESS read-create
STATUS     current
DESCRIPTION  "The PIM mode to be used for groups in this group prefix. If this object is set to ssm(2), then pimStaticRPRPAddress must be set to zero. No RP operations are ever possible for PIM Mode SSM."
REFERENCE "RFC 4601 section 3.7, RFC 3569, and 'IP Multicast MIB' (August 2007) ipMcastSsmRangeTable"
DEFVAL { asm }
::= { pimStaticRPEntry 5 }

pimStaticRPOverrideDynamic OBJECT-TYPE
SYNTAX     TruthValue
MAX-ACCESS read-create
STATUS     current
DESCRIPTION  "Whether this static RP configuration will override other group mappings in this group prefix. If this object is TRUE, then it will override:

- RP information learned dynamically for groups in this group prefix.

- RP information configured in pimStaticRPTable with pimStaticRPOverrideDynamic set to FALSE.

See pimGroupMappingTable for details."
DEFVAL { false }
::= { pimStaticRPEntry 6 }
pimStaticRPPrecedence OBJECT-TYPE
SYNTAX     Unsigned32
MAX-ACCESS read-create
STATUS     current
DESCRIPTION
"The value for pimGroupMappingPrecedence to be used for this static RP configuration. This allows fine control over which configuration is overridden by this static configuration.

If pimStaticRPOverrideDynamic is set to TRUE, all dynamic RP configuration is overridden by this static configuration, whatever the value of this object.

The absolute values of this object have a significance only on the local router and do not need to be coordinated with other routers. A setting of this object may have different effects when applied to other routers.

Do not use this object unless fine control of static RP behavior on the local router is required."
 ::= { pimStaticRPEntry 7 }

pimStaticRPRowStatus 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 cannot be set to active(1) before a valid value has been written to pimStaticRPAddress.

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

pimStaticRPStorageType 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 }
 ::= { pimStaticRPEntry 9 }
The PIM Anycast-RP Set Table

pimAnycastRPSetTable OBJECT-TYPE
SYNTAX     SEQUENCE OF PimAnycastRPSetEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"This table is used to manage Anycast-RP via PIM Register messages, as opposed to via other protocols such as MSDP (Multicast Source Discovery Protocol).

Entries must be configured in this table if and only if the local router is a member of one or more Anycast-RP sets, that is, one or more Anycast-RP addresses are assigned to the local router. Note that if using static RP configuration, this is in addition to, not instead of, the pimStaticRPTable entries that must be configured for the Anycast-RPs.

The set of rows with the same values of both pimAnycastRPSetAddressType and pimAnycastRPSetAnycastAddress corresponds to the Anycast-RP set for that Anycast-RP address.

When an Anycast-RP set configuration is active, one entry per pimAnycastRPSetAnycastAddress corresponds to the local router. The local router is identified by the pimAnycastRPSetLocalRouter object. That entry determines the source address used by the local router when forwarding PIM Register messages within the Anycast-RP set."

REFERENCE "RFC 4610, RFC 3618"
::= { pim 12 }

pimAnycastRPSetEntry OBJECT-TYPE
SYNTAX     PimAnycastRPSetEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"An entry corresponds to a single router within a particular Anycast-RP set. This entry is preserved on agent restart."

INDEX
{ pimAnycastRPSetAddressType,
  pimAnycastRPSetAnycastAddress,
  pimAnycastRPSetRouterAddress }
::= { pimAnycastRPSetTable 1 }

PimAnycastRPSetEntry ::= SEQUENCE {
pimAnycastRPSetAddressType InetAddressType,
pimAnycastRPSetAnycastAddress InetAddress,
pimAnycastRPSetRouterAddress InetAddress,
pimAnycastRPSetLocalRouter TruthValue,
pimAnycastRPSetRowStatus RowStatus,
pimAnycastRPSetStorageType StorageType

pimAnycastRPSetAddressType OBJECT-TYPE
SYNTAX InetAddressType
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "The address type of the Anycast-RP address and router address."
::= { pimAnycastRPSetEntry 1 }

pimAnycastRPSetAnycastAddress OBJECT-TYPE
SYNTAX InetAddress (SIZE (4|8|16|20))
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "The Anycast-RP address. The InetAddressType is given by the pimAnycastRPSetAddressType object."
::= { pimAnycastRPSetEntry 2 }

pimAnycastRPSetRouterAddress OBJECT-TYPE
SYNTAX InetAddress (SIZE (4|8|16|20))
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "The address of a router that is a member of the Anycast-RP set. The InetAddressType is given by the pimAnycastRPSetAddressType object.

This address differs from pimAnycastRPSetAnycastAddress. Equal values for these two addresses in a single entry are not permitted. That would cause a Register loop."
::= { pimAnycastRPSetEntry 3 }

pimAnycastRPSetLocalRouter OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-only
STATUS current
DESCRIPTION "Whether this entry corresponds to the local router."
::= { pimAnycastRPSetEntry 4 }
pimAnycastRPSetRowStatus 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)."
   ::= { pimAnycastRPSetEntry 5 }

pimAnycastRPSetStorageType 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 }
   ::= { pimAnycastRPSetEntry 6 }

--
-- The PIM Group Mapping Table
--

pimGroupMappingTable OBJECT-TYPE
   SYNTAX         SEQUENCE OF PimGroupMappingEntry
   MAX-ACCESS     not-accessible
   STATUS         current
   DESCRIPTION
      "The (conceptual) table listing mappings from multicast group prefixes to the PIM mode and RP address to use for groups within that group prefix.

      Rows in this table are created for a variety of reasons, indicated by the value of the pimGroupMappingOrigin object.

      - Rows with a pimGroupMappingOrigin value of 'fixed' are created automatically by the router at startup, to correspond to the well-defined prefixes of link-local and unroutable group addresses. These rows are never destroyed."
- Rows with a `pimGroupMappingOrigin` value of 'embedded' are created by the router to correspond to group prefixes that are to be treated as being in Embedded-RP format.

- Rows with a `pimGroupMappingOrigin` value of 'configRp' are created and destroyed as a result of rows in the `pimStaticRPTable` being created and destroyed.

- Rows with a `pimGroupMappingOrigin` value of 'configSsm' are created and destroyed as a result of configuration of SSM address ranges to the local router.

- Rows with a `pimGroupMappingOrigin` value of 'bsr' are created as a result of running the PIM Bootstrap Router (BSR) mechanism. If the local router is not the elected BSR, these rows are created to correspond to group prefixes in the PIM Bootstrap messages received from the elected BSR. If the local router is the elected BSR, these rows are created to correspond to group prefixes in the PIM Bootstrap messages that the local router sends. In either case, these rows are destroyed when the group prefixes are timed out by the BSR mechanism.

- Rows with a `pimGroupMappingOrigin` value of 'other' are created and destroyed according to some other mechanism not specified here.

Given the collection of rows in this table at any point in time, the PIM mode and RP address to use for a particular group is determined using the following algorithm.

1. From the set of all rows, the subset whose group prefix contains the group in question are selected.

2. If there are no such rows, then the group mapping is undefined.

3. If there are multiple selected rows, and a subset is defined by `pimStaticRPTable` (`pimGroupMappingOrigin` value of 'configRp') with `pimStaticRPOverrideDynamic` set to TRUE, then this subset is selected.

4. From the selected subset of rows, the subset that have the greatest value of `pimGroupMappingGrpPrefixLength` are selected.

5. If there are still multiple selected rows, the subset that has the highest precedence (the lowest numerical
value for pimGroupMappingPrecedence) is selected.

6. If there are still multiple selected rows, the row selected is implementation dependent; the implementation might or might not apply the PIM hash function to select the row.

7. The group mode to use is given by the value of pimGroupMappingPimMode from the single selected row; the RP to use is given by the value of pimGroupMappingRPAddress, unless pimGroupMappingOrigin is 'embedded', in which case, the RP is extracted from the group address in question.

REFERENCE "RFC 4601 section 3.7, RFC 3956, and RFC 4610"

::= { pim 13 }

pimGroupMappingEntry OBJECT-TYPE
SYNTAX PimGroupMappingEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "An entry (conceptual row) in the pimGroupMappingTable."
INDEX { pimGroupMappingOrigin, pimGroupMappingAddressType, pimGroupMappingGrpAddress, pimGroupMappingGrpPrefixLength, pimGroupMappingRPAddressType, pimGroupMappingRPAddress }
::= { pimGroupMappingTable 1 }

PimGroupMappingEntry ::= SEQUENCE {
  pimGroupMappingOrigin           PimGroupMappingOriginType,
  pimGroupMappingAddressType      InetAddressType,
  pimGroupMappingGrpAddress       InetAddress,
  pimGroupMappingGrpPrefixLength  InetAddressPrefixLength,
  pimGroupMappingRPAddressType    InetAddressType,
  pimGroupMappingRPAddress        InetAddress,
  pimGroupMappingPimMode          PimMode,
  pimGroupMappingPrecedence       Unsigned32
}

pimGroupMappingOrigin OBJECT-TYPE
SYNTAX PimGroupMappingOriginType
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "The mechanism by which this group mapping was learned."
::= { pimGroupMappingEntry 1 }

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pimGroupMappingAddressType OBJECT-TYPE
   SYNTAX     InetAddressType
   MAX-ACCESS not-accessible
   STATUS     current
   DESCRIPTION
      "The address type of the IP multicast group prefix."
   ::= { pimGroupMappingEntry 2 }

pimGroupMappingGrpAddress OBJECT-TYPE
   SYNTAX     InetAddress (SIZE (4|8|16|20))
   MAX-ACCESS not-accessible
   STATUS     current
   DESCRIPTION
      "The IP multicast group address that, when combined with
      pimGroupMappingGrpPrefixLength, gives the group prefix for
      this mapping. The InetAddressType is given by the
      pimGroupMappingAddressType object.

      This address object is only significant up to
      pimGroupMappingGrpPrefixLength bits. The remainder of the
      address bits are zero. This is especially important for
      this index field, which is part of the index of this entry.
      Any non-zero bits would signify an entirely different
      entry."
   ::= { pimGroupMappingEntry 3 }

pimGroupMappingGrpPrefixLength OBJECT-TYPE
   SYNTAX     InetAddressPrefixLength (4..128)
   MAX-ACCESS not-accessible
   STATUS     current
   DESCRIPTION
      "The multicast group prefix length that, when combined
      with pimGroupMappingGrpAddress, gives the group prefix for
      this mapping. The InetAddressType is given by the
      pimGroupMappingAddressType object. If
      pimGroupMappingAddressType is ‘ipv4’ or ‘ipv4z’, this
      object must be in the range 4..32. If
      pimGroupMappingAddressType is ‘ipv6’ or ‘ipv6z’, this object
      must be in the range 8..128."
   ::= { pimGroupMappingEntry 4 }

pimGroupMappingRPAddressType OBJECT-TYPE
   SYNTAX     InetAddressType
   MAX-ACCESS not-accessible
   STATUS     current
   DESCRIPTION
      "The address type of the RP to be used for groups within
      this group prefix, or unknown(0) if no RP is to be used or
if the RP address is unknown. This object must be unknown(0) if pimGroupMappingPimMode is ssm(2), or if pimGroupMappingOrigin is embedded(6).

::= { pimGroupMappingEntry 5 }

pimGroupMappingRPAddress OBJECT-TYPE
SYNTAX InetAddress (SIZE (0|4|8|16|20))
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION  "The IP address of the RP to be used for groups within this group prefix. The InetAddressType is given by the pimGroupMappingRPAddressType object."

::= { pimGroupMappingEntry 6 }

pimGroupMappingPimMode OBJECT-TYPE
SYNTAX PimMode
MAX-ACCESS read-only
STATUS current
DESCRIPTION  "The PIM mode to be used for groups in this group prefix."

::= { pimGroupMappingEntry 7 }

pimGroupMappingPrecedence OBJECT-TYPE
SYNTAX Unsigned32
MAX-ACCESS read-only
STATUS current
DESCRIPTION  "The precedence of this row, used in the algorithm that determines which row applies to a given group address (described above). Numerically higher values for this object indicate lower precedences, with the value zero denoting the highest precedence.

The absolute values of this object have a significance only on the local router and do not need to be coordinated with other routers."

::= { pimGroupMappingEntry 8 }

--
-- PIM Notifications
--

pimNeighborLoss NOTIFICATION-TYPE
OBJECTS { pimNeighborUpTime }
STATUS current
DESCRIPTION  "A pimNeighborLoss notification signifies the loss of an
adjacency with a neighbor. This notification should be generated when the neighbor timer expires, and the router has no other neighbors on the same interface with the same IP version and a lower IP address than itself.

This notification is generated whenever the counter pimNeighborLossCount is incremented, subject to the rate limit specified by pimNeighborLossNotificationPeriod.

REFERENCE "RFC 4601 section 4.3.2"

::= { pimNotifications 1 }

pimInvalidRegister NOTIFICATION-TYPE
OBJECTS { pimGroupMappingPimMode,
    pimInvalidRegisterAddressType,
    pimInvalidRegisterOrigin,
    pimInvalidRegisterGroup,
    pimInvalidRegisterRp
 }

STATUS current

DESCRIPTION "A pimInvalidRegister notification signifies that an invalid PIM Register message was received by this device.

This notification is generated whenever the counter pimInvalidRegisterMsgsRcvd is incremented, subject to the rate limit specified by pimInvalidRegisterNotificationPeriod."

REFERENCE "RFC 4601 section 4.4.2"

::= { pimNotifications 2 }

pimInvalidJoinPrune NOTIFICATION-TYPE
OBJECTS { pimGroupMappingPimMode,
    pimInvalidJoinPruneAddressType,
    pimInvalidJoinPruneOrigin,
    pimInvalidJoinPruneGroup,
    pimInvalidJoinPruneRp,
    pimNeighborUpTime
 }

STATUS current

DESCRIPTION "A pimInvalidJoinPrune notification signifies that an invalid PIM Join/Prune message was received by this device.

This notification is generated whenever the counter pimInvalidJoinPruneMsgsRcvd is incremented, subject to the rate limit specified by pimInvalidJoinPruneNotificationPeriod."
REFERENCE "RFC 4601 section 4.5.2"
::= { pimNotifications 3 }

pimRPMappingChange NOTIFICATION-TYPE
OBJECTS { pimGroupMappingPimMode,
pimGroupMappingPrecedence }
STATUS current
DESCRIPTION "A pimRPMappingChange notification signifies a change to the
active RP mapping on this device.

This notification is generated whenever the counter
pimRPMappingChangeCount is incremented, subject to the
rate limit specified by
pimRPMappingChangeNotificationPeriod."
::= { pimNotifications 4 }

pimInterfaceElection NOTIFICATION-TYPE
OBJECTS { pimInterfaceAddressType,
pimInterfaceAddress }
STATUS current
DESCRIPTION "A pimInterfaceElection notification signifies that a new DR
or DF has been elected on a network.

This notification is generated whenever the counter
pimInterfaceElectionWinCount is incremented, subject to the
rate limit specified by
pimInterfaceElectionNotificationPeriod."
REFERENCE "RFC 4601 section 4.3.2 and RFC 5015 section 3.5.2"
::= { pimNotifications 5 }

--
-- Conformance Information
--

pimMIBConformance OBJECT IDENTIFIER ::= { pimStdMIB 2 }
pimMIBCompliances OBJECT IDENTIFIER ::= { pimMIBConformance 1 }
pimMIBGroups OBJECT IDENTIFIER ::= { pimMIBConformance 2 }

--
-- Compliance Statements
--

pimMIBComplianceAsm MODULE-COMPLIANCE
STATUS current
DESCRIPTION
"The compliance statement for routers which are running PIM-SM (Sparse Mode)."

MODULE -- this module
MANDATORY-GROUPS { pimTopologyGroup,
     pimSsmGroup,
     pimRPConfigGroup,
     pimSmGroup }

GROUP   pimNotificationGroup
DESCRIPTION
 "This group is optional."

GROUP pimTuningParametersGroup
DESCRIPTION
 "This group is optional."

GROUP pimRouterStatisticsGroup
DESCRIPTION
 "This group is optional."

GROUP pimAnycastRpGroup
DESCRIPTION
 "This group is optional."

GROUP pimStaticRPPrecedenceGroup
DESCRIPTION
 "This group is optional."

GROUP pimNetMgmtNotificationObjects
DESCRIPTION
 "This group is optional."

GROUP pimNetMgmtNotificationGroup
DESCRIPTION
 "This group is optional."

GROUP pimDiagnosticsGroup
DESCRIPTION
 "This group is optional."

GROUP pimDeviceStorageGroup
DESCRIPTION
 "This group is optional."

::= { pimMIBCompliances 1 }

pimMIBComplianceBidir MODULE-COMPLIANCE
 STATUS  current
DESCRIPTION
 "The compliance statement for routers which are running
 Bidir-PIM."

MODULE  -- this module
MANDATORY-GROUPS { pimTopologyGroup,
     pimRPConfigGroup,
     pimSmGroup,
     pimBidirGroup }

GROUP   pimNotificationGroup
DESCRIPTION
 "This group is optional."

GROUP   pimTuningParametersGroup
DESCRIPTION
 "This group is optional."

GROUP   pimRouterStatisticsGroup
DESCRIPTION
 "This group is optional."

GROUP   pimAnycastRpGroup
DESCRIPTION
 "This group is optional."

GROUP   pimStaticRPPrecedenceGroup
DESCRIPTION
 "This group is optional."

GROUP   pimNetMgmtNotificationObjects
DESCRIPTION
 "This group is optional."

GROUP   pimNetMgmtNotificationGroup
DESCRIPTION
 "This group is optional."

GROUP   pimDiagnosticsGroup
DESCRIPTION
 "This group is optional."

GROUP   pimDeviceStorageGroup
DESCRIPTION
 "This group is optional."

 ::= { pimMIBCompliances 2 }
STATUS  current
DESCRIPTION
"The compliance statement for routers which are running
PIM SSM (Source Specific Multicast)."
MODULE  -- this module
MANDATORY-GROUPS { pimTopologyGroup,
pimSsmGroup }

GROUP  pimNotificationGroup
DESCRIPTION
"This group is optional."

GROUP  pimTuningParametersGroup
DESCRIPTION
"This group is optional."

GROUP  pimRouterStatisticsGroup
DESCRIPTION
"This group is optional."

GROUP  pimNetMgmtNotificationObjects
DESCRIPTION
"This group is optional."

GROUP  pimNetMgmtNotificationGroup
DESCRIPTION
"This group is optional."

GROUP  pimDiagnosticsGroup
DESCRIPTION
"This group is optional."

GROUP  pimDeviceStorageGroup
DESCRIPTION
"This group is optional."

::= { pimMIBCompliances 3 }
pimMIBComplianceDm MODULE-COMPLIANCE
STATUS  current
DESCRIPTION
"The compliance statement for routers which are running
PIM-DM (Dense Mode)."
MODULE  -- this module
MANDATORY-GROUPS { pimTopologyGroup,
pimSsmGroup,
pimRPConfigGroup,
pimSmGroup,
pimDmGroup }

GROUP  pimNotificationGroup
DESCRIPTION
 "This group is optional."

GROUP  pimTuningParametersGroup
DESCRIPTION
 "This group is optional."

GROUP  pimRouterStatisticsGroup
DESCRIPTION
 "This group is optional."

GROUP  pimAnycastRpGroup
DESCRIPTION
 "This group is optional."

GROUP  pimStaticRPPrecedenceGroup
DESCRIPTION
 "This group is optional."

GROUP  pimNetMgmtNotificationObjects
DESCRIPTION
 "This group is optional."

GROUP  pimNetMgmtNotificationGroup
DESCRIPTION
 "This group is optional."

GROUP  pimDiagnosticsGroup
DESCRIPTION
 "This group is optional."

GROUP  pimDeviceStorageGroup
DESCRIPTION
 "This group is optional."

::= { pimMIBCompliances 4 }

--
-- Units of Conformance
--

pimTopologyGroup OBJECT-GROUP
 OBJECTS { pimInterfaceAddressType,
            pimInterfaceAddress,
            pimInterfaceGenerationIDValue,
pimInterfaceDR,
pimInterfaceDRPriorityEnabled,
pimInterfaceHelloHoldtime,
pimInterfaceJoinPruneHoldtime,
pimInterfaceLanDelayEnabled,
pimInterfaceEffectPropagDelay,
pimInterfaceEffectOverrideIvl,
pimInterfaceSuppressionEnabled,
pimInterfaceBidirCapable,
pimNeighborGenerationIDPresent,
pimNeighborGenerationIDValue,
pimNeighborUpTime,
pimNeighborExpiryTime,
pimNeighborDRPriorityPresent,
pimNeighborDRPriority,
pimNeighborLanPruneDelayPresent,
pimNeighborTBit,
pimNeighborPropagationDelay,
pimNeighborOverrideInterval,
pimNeighborBidirCapable,
pimNbrSecAddress
}
STATUS current
DESCRIPTION
"A collection of read-only objects used to report local PIM
topology."
 ::= { pimMIBGroups 1 }

pimNotificationGroup NOTIFICATION-GROUP
NOTIFICATIONS { pimNeighborLoss }
STATUS current
DESCRIPTION
"A collection of notifications for signaling important PIM
events."
 ::= { pimMIBGroups 2 }

pimTuningParametersGroup OBJECT-GROUP
OBJECTS { pimKeepalivePeriod,
pimRegisterSuppressionTime,
pimInterfaceDRPriority,
pimInterfaceHelloInterval,
pimInterfaceTrigHelloInterval,
pimInterfaceJoinPruneInterval,
pimInterfacePropagationDelay,
pimInterfaceOverrideInterval,
pimInterfaceDomainBorder,
pimInterfaceStubInterface,
pimInterfaceStatus,
pimInterfaceStorageType

}  
STATUS current
DESCRIPTION
   "A collection of writeable objects used to configure PIM
   behavior and to tune performance."
::= { pimMIBGroups 3 }

pimRouterStatisticsGroup OBJECT-GROUP
  OBJECTS { pimStarGEntries,
             pimStarGIEntries,
             pimSGEntries,
             pimSGIEntries,
             pimSGRptEntries,
             pimSGRptIEntries
            }
  STATUS current
  DESCRIPTION
     "A collection of statistics global to the PIM router."
::= { pimMIBGroups 4 }

pimSsmGroup OBJECT-GROUP
  OBJECTS { pimSGUpTime,
             pimSGPimMode,
             pimSGUpstreamJoinState,
             pimSGUpstreamJoinTimer,
             pimSGUpstreamNeighbor,
             pimSGRFFIfIndex,
             pimSGRFFNextHopType,
             pimSGRFFNextHop,
             pimSGRFFRouteProtocol,
             pimSGRFFRouteAddress,
             pimSGRFFRoutePrefixLength,
             pimSGRFFRouteMetricPref,
             pimSGRFFRouteMetric,
             pimSGSPTBit,
             pimSGKeepaliveTimer,
             pimSGDRRegisterState,
             pimSGDRRegisterStopTimer,
             pimSGRRegisterPMBRAddressType,
             pimSGRRegisterPMBRAddress,
             pimSGIUpTime,
             pimSGILocalMembership,
             pimSGIJoinPruneState,
             pimSGIPrunePendingTimer,
             pimSGIJoinExpiryTimer,
             pimSGIAssertState,
             pimSGIAssertTimer,
pimSGIAssertWinnerAddressType,
pimSGIAssertWinnerAddress,
pimSGIAssertWinnerMetricPref,
pimSGIAssertWinnerMetric
}
STATUS current
DESCRIPTION
"A collection of objects to support management of PIM routers running the PIM SSM (Source Specific Multicast) protocol, in PIM mode SM (Sparse Mode)."
 ::= { pimMIBGroups 5 }

pimRPConfigGroup OBJECT-GROUP
OBJECTS { pimStaticRPRPAddress,
pimStaticRPImMode,
pimStaticRPOverrideDynamic,
pimStaticRPRowStatus,
pimStaticRPStorageType,
pimGroupMappingPimMode,
pimGroupMappingPrecedence
}
STATUS current
DESCRIPTION
"A collection of objects to support configuration of RPs (Rendezvous Points) and Group Mappings."
 ::= { pimMIBGroups 6 }

pimSmGroup OBJECT-GROUP
OBJECTS { pimStarGUpTime,
pimStarGPImMode,
pimStarGRPAddressType,
pimStarGRPAddress,
pimStarGPImModeOrigin,
pimStarGRPIsLocal,
pimStarGUpstreamJoinState,
pimStarGUpstreamJoinTimer,
pimStarGUpstreamNeighborType,
pimStarGUpstreamNeighbor,
pimStarGRPFIfIndex,
pimStarGRPFNextHopType,
pimStarGRPFNextHop,
pimStarGRPFRouteProtocol,
pimStarGRPFRouteAddress,
pimStarGRPFRoutePrefixLength,
pimStarGRPFRouteMetricPref,
pimStarGRPFRouteMetric,
pimStarGIUpTime,
pimStarGIIsLocalMembership,
pimStarGIJoinPruneState,
pimStarGIIPrunePendingTimer,
pimStarGIJoinExpiryTimer,
pimStarGIAssertState,
pimStarGIAssertTimer,
pimStarGIAssertWinnerAddressType,
pimStarGIAssertWinnerAddress,
pimStarGIAssertWinnerMetricPref,
pimStarGIAssertWinnerMetric,
pimSGRptUpTime,
pimSGRptUpstreamPruneState,
pimSGRptUpstreamOverrideTimer,
pimSGRptIPruneUpTime,
pimSGRptIJoinPruneState,
pimSGRptIPrunePendingTimer,
pimSGRptIPruneExpiryTimer
}

STATUS  current
DESCRIPTION
"A collection of objects to support management of PIM routers running PIM-SM (Sparse Mode). The groups pimSsmGroup and pimRPConfigGroup are also required."
 ::= { pimMIBGroups 7 }

pimBidirGroup OBJECT-GROUP
OBJECTS { pimInterfaceDFElectionRobustness,
pimBidirDFElectionWinnerAddressType,
pimBidirDFElectionWinnerAddress,
pimBidirDFElectionWinnerUpTime,
pimBidirDFElectionWinnerMetricPref,
pimBidirDFElectionWinnerMetric,
pimBidirDFElectionState,
pimBidirDFElectionStateTimer
}

STATUS  current
DESCRIPTION
"A collection of objects to support management of PIM routers running BIDIR mode. The groups pimSsmGroup, pimSmGroup and pimRPConfigGroup are also required."
 ::= { pimMIBGroups 8 }

pimAnycastRpGroup OBJECT-GROUP
OBJECTS { pimAnycastRPSetLocalRouter,
pimAnycastRPSetRowStatus,
pimAnycastRPSetStorageType
}

STATUS  current
DESCRIPTION
"A collection of objects to support management of the PIM Anycast-RP mechanism."
 ::= { pimMIBGroups 9 }

pimStaticRPPrecedenceGroup OBJECT-GROUP
OBJECTS { pimStaticRPPrecedence }
STATUS current
DESCRIPTION
"A collection of objects to allow fine control of interactions between static RP configuration and dynamically acquired group to RP mappings."
 ::= { pimMIBGroups 10 }

pimNetMgmtNotificationObjects OBJECT-GROUP
OBJECTS { pimInvalidRegisterNotificationPeriod,
           pimInvalidRegisterMsgsRcvd,
           pimInvalidRegisterAddressType,
           pimInvalidRegisterOrigin,
           pimInvalidRegisterGroup,
           pimInvalidRegisterRp,
           pimInvalidJoinPruneNotificationPeriod,
           pimInvalidJoinPruneMsgsRcvd,
           pimInvalidJoinPruneAddressType,
           pimInvalidJoinPruneOrigin,
           pimInvalidJoinPruneGroup,
           pimInvalidJoinPruneRp,
           pimRPMappingNotificationPeriod,
           pimRPMappingChangeCount,
           pimInterfaceElectionNotificationPeriod,
           pimInterfaceElectionWinCount }
STATUS current
DESCRIPTION
"A collection of objects to support notification of PIM network management events."
 ::= { pimMIBGroups 11 }

pimNetMgmtNotificationGroup NOTIFICATION-GROUP
NOTIFICATIONS { pimInvalidRegister,
                 pimInvalidJoinPrune,
                 pimRPMappingChange,
                 pimInterfaceElection }
STATUS current
DESCRIPTION
"A collection of notifications for signaling PIM network management events."
::= { pimMIBGroups 12 }

pimDiagnosticsGroup OBJECT-GROUP
  OBJECTS { pimInAsserts,
           pimOutAsserts,
           pimLastAssertInterface,
           pimLastAssertGroupAddressType,
           pimLastAssertGroupAddress,
           pimLastAssertSourceAddressType,
           pimLastAssertSourceAddress,
           pimNeighborLossNotificationPeriod,
           pimNeighborLossCount }
  STATUS  current
  DESCRIPTION
            "Objects providing additional diagnostics related to a PIM
             router."
::= { pimMIBGroups 13 }

pimDmGroup OBJECT-GROUP
  OBJECTS { pimRefreshInterval,
            pimInterfacePruneLimitInterval,
            pimInterfaceGraftRetryInterval,
            pimInterfaceSRPriorityEnabled,
            pimNeighborSRCapable,
            pimSGUpstreamPruneState,
            pimSGUpstreamPruneLimitTimer,
            pimSGOriginatorState,
            pimSGSourceActiveTimer,
            pimSGStateRefreshTimer }
  STATUS  current
  DESCRIPTION
            "A collection of objects required for management of PIM
             Dense Mode (PIM-DM) function. The groups pimSsmGroup and
             pimSmGroup are also required."
  REFERENCE "RFC 3973"
::= { pimMIBGroups 14 }
pimDeviceStorageGroup OBJECT-GROUP
   OBJECTS { pimDeviceConfigStorageType
   }
   STATUS current
   DESCRIPTION
     "An object that specifies the volatility of global PIM
      configuration settings on this device."
   ::= { pimMIBGroups 15 }
END

6. Security Considerations

There are a number of management objects defined in this MIB module
with a MAX-ACCESS clause of read-write and/or read-create. 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. These are the tables and objects and their
sensitivity/vulnerability:

The following tables and objects could be employed to modify
multicast routing behavior in a way that prevents, disrupts, or
subverts services provided by the network, including (but not limited
to) multicast data traffic delivery. For example, attacks can be
envisioned that would pass nominated multicast data streams through a
nominated location, without the sources or listeners becoming aware
of this subversion.

pimKeepalivePeriod pimRegisterSuppressionTime
pimNeighborLossNotificationPeriod
pimInvalidRegisterNotificationPeriod
pimInvalidJoinPruneNotificationPeriod pimRPMappingNotificationPeriod
pimInterfaceElectionNotificationPeriod pimRefreshInterval
pimInterfaceTable pimInterfaceEntry pimInterfaceIfIndex
pimInterfaceIPVersion pimInterfaceHelloInterval
pimInterfaceTrigHelloInterval pimInterfaceJoinPruneInterval
pimInterfaceDFElectionRobustness pimInterfaceHelloHoldtime
pimInterfaceJoinPruneHoldtime pimInterfacePropagationDelay
pimInterfaceOverrideInterval pimInterfaceDRPriority
pimInterfaceDomainBorder pimInterfaceStatus pimInterfaceStubInterface
pimInterfacePruneLimitInterval pimStaticRPTable pimStaticRPEntry
pimStaticRPAddressType pimStaticRPGrpAddress
pimStaticRPGrpPrefixLength pimStaticRPRPAAddress pimStaticRPPimMode
pimStaticRPOverrideDynamic pimStaticRPRowStatus pimStaticRPPrecedence
pimAnycastRPSetTable pimAnycastRPSetEntry pimAnycastRPSetAddressType
pimAnycastRPSetAnycastAddress pimAnycastRPSetRouterAddress
Some of the readable objects in this MIB module (i.e., objects with a MAX-ACCESS other than not-accessible) 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. These are the tables and objects and their sensitivity/vulnerability:

The following tables and objects could be employed to determine 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.

The following tables and objects may also be used to determine whether multicast data is flowing in the network, or has flowed recently. They may also be used to determine the network location 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.

pimKeepalivePeriod pimRegisterSuppressionTime pimStarGEntries
pimStarGIEntries pimSGEntries pimSGRptEntries
pimSGRptIEntries pimOutAsserts pimInAsserts pimLastAssertInterface
pimLastAssertGroupAddressType pimLastAssertGroupAddress
pimLastAssertSourceAddressType pimLastAssertSourceAddress
pimNeighborLossNotificationPeriod pimNeighborLossCount
pimInvalidRegisterNotificationPeriod pimInvalidRegisterMsgsRcvd
pimInvalidRegisterAddressType pimInvalidRegisterOrigin
pimInvalidRegisterGroup pimInvalidRegisterRp
pimInvalidJoinPruneNotificationPeriod pimInvalidJoinPruneMsgsRcvd
pimInvalidJoinPruneAddressType pimInvalidJoinPruneOrigin
pimInvalidJoinPruneGroup pimInvalidJoinPruneRp
pimRPMappingNotificationPeriod pimRPMappingChangeCount
pimInterfaceElectionNotificationPeriod pimInterfaceElectionWinCount
pimRefreshInterval pimInterfaceTable pimInterfaceEntry
pimInterfaceIfIndex pimInterfaceIPAddressType
pimInterfaceAddress pimInterfaceDR pimInterfaceHelloInterval
pimInterfaceTrigHelloInterval pimInterfaceJoinPruneInterval
pimInterfaceDElectionRobustness pimInterfaceHelloHoldtime
pimInterfaceJoinPruneHoldtime pimInterfacePropagationDelay
pimInterfaceOverrideInterval pimInterfaceGenerationIDValue
pimInterfaceDRPriority pimInterfaceLanDelayEnabled
pimInterfaceEffectPropagDelay pimInterfaceEffectOverrideIvl
pimInterfaceSuppressionEnabled pimInterfaceBidirCapable
pimInterfaceDRPriorityEnabled pimInterfaceDomainBorder
pimInterfaceStatus pimInterfaceStubInterface
There is also a specific danger arising from the notification pimInvalidRegister. This is originated by devices that receive an incorrect unicast-encapsulated multicast data packet, which poses a clear danger of propagating a DoS (Denial of Service) attack from the data or control plane to the network management plane. The following steps are taken to guard against this.

1. The notification is disabled by default. The writeable field pimInvalidRegisterNotificationPeriod must be set in order to enable it.

2. The syntax of pimInvalidRegisterNotificationPeriod prevents any given device from originating the notification more frequently than once every 10 seconds.

3. The counter pimInvalidRegisterMsgsRcvd provides equivalent function to the notification. Management applications are encouraged to monitor this counter in preference to enabling the notification.

The same measures are taken in respect of pimInvalidJoinPrune, though as this notification can only arise as a result of unroutable control packets, the risk is not so acute.

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 indeed GET or SET (change/create/delete) them.

7. IANA Considerations

PIM-STD-MIB is rooted under the mib-2 subtree. IANA has assigned (mib-2 157) to the PIM-STD-MIB module specified in this document.

8. Acknowledgements

This MIB module is based on the original work in RFC 2934 [RFC2934] by K. McCloghrie, D. Farinacci, D. Thaler, and W. Fenner and has been updated based on feedback from the IETF’s Protocol Independent Multicast (PIM) Working Group.

Jonathan Nicholas was the editor of early versions of this document, and contributed the objects for management of PIM-DM.

9. References

9.1. Normative References


9.2. Informative References


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