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Definitions of Managed Objects for the Fourth Version of Border Gateway Protocol (BGP-4), Second Version draft-ietf-idr-bgp4-mibv2-06

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Abstract

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols. In particular it defines objects for managing the Border Gateway Protocol, Version 4.

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1. Introduction

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This memo defines a portion of the Management Information Base (MIB) for use with network management protocols. In particular it defines objects for managing the Border Gateway Protocol, Version 4 [\[RFC4271\]](#) ([Rekhter, Y., Li, T., and S. Hares, "A Border Gateway Protocol 4 \(BGP-4\)," January 2006.](#)).

2. The Internet-Standard Management Framework

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For a detailed overview of the documents that describe the current Internet-Standard Management Framework, please refer to section 7 of RFC 3410 [\[RFC3410\]](#) ([Case, J., Mundy, R., Partain, D., and B. Stewart, "Introduction and Applicability Statements for Internet-Standard Management Framework," December 2002.](#)).

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 [\[RFC2578\]](#) ([McCloghrie, K., Ed., Perkins, D., Ed., and J. Schoenwaelder, Ed., "Structure of Management Information Version 2 \(SMIV2\)," April 1999.](#)), STD 58, RFC 2579 [\[RFC2579\]](#) ([McCloghrie, K., Ed., Perkins, D., Ed., and J. Schoenwaelder, Ed., "Textual Conventions for SMIV2,"](#)

[April 1999.](#)) and STD 58, RFC 2580 [\[RFC2580\]](#) (McCloghrie, K., Perkins, D., and J. Schoenwaelder, "Conformance Statements for SMIV2," [April 1999.](#)).

3. Conventions

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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 [\[RFC2119\]](#) (Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels," [March 1997.](#)).

4. Overview

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As part of the IETF standardization effort for the BGP-4 protocol, [\[RFC4273\]](#) (Haas, J. and S. Hares, "Definitions of Managed Objects for BGP-4," [January 2006.](#)) was written to address open issues in the previous version of the BGP-4 MIB, [\[RFC1657\]](#) (Willis, S., Burruss, J., and J. Chu, "Definitions of Managed Objects for the Fourth Version of the Border Gateway Protocol (BGP-4) using SMIV2," [July 1994.](#)). However, that RFC was primarily intended to address the base BGP-4 protocol as documented in [\[RFC4271\]](#) (Rekhter, Y., Li, T., and S. Hares, "A Border Gateway Protocol 4 (BGP-4)," [January 2006.](#)).

The BGP-4 protocol has greatly increased in scope over the years from its original definition. Scaling mechanisms such as [Route Reflection](#) (Bates, T., Chen, E., and R. Chandra, "BGP Route Reflection: An Alternative to Full Mesh Internal BGP (IBGP)," [April 2006.](#)) [\[RFC4456\]](#) and [Confederations](#) (Traina, P., McPherson, D., and J. Scudder, "Autonomous System Confederations for BGP," [August 2007.](#)) [\[RFC5065\]](#) have been introduced. [Multi-protocol extensions](#) (Bates, T., Chandra, R., Katz, D., and Y. Rekhter, "Multiprotocol Extensions for BGP-4," [January 2007.](#)) [\[RFC4760\]](#) were introduced along which allowed advertisement of reachability such as [IPv6](#) (Marques, P. and F. Dupont, "Use of BGP-4 Multiprotocol Extensions for IPv6 Inter-Domain Routing," [March 1999.](#)) [\[RFC2545\]](#), [MPLS Labeled routes](#) (Rekhter, Y. and E. Rosen, "Carrying Label Information in BGP-4," [May 2001.](#)) [\[RFC3107\]](#), etc.

This MIB addresses several of the deficiencies of the previous BGP-4 MIB and provides an extension mechanism to permit additional MIB modules to be authored without requiring the base BGP-4 MIB to be updated. This is seen as a desirable goal since the BGP-4 protocol continues to receive attention by those wishing to add to its functionality.

In particular, this MIB addresses some specific weaknesses of the previous version:

*Add the ability to monitor IPv6 BGP-4 peering sessions and carry IPv6 reachability. Other forms of reachability can be added at a later date courtesy of the address-family independent manner in which this was done.

*Add several counters of operational interest. For example, the number of routes received from a given BGP peer.

*Replaces objects that were incapable of carrying the full range of their values with ones that can.

*Provides human-readable output for some complex data structures, such as the AS_PATH while also preserving a version of the data that is canonically machine readable.

5. Structure of the MIB Module

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5.1. Global Scalars

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*bgpVersion - A vector of supported BGP Versions.

*bgpIdentifier - The BGP identifier of the local system.

*bgpLocalAsNew - A 4-byte capable local AS number which replaces the bgpLocalAs object.

*bgpAfPathAttrCount - The number of entries in the bgpAfPathAttrTable.

5.2. Tables

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*bgpPeerAfTable - The BGP peer table. This table is capable of representing IPv6 and other address-family independent peering sessions. This table replaces the bgpPeerTable from previous versions of this MIB.

*bgpPeerAfErrorsTable - A table of peering session errors. This table covers information previously present in bgpPeerTable.

*bgpPeerAfEventTimesTable - A table of peer-specific event timers. This table covers information previously present in bgpPeerTable.

*bgpPeerAfConfiguredTimersTable - A table of the configured values of peer-specific event timers. This table covers information previously present in bgpPeerTable.

*bgpPeerAfNegotiatedTimersTable - A table of per-peer negotiated timers. This information covers information previously derived from the bgpPeerTable.

*bgpPerAfCountersTable - A table of per-peer counters for messages and the BGP FSM.

*bgpPrefixCountersTable - A table of per-peer AFI-SAFI counters for prefixes.

*bgpNlriTable - A table of per-peer per AFI-SAFI prefix data. This table covers information previously present in bgp4PathAttrTable.

*bgpAdjRibsOutTable - A per-peer per AFI-SAFI table indicating what reachability has been advertised to a given peer.

*bgpAfPathAttrTable - A table of BGP Path Attribute information.

*bgpAsPathTable - A table that decomposes the elements of a BGP AS Path.

*bgpAfPathUnknownTable - A table that decomposes the unknown elements received in a BGP Path Attribute tuple.

5.3. Obsoleted Tables

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*bgpPeerTable - Replaced by the information in bgpPeerAfTable, bgpPeerAfErrorsTable, bgpPeerConfiguredTimersTable, bgpPeerAfNegotiatedTimersTable, bgpPeerAfCountersTable.

*bgpRcvPathAttrTable - Covered BGP-3 and earlier.

*bgp4PathAttrTable - Replaced by the information in bgpNlriTable, bgpAfPathAttrTable and bgpAfPathUnknownTable.

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5.4. Textual Conventions

- *BgpIdentifierTC - Representation of a BGP Identifier
 - *BgpAfiTC - Representation of a BGP Address Family Identifier
 - *BgpSafiTC - Representation of a BGP Subsequent Address Family Identifier
 - *BgpPathAttrFlagsTC - Representation of BGP-4 Path Attribute Flags.
-

5.5. Notifications

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- *bgpAfEstablishedNotification - Sent when a BGP peer transitions into the Established state. Replaces the previous bgpEstablishedNotification, which was not address family independent.
 - *bgpAfBackwardTransNotification - Sent when a BGP peer transitions out of the Established state. Replaces the previous bgpBackwardTransNotification, which was not address family independent.
 - *bgpEstablished - Erroneously added to an incorrect OID in a previous version of this MIB.
 - *bgpBackwardsTransition - Erroneously added to an incorrect OID in a previous version of this MIB.
-

5.6. Extensions

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A feature of this MIB is the recognition that the BGP protocol continues to grow in functionality. The bgpExtensions OID is defined to provide a place for IDR-approved MIB modules for BGP extensions to be added to the bgp MIB subtree.

It is intended that, where possible, that tables added via extensions that add information via additional path attributes use bgpAfPathAttrIndex as a common index, either via INDEX or AUGMENTS.

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6. Relationship to Other MIB Modules

6.1. Relationship to the TCP-MIB

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The `bgpPeerAfLocalAddrType/bgpPeerAfLocalAddr/bgpPeerAfLocalPort` and `bgpPeerAfRemoteAddrType/bgpPeerAfRemoteAddr/bgpPeerAfRemotePort` objects may provide a suitable index for monitoring the BGP peering session's TCP session via the [TCP-MIB \(Raghunarayan, R., "Management Information Base for the Transmission Control Protocol \(TCP\)," March 2005.\)](#) [RFC4022].

Note that conducting BGP peering sessions over transport protocols other than TCP over IP are out of scope of the current BGP specifications.

6.2. MIB modules required for IMPORTS

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The following MIB module IMPORTS objects from SNMPv2-SMI [\[RFC2578\]](#) (McCloghrie, K., Ed., Perkins, D., Ed., and J. Schoenwaelder, Ed., "Structure of Management Information Version 2 (SMIv2)," April 1999.), SNMPv2-TC [\[RFC2579\]](#) (McCloghrie, K., Ed., Perkins, D., Ed., and J. Schoenwaelder, Ed., "Textual Conventions for SMIv2," April 1999.), SNMPv2-CONF [\[RFC2580\]](#) (McCloghrie, K., Perkins, D., and J. Schoenwaelder, "Conformance Statements for SMIv2," April 1999.), INET-ADDRESS-MIB [\[RFC4001\]](#) (Daniele, M., Haberman, B., Routhier, S., and J. Schoenwaelder, "Textual Conventions for Internet Network Addresses," February 2005.) and SNMP-FRAMEWORK-MIB [\[RFC3411\]](#) (Harrington, D., Presuhn, R., and B. Wijnen, "An Architecture for Describing Simple Network Management Protocol (SNMP) Management Frameworks," December 2002.).

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7. Definitions

BGP4-MIB DEFINITIONS ::= BEGIN

IMPORTS

MODULE-IDENTITY, OBJECT-TYPE, NOTIFICATION-TYPE,
IpAddress, Counter32, Gauge32, mib-2, Unsigned32, Integer32
FROM SNMPv2-SMI
InetAddressType, InetAddress, InetPortNumber,
InetAutonomousSystemNumber, InetAddressPrefixLength
FROM INET-ADDRESS-MIB
TEXTUAL-CONVENTION, TruthValue, RowPointer, TimeStamp
FROM SNMPv2-TC
MODULE-COMPLIANCE, OBJECT-GROUP, NOTIFICATION-GROUP
FROM SNMPv2-CONF
SnmplibAdminString
FROM SNMP-FRAMEWORK-MIB;

bgp MODULE-IDENTITY

LAST-UPDATED "200711070000Z"
ORGANIZATION "IETF IDR Working Group"
CONTACT-INFO "E-mail: idr@ietf.org"

DESCRIPTION

"The MIB module for the BGP-4 protocol.

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

-- RFC Editor - replace XXX with RFC number

REVISION "200711110000Z"

DESCRIPTION

"Changes from RFC 4273:

TODO"

REVISION "200601110000Z"

DESCRIPTION

"Changes from RFC 1657:

- 1) Fixed the definitions of the notifications
to make them equivalent to their initial
definition in RFC 1269.
- 2) Added compliance and conformance info.
- 3) Updated information for the values of
bgpPeerNegotiatedVersion, bgp4PathAttrLocalPref,
bgp4PathAttrCalcLocalPref,
bgp4PathAttrMultiExitDisc,
bgp4PathAttrASPathSegment.
- 4) Added additional clarification comments where

needed.

- 5) Noted where objects do not fully reflect the protocol as Known Issues.
- 6) Updated the DESCRIPTION for the bgp4PathAttrAtomicAggregate object.
- 7) The following objects have had their DESCRIPTION clause modified to remove the text that suggested (using 'should' verb) initializing the counter to zero on a transition to the established state:
 bgpPeerInUpdates, bgpPeerOutUpdates,
 bgpPeerInTotalMessages, bgpPeerOutTotalMessages
Those implementations that still do this are still compliant with this new wording.
Applications should not assume counters have started at zero.

Published as RFC 4273."

REVISION "199405050000Z"

DESCRIPTION

"Translated to SMIV2 and published as RFC 1657."

REVISION "199110261839Z"

DESCRIPTION

"Initial version, published as RFC 1269."

::= { mib-2 15 }

--

-- Textual Conventions

--

BgpIdentifierTC ::= TEXTUAL-CONVENTION

DISPLAY-HINT "1d."

STATUS current

DESCRIPTION

"The representation of a BGP Identifier. The BGP Identifier should be represented in the OCTET STRING as with the first OCTET of the string containing the first OCTET of the BGP Identifier received or sent in the OPEN packet and so on.

The BGP Identifier is displayed as if it is an IP address, even if it would be an illegal one."

REFERENCE

"RFC 4273, Section 4.2"

SYNTAX OCTET STRING(SIZE (4))

BgpAfItC ::= TEXTUAL-CONVENTION

DISPLAY-HINT "d"

STATUS current
DESCRIPTION
 "The representation of a BGP AFI"
REFERENCE
 "RFC 4760, Section 3"
SYNTAX Unsigned32(0..65535)

BgpSafiTC ::= TEXTUAL-CONVENTION
 DISPLAY-HINT "d"
 STATUS current
 DESCRIPTION
 "The representation of a BGP SAFI"
 REFERENCE
 "RFC 4760, Section 3"
 SYNTAX Unsigned32(0..255)

BgpPathAttrFlagsTC ::= TEXTUAL-CONVENTION
 STATUS current
 DESCRIPTION
 "The representation of BGP Path Attribute Flags. Note that this
 textual convention is meant to directly map to a BGP Path
 Attribute's Flags and is thus constrained by protocol to have no
 more than 8 total bits in use."
 REFERENCE
 "RFC 4271, Sec. 4.3"
 SYNTAX BITS {
 optional(0), -- When set, path attribute is optional instead of
 -- well known.
 transitive(1), -- Path attribute is transitive when set.
 partial(2), -- Path attribute is partial when set.
 extLength(3) -- Path attributes has extended length field.
 -- 4-7 are reserved
 -- values 8 or greater are illegal.
 }

--
-- Top level scalars for this MIB
--

bgpVersion OBJECT-TYPE
 SYNTAX OCTET STRING (SIZE (1..255))
 MAX-ACCESS read-only
 STATUS current
 DESCRIPTION
 "Vector of supported BGP protocol version
 numbers. Each peer negotiates the version
 from this vector. Versions are identified
 via the string of bits contained within this

object. The first octet contains bits 0 to 7, the second octet contains bits 8 to 15, and so on, with the most significant bit referring to the lowest bit number in the octet (e.g., the MSB of the first octet refers to bit 0). If a bit, i, is present and set, then the version (i+1) of the BGP is supported."

REFERENCE

"RFC 4271, Section 4.2."

::= { bgp 1 }

-- bgp 2 and 3 have been deprecated and are documented
-- elsewhere in this MIB

bgpIdentifier OBJECT-TYPE

SYNTAX IPAddress

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The BGP Identifier of the local system.

A SYNTAX of BgpIdentifierTC would be used here, however it would cause this object to be deprecated with no additional value. The comments in the DESCRIPTION of BgpIdentifierTC apply here."

REFERENCE

"RFC 4271, Section 4.2."

::= { bgp 4 }

bgpLocalAsNew OBJECT-TYPE

SYNTAX InetAutonomousSystemNumber

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The local autonomous system number.

This object supports 4 byte ASes and replaces bgpLocalAs."

REFERENCE

"RFC 4271, Section 4.2, 'My Autonomous System'.

RFC 4893, BGP Support for Four-octet AS Number Space."

::= { bgp 9 }

--

-- Address Family (Af) independent per-peer management information.

--

bgpPeerAf
OBJECT IDENTIFIER ::= { bgp 10 }

--

-- Address Family (Af) independent per-peer session management
-- information.
--

bgpPeerAfTable OBJECT-TYPE
SYNTAX SEQUENCE OF BgpPeerAfEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"BGP peer table. This table contains, one entry per BGP
peer, information about the connections with BGP peers.

This table replaces bgpPeerTable."
::= { bgpPeerAf 1 }

bgpPeerAfEntry OBJECT-TYPE
SYNTAX BgpPeerAfEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Entry containing information about the connection with
a remote BGP peer."
INDEX {
bgpPeerAfInstance,
bgpPeerAfLocalAddrType,
bgpPeerAfLocalAddr,
bgpPeerAfRemoteAddrType,
bgpPeerAfRemoteAddr
}
::= { bgpPeerAfTable 1 }

BgpPeerAfEntry ::= SEQUENCE {
bgpPeerAfInstance
Unsigned32,
bgpPeerAfIdentifier
BgpIdentifierTC,
bgpPeerAfPeerState
INTEGER,
bgpPeerAfAdminStatus
INTEGER,
bgpPeerAfConfiguredVersion
Unsigned32,
bgpPeerAfNegotiatedVersion

```

        Unsigned32,
    bgpPeerAfLocalAddrType
        InetAddressType,
    bgpPeerAfLocalAddr
        InetAddress,
    bgpPeerAfLocalPort
        InetPortNumber,
    bgpPeerAfLocalAs
        InetAutonomousSystemNumber,
    bgpPeerAfRemoteAddrType
        InetAddressType,
    bgpPeerAfRemoteAddr
        InetAddress,
    bgpPeerAfRemotePort
        InetPortNumber,
    bgpPeerAfRemoteAs
        InetAutonomousSystemNumber
}

```

bgpPeerAfInstance OBJECT-TYPE

SYNTAX Unsigned32

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The routing instance index.

Some BGP implementations permit the creation of multiple instances of a BGP routing process. An example includes routers running BGP/MPLS IP Virtual Private Networks.

Implementations that do not support multiple routing instances should return 1 for this object."

::= { bgpPeerAfEntry 1 }

bgpPeerAfIdentifier OBJECT-TYPE

SYNTAX BgpIdentifierTC

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The BGP Identifier of this entry's remote BGP peer.

This entry should be 0.0.0.0 unless the bgpPeerAfPeerState is in the openconfirm or the established state."

REFERENCE

"RFC 4271, Section 4.2, 'BGP Identifier'."

::= { bgpPeerAfEntry 2 }

-- TODO - update according to new FSM

bgpPeerAfPeerState OBJECT-TYPE

```
SYNTAX INTEGER {
    idle(1),
    connect(2),
    active(3),
    opensent(4),
    openconfirm(5),
    established(6)
}
MAX-ACCESS read-only
STATUS current
DESCRIPTION
    "The BGP peer connection state."
REFERENCE
    "RFC 4271, Section 8.2.2."
 ::= { bgpPeerAfEntry 3 }
```

bgpPeerAfAdminStatus OBJECT-TYPE

```
SYNTAX INTEGER {
    halted(1),
    running(2)
}
MAX-ACCESS read-only
STATUS current
DESCRIPTION
    "Whether or not the BGP FSM for this remote peer is
    halted or running. The BGP FSM for a remote peer is
    halted after processing a Stop event. Likewise, it is
    in the running state after a Start event.

    The bgpPeerAfState will generally be in the idle state
    when the FSM is halted, although some extensions such
    as Graceful Restart will leave the peer in the Idle
    state but with the FSM running."
REFERENCE
    "RFC 4271, Section 8.1.2."
 ::= { bgpPeerAfEntry 4 }
```

bgpPeerAfConfiguredVersion OBJECT-TYPE

```
SYNTAX Unsigned32 (1..255)
MAX-ACCESS read-only
STATUS current
DESCRIPTION
    "The configured version to originally start with this
    remote peer. The BGP speaker may permit negotiation to a
    lower version number of the protocol."
REFERENCE
    "RFC 4271, Section 4.2."
```

RFC 4271, Section 7."
::= { bgpPeerAfEntry 5 }

bgpPeerAfNegotiatedVersion OBJECT-TYPE

SYNTAX Unsigned32 (1..255)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The negotiated version of BGP running between
the two peers.

This entry MUST be zero (0) unless the
bgpPeerAfState is in the openconfirm or the
established state.

Note that legal values for this object are
between 0 and 255."

REFERENCE

"RFC 4271, Section 4.2.

RFC 4271, Section 7."

::= { bgpPeerAfEntry 6 }

bgpPeerAfLocalAddrType OBJECT-TYPE

SYNTAX InetAddressType

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The address family of the local end of the peering
session."

::= { bgpPeerAfEntry 7 }

bgpPeerAfLocalAddr OBJECT-TYPE

SYNTAX InetAddress (SIZE(4..20))

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The local IP address of this entry's BGP connection."

::= { bgpPeerAfEntry 8 }

bgpPeerAfLocalPort OBJECT-TYPE

SYNTAX InetPortNumber

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The local port for the TCP connection between the BGP
peers."

::= { bgpPeerAfEntry 9 }

bgpPeerAfLocalAs OBJECT-TYPE

SYNTAX InetAutonomousSystemNumber
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "Some implementations of BGP can represent themselves
 as multiple ASes. This is the AS that this peering
 session is representing itself as to the remote peer."
 ::= { bgpPeerAfEntry 10 }

bgpPeerAfRemoteAddrType OBJECT-TYPE
SYNTAX InetAddressType
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
 "The address family of the remote end of the peering
 session."
 ::= { bgpPeerAfEntry 11 }

bgpPeerAfRemoteAddr OBJECT-TYPE
SYNTAX InetAddress (SIZE(4..20))
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
 "The remote IP address of this entry's BGP peer."
 ::= { bgpPeerAfEntry 12 }

bgpPeerAfRemotePort OBJECT-TYPE
SYNTAX InetPortNumber
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "The remote port for the TCP connection between the BGP
 peers.

 Note that the objects bgpPeerAfLocalAddr,
 bgpPeerAfLocalPort, bgpPeerAfRemoteAddr and
 bgpPeerAfRemotePort provide the appropriate reference to
 the standard MIB TCP connection table, or even the ipv6
 TCP MIB as in RFC 4022."
REFERENCE
 "RFC 2012 - SNMPv2 Management Information Base for the
 Transmission Control Protocol using SMIV2.
 RFC 4022 - IP Version 6 Management Information Base
 for the Transmission Control Protocol."
 ::= { bgpPeerAfEntry 13 }

bgpPeerAfRemoteAs OBJECT-TYPE
SYNTAX InetAutonomousSystemNumber
MAX-ACCESS read-only

```

STATUS current
DESCRIPTION
    "The remote autonomous system number received in the BGP
    OPEN message."
REFERENCE
    "RFC 4271, Section 4.2."
::= { bgpPeerAfEntry 14 }

--
-- Address Family (Af) independent per-peer error management
-- information.
--

bgpPeerAfErrors
    OBJECT IDENTIFIER ::= { bgpPeerAf 2 }

bgpPeerAfErrorsTable OBJECT-TYPE
    SYNTAX SEQUENCE OF BgpPeerAfErrorsEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "On a per-peer basis, this table reflects the last
        protocol-defined error encountered and reported on
        the peer session. If no entry for a given peer
        exists in this table, then no such errors have been
        observed, reported, and recorded on the session."
    ::= { bgpPeerAfErrors 1 }

bgpPeerAfErrorsEntry OBJECT-TYPE
    SYNTAX BgpPeerAfErrorsEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "Each entry contains information about errors sent
        and received for a particular BGP peer."
    AUGMENTS {
        bgpPeerAfEntry
    }
    ::= { bgpPeerAfErrorsTable 1 }

BgpPeerAfErrorsEntry ::= SEQUENCE {
    bgpPeerAfLastErrorReceived
        OCTET STRING,
    bgpPeerAfLastErrorSent
        OCTET STRING,
    bgpPeerAfLastErrorReceivedTime
        TimeStamp,
    bgpPeerAfLastErrorSentTime
        TimeStamp,

```

```

    bgpPeerAfLastErrorReceivedText
        SnmpAdminString,
    bgpPeerAfLastErrorSentText
        SnmpAdminString,
    bgpPeerAfLastErrorReceivedData
        OCTET STRING,
    bgpPeerAfLastErrorSentData
        OCTET STRING
}

```

```

bgpPeerAfLastErrorReceived OBJECT-TYPE
    SYNTAX OCTET STRING (SIZE (2))
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "The last error code and subcode received from this peer
        via NOTIFICATION message on this connection.  If no
        error has occurred, this field is zero.  Otherwise, the
        first byte of this two byte OCTET STRING contains the
        error code, and the second byte contains the subcode."
    REFERENCE
        "RFC 4271, Section 4.5.
        RFC 4486 optionally supported.
        RFC 3362, Section 5 optionally supported."
    ::= { bgpPeerAfErrorsEntry 1 }

```

```

bgpPeerAfLastErrorSent OBJECT-TYPE
    SYNTAX OCTET STRING (SIZE (2))
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "The last error code and subcode sent by this BGP
        Speaker via NOTIFICATION message on this connection.
        If no error has occurred, this field is zero.
        Otherwise, the first byte of this two byte OCTET STRING
        contains the error code, and the second byte contains
        the subcode."
    REFERENCE
        "RFC 4271, Section 4.5.
        RFC 4486 optionally supported.
        RFC 3362, Section 5 optionally supported."
    ::= { bgpPeerAfErrorsEntry 2 }

```

```

bgpPeerAfLastErrorReceivedTime OBJECT-TYPE
    SYNTAX TimeStamp
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "The timestamp that the last NOTIFICATION was received from

```

this peer."
REFERENCE
 "RFC 4271, Section 4.5."
::= { bgpPeerAfErrorsEntry 3 }

bgpPeerAfLastErrorSentTime OBJECT-TYPE
 SYNTAX TimeStamp
 MAX-ACCESS read-only
 STATUS current
 DESCRIPTION
 "The timestamp that the last NOTIFICATION was sent to
 this peer."
REFERENCE
 "RFC 4271, Section 4.5."
::= { bgpPeerAfErrorsEntry 4 }

bgpPeerAfLastErrorReceivedText OBJECT-TYPE
 SYNTAX SnmpAdminString
 MAX-ACCESS read-only
 STATUS current
 DESCRIPTION
 "This object contains an implementation specific
 explanation of the error that was reported."
::= { bgpPeerAfErrorsEntry 5 }

bgpPeerAfLastErrorSentText OBJECT-TYPE
 SYNTAX SnmpAdminString
 MAX-ACCESS read-only
 STATUS current
 DESCRIPTION
 "This object contains an implementation specific
 explanation of the error that is being reported."
::= { bgpPeerAfErrorsEntry 6 }

bgpPeerAfLastErrorReceivedData OBJECT-TYPE
 SYNTAX OCTET STRING (SIZE(0..4075))
 MAX-ACCESS read-only
 STATUS current
 DESCRIPTION
 "The last error code's data seen by this peer."

 Per RFC 2578, some implementations may have limitations
 dealing with OCTET STRINGS larger than 255. Thus, this
 data may be truncated."
REFERENCE
 "RFC 4271, Section 4.5,
 RFC 2578, Section 7.1.2,
 RFC 4486 optionally supported.
 RFC 3362, Section 5 optionally supported."

```

        ::= { bgpPeerAfErrorsEntry 7 }

bgpPeerAfLastErrorSentData OBJECT-TYPE
    SYNTAX OCTET STRING (SIZE(0..4075))
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "The last error code's data sent to this peer.

        Per RFC 2578, some implementations may have limitations
        dealing with OCTET STRINGS larger than 255.  Thus, this
        data may be truncated."
    REFERENCE
        "RFC 4271, Section 4.5,
        RFC 2578, Section 7.1.2
        RFC 4486 optionally supported.
        RFC 3362, Section 5 optionally supported."
    ::= { bgpPeerAfErrorsEntry 8 }

--
-- Address Family (Af) independent per-peer timer information
--

bgpPeerAfTimers
    OBJECT IDENTIFIER ::= { bgpPeerAf 3 }

--
-- Per-peer Event Times
--

bgpPeerAfEventTimesTable OBJECT-TYPE
    SYNTAX SEQUENCE OF BgpPeerAfEventTimesEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "A table reporting the per-peering session amount
        of time elapsed and update events since the peering
        session advanced into the established state."
    ::= { bgpPeerAfTimers 1 }

bgpPeerAfEventTimesEntry OBJECT-TYPE
    SYNTAX BgpPeerAfEventTimesEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "Each row contains a set of statistics about time
        spent and events encountered in the peer session
        established state."
    AUGMENTS {

```

```

        bgpPeerAfEntry
    }
    ::= { bgpPeerAfEventTimesTable 1 }

BgpPeerAfEventTimesEntry ::= SEQUENCE {
    bgpPeerAfFsmEstablishedTime
        Gauge32,
    bgpPeerAfInUpdatesElapsedTime
        Gauge32
}

bgpPeerAfFsmEstablishedTime OBJECT-TYPE
    SYNTAX Gauge32
    UNITS "seconds"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "This timer indicates how long (in seconds) this peer
        has been in the established state or how long since this
        peer was last in the established state. It is set to
        zero when a new peer is configured or when the router is
        booted."
    REFERENCE
        "RFC 4271, Section 8."
    ::= { bgpPeerAfEventTimesEntry 1 }

bgpPeerAfInUpdatesElapsedTime OBJECT-TYPE
    SYNTAX Gauge32
    UNITS "seconds"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Elapsed time (in seconds) since the last BGP UPDATE
        message was received from the peer. Each time
        bgpPeerInUpdates is incremented, the value of this
        object is set to zero (0)."
    REFERENCE
        "RFC 4271, Section 4.3.
        RFC 4271, Section 8.2.2, Established state."
    ::= { bgpPeerAfEventTimesEntry 2 }

--
-- Per-Peer Configured Timers
--

bgpPeerAfConfiguredTimersTable OBJECT-TYPE
    SYNTAX SEQUENCE OF BgpPeerAfConfiguredTimersEntry
    MAX-ACCESS not-accessible

```

STATUS current
DESCRIPTION
 "Per peer management data on BGP session timers."
::= { bgpPeerAfTimers 2 }

bgpPeerAfConfiguredTimersEntry OBJECT-TYPE
SYNTAX BgpPeerAfConfiguredTimersEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
 "Each entry corresponds to the current state of
 BGP timers on a given peering session."
AUGMENTS {
 bgpPeerAfEntry
}
::= { bgpPeerAfConfiguredTimersTable 1 }

BgpPeerAfConfiguredTimersEntry ::= SEQUENCE {
 bgpPeerAfConnectRetryInterval
 Unsigned32,
 bgpPeerAfHoldTimeConfigured
 Unsigned32,
 bgpPeerAfKeepAliveConfigured
 Unsigned32,
 bgpPeerAfMinASOrigInterval
 Unsigned32,
 bgpPeerAfMinRouteAdverInterval
 Unsigned32
}

bgpPeerAfConnectRetryInterval OBJECT-TYPE
SYNTAX Unsigned32 (1..65535)
UNITS "seconds"
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "Time interval (in seconds) for the ConnectRetry timer.
 The suggested value for this timer is 120 seconds."
REFERENCE
 "RFC 4271, Section 8.2.2. This is the value used
 to initialize the 'ConnectRetryTimer'."
::= { bgpPeerAfConfiguredTimersEntry 1 }

bgpPeerAfHoldTimeConfigured OBJECT-TYPE
SYNTAX Unsigned32 (0 | 3..65535)
UNITS "seconds"
MAX-ACCESS read-only
STATUS current
DESCRIPTION

"Time interval (in seconds) for the Hold Timer established with the peer. The value of this object is calculated by this BGP speaker, using the smaller of the values in bgpPeerHoldTimeConfigured and the Hold Time received in the OPEN message.

This value must be at least three seconds if it is not zero (0).

If the Hold Timer has not been established with the peer this object MUST have a value of zero (0).

If the bgpPeerHoldTimeConfigured object has a value of (0), then this object MUST have a value of (0)."

REFERENCE

"RFC 4271, Section 4.2."

::= { bgpPeerAfConfiguredTimersEntry 2 }

bgpPeerAfKeepAliveConfigured OBJECT-TYPE

SYNTAX Unsigned32 (0 | 1..21845)

UNITS "seconds"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Time interval (in seconds) for the KeepAlive timer configured for this BGP speaker with this peer. The value of this object will only determine the KEEPALIVE messages' frequency relative to the value specified in bgpPeerHoldTimeConfigured; the actual time interval for the KEEPALIVE messages is indicated by bgpPeerKeepAlive.

A reasonable maximum value for this timer would be one third of that of bgpPeerHoldTimeConfigured.

If the value of this object is zero (0), no periodic KEEPALIVE messages are sent to the peer after the BGP connection has been established. The suggested value for this timer is 30 seconds."

REFERENCE

"RFC 4271, Section 4.4.

RFC 4271, Section 10."

::= { bgpPeerAfConfiguredTimersEntry 3 }

bgpPeerAfMinASOrigInterval OBJECT-TYPE

SYNTAX Unsigned32 (0..65535)

UNITS "seconds"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Time interval (in seconds) for the
MinASOriginationInterval timer.

The suggested value for this timer is 15 seconds."

REFERENCE

"RFC 4271, Section 9.2.1.2.
RFC 4271, Section 10."

::= { bgpPeerAfConfiguredTimersEntry 4 }

bgpPeerAfMinRouteAdverInterval OBJECT-TYPE

SYNTAX Unsigned32 (0..65535)

UNITS "seconds"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Time interval (in seconds) for the
MinRouteAdvertisementInterval timer.

The suggested value for this timer is 30 seconds for
EBGP connections and 5 seconds for IBGP connections."

REFERENCE

"RFC 4271, Section 9.2.1.1.
RFC 4271, Section 10."

::= { bgpPeerAfConfiguredTimersEntry 5 }

--

-- Per-Peer Negotiated Timers

--

bgpPeerAfNegotiatedTimersTable OBJECT-TYPE

SYNTAX SEQUENCE OF BgpPeerAfNegotiatedTimersEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"Configured values of per-peer timers are seen
in the bgpPeerAfConfiguredTimersTable.

Values in this table reflect the current
operational values, after negotiation from values
derived from initial configuration."

::= { bgpPeerAfTimers 3 }

bgpPeerAfNegotiatedTimersEntry OBJECT-TYPE

SYNTAX BgpPeerAfNegotiatedTimersEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"Each entry reflects a value of the currently
operational, negotiated timer as reflected in the

```

        BgpPeerAfNegotiatedTimersEntry."
    AUGMENTS {
        bgpPeerAfEntry
    }
    ::= { bgpPeerAfNegotiatedTimersTable 1 }

BgpPeerAfNegotiatedTimersEntry ::= SEQUENCE {
    bgpPeerAfHoldTime
        Unsigned32,
    bgpPeerAfKeepAlive
        Unsigned32
}

bgpPeerAfHoldTime OBJECT-TYPE
    SYNTAX Unsigned32 ( 0 | 3..65535 )
    UNITS "seconds"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "The value of this object is calculated by this BGP
        Speaker as being;

        zero (0) - if this was the value sent by the peer and
        this value is permitted by this BGP Speaker. In this
        case, no keepalive messages are sent and the Hold Timer
        is not set.

        At least three (3). This value is the smaller of
        the value sent by this peer in the OPEN message and
        bgpPeerAfHoldTimeConfigured for this peer.

        This value is only defined when the peering session is
        in the Established state."
    REFERENCE
        "RFC 4271, Section 4.2."
    ::= { bgpPeerAfNegotiatedTimersEntry 1 }

bgpPeerAfKeepAlive OBJECT-TYPE
    SYNTAX Unsigned32 ( 0 | 1..21845 )
    UNITS "seconds"
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Time interval in seconds for the KeepAlive timer
        established with the peer. The value of this object
        is calculated by this BGP speaker such that, when
        compared with bgpPeerAfHoldTime, it has the same
        proportion as what bgpPeerAfKeepAliveConfigured has
        when compared with bgpPeerAfHoldTimeConfigured. If

```

the value of this object is zero (0), it indicates that the KeepAlive timer has not been established with the peer, or, the value of bgpPeerAfKeepAliveConfigured is zero (0).

This value is only defined when the peering session is in the Established state."

REFERENCE

"RFC 4271, Section 4.4."

::= { bgpPeerAfNegotiatedTimersEntry 2 }

--

-- Per-peer counters

--

bgpPeerAfCounters

OBJECT IDENTIFIER ::= { bgpPeerAf 4 }

bgpPeerAfCountersTable OBJECT-TYPE

SYNTAX SEQUENCE OF BgpPeerAfCountersEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The counters associated with a BGP Peer."

::= { bgpPeerAfCounters 1 }

bgpPeerAfCountersEntry OBJECT-TYPE

SYNTAX BgpPeerAfCountersEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"Each entry contains counters of message transmissions and FSM transitions for a given BGP Peering session."

AUGMENTS {

bgpPeerAfEntry

}

::= { bgpPeerAfCountersTable 1 }

BgpPeerAfCountersEntry ::= SEQUENCE {

bgpPeerAfInUpdates

Counter32,

bgpPeerAfOutUpdates

Counter32,

bgpPeerAfInTotalMessages

Counter32,

bgpPeerAfOutTotalMessages

Counter32,

bgpPeerAfFsmEstablishedTrans

Counter32

}

bgpPeerAfInUpdates OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of BGP UPDATE messages received on this connection. This object should be initialized to zero (0) when the connection is established."

::= { bgpPeerAfCountersEntry 1 }

bgpPeerAfOutUpdates OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of BGP UPDATE messages transmitted on this connection. This object should be initialized to zero (0) when the connection is established."

::= { bgpPeerAfCountersEntry 2 }

bgpPeerAfInTotalMessages OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The total number of messages received from the remote peer on this connection. This object should be initialized to zero when the connection is established."

::= { bgpPeerAfCountersEntry 3 }

bgpPeerAfOutTotalMessages OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The total number of messages transmitted to the remote peer on this connection. This object should be initialized to zero when the connection is established."

::= { bgpPeerAfCountersEntry 4 }

bgpPeerAfFsmEstablishedTrans OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The total number of times the BGP FSM transitioned into the established state for this peer."

```

        ::= { bgpPeerAfCountersEntry 5 }

--
-- Per-Peer Prefix Counters
--

bgpPrefixCountersTable OBJECT-TYPE
    SYNTAX SEQUENCE OF BgpPrefixCountersEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "Additional per-peer, per AFI-SAFI counters for
        prefixes"
    ::= { bgpPeerAfCounters 2 }

bgpPrefixCountersEntry OBJECT-TYPE
    SYNTAX BgpPrefixCountersEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "Entry containing information about a bgp-peers prefix
        counters."
    INDEX {
        bgpPeerAfInstance,
        bgpPeerAfLocalAddrType,
        bgpPeerAfLocalAddr,
        bgpPeerAfRemoteAddrType,
        bgpPeerAfRemoteAddr,
        bgpPrefixCountersAfi,
        bgpPrefixCountersSafi
    }
    ::= { bgpPrefixCountersTable 1 }

BgpPrefixCountersEntry ::= SEQUENCE {
    bgpPrefixCountersAfi
        BgpAfiTC,
    bgpPrefixCountersSafi
        BgpSafiTC,
    bgpPrefixInPrefixes
        Gauge32,
    bgpPrefixInPrefixesAccepted
        Gauge32,
    bgpPrefixOutPrefixes
        Gauge32
}

bgpPrefixCountersAfi OBJECT-TYPE
    SYNTAX BgpAfiTC
    MAX-ACCESS not-accessible

```

STATUS current
DESCRIPTION
 "The AFI index of the per-peer, per prefix counters"
::= { bgpPrefixCountersEntry 1 }

bgpPrefixCountersSafi OBJECT-TYPE
SYNTAX BgpSafiTC
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
 "The SAFI index of the per-peer, per prefix counters"
::= { bgpPrefixCountersEntry 2 }

bgpPrefixInPrefixes OBJECT-TYPE
SYNTAX Gauge32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "The number of prefixes received from a peer and are
 stored in the Adj-Ribs-In for that peer.

 Note that this number does not reflect prefixes that
 have been discarded due to policy."
::= { bgpPrefixCountersEntry 3 }

bgpPrefixInPrefixesAccepted OBJECT-TYPE
SYNTAX Gauge32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "The number of prefixes for a peer that are installed
 in the Adj-Ribs-In and are eligible to become active
 in the Loc-Rib."
::= { bgpPrefixCountersEntry 4 }

bgpPrefixOutPrefixes OBJECT-TYPE
SYNTAX Gauge32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "The number of prefixes for a peer that are installed
 in that peer's Adj-Ribs-Out."
::= { bgpPrefixCountersEntry 5 }

--
-- BGP NLRI Data
--

bgpRib

```

OBJECT IDENTIFIER ::= { bgp 11 }

--
-- NLRI Table
--

bgpNlriTable OBJECT-TYPE
    SYNTAX SEQUENCE OF BgpNlriEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "The BGP-4 Received Path Attribute Table contains
        information about paths to destination networks
        received from all BGP4 peers. Collectively, this
        represents the Adj-Ribs-In. The route where
        bgpNlriBest is true represents, for this NLRI,
        the route that is installed in the LocRib from the
        Adj-Ribs-In."
    ::= { bgpRib 1 }

bgpNlriEntry OBJECT-TYPE
    SYNTAX BgpNlriEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "Information about a path to a network."
    INDEX {
        bgpNlriAfi,
        bgpNlriSafi,
        bgpNlriPrefix,
        bgpNlriPrefixLen,
        bgpNlriIndex,
        bgpPeerAfInstance,
        bgpPeerAfLocalAddrType,
        bgpPeerAfLocalAddr,
        bgpPeerAfRemoteAddrType,
        bgpPeerAfRemoteAddr
    }
    ::= { bgpNlriTable 1 }

BgpNlriEntry ::= SEQUENCE {
    bgpNlriIndex
        Unsigned32,
    bgpNlriAfi
        BgpAfiTC,
    bgpNlriSafi
        BgpSafiTC,
    bgpNlriPrefixType
        InetAddressType,

```

```

    bgpNlriPrefix
        InetAddress,
    bgpNlriPrefixLen
        InetAddressPrefixLength,
    bgpNlriBest
        TruthValue,
    bgpNlriCalcLocalPref
        Unsigned32,
    bgpAfPathAttrIndex
        Unsigned32,
    bgpAfPathAttrUnknownIndex
        Unsigned32
}

```

bgpNlriIndex OBJECT-TYPE

SYNTAX Unsigned32

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This index allows for multiple instances of a base prefix for a certain AFI-SAFI from a given peer.

This is currently useful for two things:

1. Allowing for a peer in future implementations to send more than a single route instance.
2. Allow for extensions which extend the NLRI field to send the same prefix while utilizing other extension specific information. An example of this is RFC 3107 - Carrying MPLS labels in BGP."

REFERENCE

"RFC 3107 - Carrying Label Information in BGP-4."

::= { bgpNlriEntry 1 }

bgpNlriAfi OBJECT-TYPE

SYNTAX BgpAfiTC

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The address family of the prefix for this NLRI.

Note that the AFI is not necessarily equivalent to the an InetAddressType."

REFERENCE

"RFC 4760 - Multiprotocol Extensions for BGP-4"

::= { bgpNlriEntry 2 }

bgpNlriSafi OBJECT-TYPE

SYNTAX BgpSafiTC

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The subsequent address family of the prefix for this NLRI"

REFERENCE

"RFC 4760 - Multiprotocol Extensions for BGP-4"

::= { bgpNlriEntry 3 }

bgpNlriPrefixType OBJECT-TYPE

SYNTAX InetAddressType

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The type of the IP address prefix in the Network Layer Reachability Information field. The value of this object is derived from the appropriate value from the bgpNlriAfi field. Where an appropriate InetAddressType is not available, the value of the object must be unknown(0)."

::= { bgpNlriEntry 4 }

bgpNlriPrefix OBJECT-TYPE

SYNTAX InetAddress (SIZE (4..20))

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An IP address prefix in the Network Layer Reachability Information field. This object is an IP address containing the prefix with length specified by bgpAfPathAttrAddrPrefixLen. Any bits beyond the length specified by bgpAfPathAttrAddrPrefixLen are zeroed."

REFERENCE

"RFC 4271, Section 4.3."

::= { bgpNlriEntry 5 }

bgpNlriPrefixLen OBJECT-TYPE

SYNTAX InetAddressPrefixLength

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"Length in bits of the address prefix in the Network Layer Reachability Information field."

::= { bgpNlriEntry 6 }

bgpNlriBest OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-only

STATUS current
DESCRIPTION
 "An indication of whether or not this route
 was chosen as the best BGP4 route for this
 destination."
REFERENCE
 "RFC 4271, Section 9.1.2."
::= { bgpNlriEntry 7 }

bgpNlriCalcLocalPref OBJECT-TYPE
SYNTAX Unsigned32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "The degree of preference calculated by the
 receiving BGP4 speaker for an advertised
 route.

 In the case where this prefix is ineligible, this
 object will be absent."
REFERENCE
 "RFC 4271, Section 9.1.1"
::= { bgpNlriEntry 8 }

bgpAfPathAttrIndex OBJECT-TYPE
SYNTAX Unsigned32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "This value is a unique index for entries in the
 bgpAfPathAttrTable. It is assigned by the agent at the
 point of creation of the bgpAfPathAttrTable row entry.
 While its value is guaranteed to be unique at any time,
 it is otherwise opaque to the management application
 with respect to its value or the contiguity of
 bgpAfPathAttrIndex row instance values across rows of the
 bgpAfPathAttrTable.

 Note well that this index is used to distinguish unique
 sets of Path Attributes sent as part of BGP NLRI. The
 implementor is thus encouraged to make this index unique
 per set of all received path attributes. This value may
 be used to index tables in extension MIBs that share the
 property of belonging to the same received Path Attribute
 tuple."
::= { bgpNlriEntry 9 }

bgpAfPathAttrUnknownIndex OBJECT-TYPE
SYNTAX Unsigned32

```

MAX-ACCESS read-only
STATUS current
DESCRIPTION
    "This value is a unique index for entries in the
    bgpAfPathAttrUnknownTable. It is assigned by the agent at
    the point of creation of the bgpAfPathAttrUnknownTable row
    entry. While its value is guaranteed to be unique at
    any time, it is otherwise opaque to the management
    application with respect to its value or the contiguity
    of bgpAfPathAttrUnknownIndex row instance values across
    rows of the bgpAfPathAttrUnknownTable."
::= { bgpNlriEntry 10 }

```

```

--
-- Adj-Ribs-Out Table
--

```

```

bgpAdjRibsOutTable OBJECT-TYPE
    SYNTAX SEQUENCE OF BgpAdjRibsOutEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "This table contains on a per-peer basis one or more
        routes from the bgpNlriTable that have been
        placed in this peer's Adj-Ribs-Out."
    REFERENCE
        "RFC 4271, Section 3.2."
    ::= { bgpRib 2 }

```

```

bgpAdjRibsOutEntry OBJECT-TYPE
    SYNTAX BgpAdjRibsOutEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "List of BGP routes that have been placed into a
        peer's Adj-Ribs-Out."
    INDEX {
        bgpPeerAfInstance,
        bgpPeerAfLocalAddrType,
        bgpPeerAfLocalAddr,
        bgpPeerAfRemoteAddrType,
        bgpPeerAfRemoteAddr,
        bgpNlriAfi,
        bgpNlriSafi,
        bgpNlriPrefix,
        bgpNlriPrefixLen,
        bgpAdjRibsOutIndex
    }
    ::= { bgpAdjRibsOutTable 1 }

```

```

BgpAdjRibsOutEntry ::= SEQUENCE {
    bgpAdjRibsOutIndex
        Unsigned32,
    bgpAdjRibsOutRoute
        RowPointer
}

bgpAdjRibsOutIndex OBJECT-TYPE
    SYNTAX Unsigned32
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "Certain extensions to BGP permit multiple instance of
        a per afi, per safi prefix to be advertised to a peer.
        This object allows the enumeration of them."
    ::= { bgpAdjRibsOutEntry 1 }

bgpAdjRibsOutRoute OBJECT-TYPE
    SYNTAX RowPointer
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "This object points to the route in the bgpNlriTable
        that corresponds to the entry in the peer's
        Adj-Rib-Out. Outgoing route maps are not
        reflected at this point as those are part of the
        Update-Send process."
    REFERENCE
        "RFC 4271, Section 9.2."
    ::= { bgpAdjRibsOutEntry 2 }

--
-- Path Attribute Counter
--

bgpAfPathAttrCount OBJECT-TYPE
    SYNTAX Counter32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "The number of entries in the bgpAfPathAttrTable."
    ::= { bgpRib 3 }

--
-- Path Attributes Table
--

bgpAfPathAttrTable OBJECT-TYPE

```

SYNTAX SEQUENCE OF BgpAfPathAttrEntry
 MAX-ACCESS not-accessible
 STATUS current
 DESCRIPTION
 "Provides per advertised network-prefix attribute data,
 as advertised over a peering session."
 ::= { bgpRib 4 }

bgpAfPathAttrEntry OBJECT-TYPE

SYNTAX BgpAfPathAttrEntry
 MAX-ACCESS not-accessible
 STATUS current
 DESCRIPTION
 "Each entry contains data about path attributes
 associated with a given prefix in the bgpNlriTable."
 REFERENCE
 "RFC 4271, Section 5."
 INDEX {
 bgpAfPathAttrIndex
 }
 ::= { bgpAfPathAttrTable 1 }

BgpAfPathAttrEntry ::= SEQUENCE {
 bgpAfPathAttrOrigin
 INTEGER,
 bgpAfPathAttrNextHopAddrType
 InetAddressType,
 bgpAfPathAttrNextHop
 InetAddress,
 bgpAfPathAttrLinkLocalNextHop
 InetAddress,
 bgpAfPathAttrMedPresent
 TruthValue,
 bgpAfPathAttrMed
 Unsigned32,
 bgpAfPathAttrLocalPref
 Unsigned32,
 bgpAfPathAttrAtomicAggregate
 INTEGER,
 bgpAfPathAttrAggregatorAS
 InetAddressAutonomousSystemNumber,
 bgpAfPathAttrAggregatorAddr
 BgpIdentifierTC,
 bgpAsPathCalcLength
 Unsigned32,
 bgpAsPathIndex
 Unsigned32,
 bgpAsPathString
 SnmpAdminString

```
}
```

```
bgpAfPathAttrOrigin OBJECT-TYPE
```

```
SYNTAX INTEGER {  
    igp(1), -- networks are interior  
    egp(2), -- networks learned via the EGP protocol  
    incomplete(3) -- networks that  
        -- are learned by some other  
        -- means  
}
```

```
MAX-ACCESS read-only
```

```
STATUS current
```

```
DESCRIPTION
```

```
"The ultimate origin of the path information."
```

```
REFERENCE
```

```
"RFC 4271, Section 4.3.
```

```
    RFC 4271, Section 5.1.1."
```

```
::= { bgpAfPathAttrEntry 1 }
```

```
bgpAfPathAttrNextHopAddrType OBJECT-TYPE
```

```
SYNTAX InetAddressType
```

```
MAX-ACCESS read-only
```

```
STATUS current
```

```
DESCRIPTION
```

```
"The address family of the address for  
the border router that should be used  
to access the destination network."
```

```
::= { bgpAfPathAttrEntry 2 }
```

```
bgpAfPathAttrNextHop OBJECT-TYPE
```

```
SYNTAX InetAddress (SIZE(4..20))
```

```
MAX-ACCESS read-only
```

```
STATUS current
```

```
DESCRIPTION
```

```
"The address of the border router that  
should be used to access the destination  
network. This address is the nexthop  
address received in the UPDATE packet associated with  
this prefix.
```

```
Note that for RFC2545 style double nexthops,  
this object will always contain the global scope  
nexthop. bgpPathAttrLinkLocalNextHop will contain  
the linklocal scope nexthop, if it is present.
```

```
In the case a mechanism is developed to use only a link  
local nexthop, bgpAfPathAttrNextHop will contain the  
link local nexthop."
```

```
REFERENCE
```

"RFC 4271, Section 4.3,
RFC 4271, Section 5.1.3,
RFC 2545, Section 3."
::= { bgpAfPathAttrEntry 3 }

bgpAfPathAttrLinkLocalNextHop OBJECT-TYPE

SYNTAX InetAddress (SIZE(20))

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This value contains an IPv6 link local address of
InetAddressType of type ipv6z and is present only when
receiving RFC 2545 style double nexthops.

This object is optionally present in BGP
implementations that do not support IPv6."

REFERENCE

"RFC 2545, Section 3."

::= { bgpAfPathAttrEntry 4 }

bgpAfPathAttrMedPresent OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Whether or not the MED value was sent in the UPDATE
message."

::= { bgpAfPathAttrEntry 5 }

bgpAfPathAttrMed OBJECT-TYPE

SYNTAX Unsigned32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This metric is used to discriminate between multiple
exit points to an adjacent autonomous system. When the MED
value is absent but has a calculated default value, this
object will contain the calculated value."

REFERENCE

"RFC 4271, Section 4.3.

RFC 4271, Section 5.1.4."

::= { bgpAfPathAttrEntry 6 }

bgpAfPathAttrLocalPref OBJECT-TYPE

SYNTAX Unsigned32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The originating BGP4 speakers degree of preference for an

advertised route. If the route was not sent with a LOCAL_PREF value, this object will be absent."

REFERENCE

"RFC 4271, Section 4.3.

RFC 4271, Section 5.1.5."

::= { bgpAfPathAttrEntry 7 }

bgpAfPathAttrAtomicAggregate OBJECT-TYPE

SYNTAX INTEGER {

atomicAggregatePresent(1),

atomicAggregateMissing(2)

}

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"When this object is set to atomicAggregatePresent, the ATOMIC_AGGREGATE Path Attribute is present and indicates that the NLRI MUST NOT be made more specific."

REFERENCE

"RFC 4271, Sections 5.1.6 and 9.1.4."

::= { bgpAfPathAttrEntry 8 }

bgpAfPathAttrAggregatorAS OBJECT-TYPE

SYNTAX InetAutonomousSystemNumber

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The AS number of the last BGP4 speaker that performed route aggregation. If the AGGREGATOR path attribute is absent, this object will not be present in the conceptual row."

REFERENCE

"RFC 4271, Section 5.1.7.

RFC 4271, Section 9.2.2.2."

::= { bgpAfPathAttrEntry 9 }

bgpAfPathAttrAggregatorAddr OBJECT-TYPE

SYNTAX BgpIdentifierTC

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The IP address of the last BGP4 speaker that performed route aggregation. If the AGGREGATOR path attribute is absent, this object will not be present in the conceptual row."

REFERENCE

"RFC 4271, Section 5.1.7.

RFC 4271, Section 9.2.2.2."

::= { bgpAfPathAttrEntry 10 }

bgpAsPathCalcLength OBJECT-TYPE

SYNTAX Unsigned32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This value represents the calculated length of the AS Path according to the rules of the BGP specification. This value is used in route selection."

REFERENCE

"RFC 4271, Section 9.1.2.2.a"

::= { bgpAfPathAttrEntry 11 }

bgpAsPathIndex OBJECT-TYPE

SYNTAX Unsigned32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This value is a unique index for the decomposed AS Path in the bgpAsPathTable. It is assigned by the agent at the point of creation of the bgpAsPathTable row entry. While its value is guaranteed to be unique at any time, it is otherwise opaque to the management application with respect to its value or the contiguity of bgpAsPathIndex row instance values across rows of the bgpAsPathTable."

::= { bgpAfPathAttrEntry 12 }

bgpAsPathString OBJECT-TYPE

SYNTAX SnmpAdminString

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This is a string depicting the autonomous system path to this network which was received from the peer which advertised it. The format of the string is implementation-dependent, and should be designed for operator readability."

Note that SnmpAdminString is only capable of representing a maximum of 255 characters. This may lead to the string being truncated in the presence of a large AS Path. The bgpAsPathTable will give access to the full AS Path."

::= { bgpAfPathAttrEntry 13 }

--

-- BGP 4 AS_PATH. This table provides a platform neutral
-- representation of the AS_PATH.

--

bgpAsPathTable OBJECT-TYPE

SYNTAX SEQUENCE OF BgpAsPathEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The BGP-4 Path Attribute AS Path Table contains the per network path (NLRI) AS PATH data received from the advertising BGP peer.

Note that the bgpAsPathElementValue is 4-byte AS capable. This table and related objects in this MIB are meant to reflect the active AS_PATH for a 2-byte or a 4-byte AS speaker. For a transitional 2-byte to 4-byte speaker, the received AS_PATH and AS4_PATH path attributes may be present in an extension MIB."

REFERENCE

"RFC 4271, Sections 4.3 and 5.1.2.

RFC 4893, BGP Support for Four-octet AS Number Space"

::= { bgpRib 6 }

bgpAsPathTableEntry OBJECT-TYPE

SYNTAX BgpAsPathEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"Information about an AS path provided with a path to a network."

INDEX {

bgpAsPathIndex,

bgpAsPathSegmentIndex,

bgpAsPathElementIndex

}

::= { bgpAsPathTable 1 }

BgpAsPathEntry ::= SEQUENCE {

bgpAsPathSegmentIndex

Unsigned32,

bgpAsPathElementIndex

Unsigned32,

bgpAsPathType

INTEGER,

bgpAsPathElementValue

InetAutonomousSystemNumber

}

bgpAsPathSegmentIndex OBJECT-TYPE

SYNTAX Unsigned32

MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
 "A per-AS path segment index. This will index a set of autonomous systems in an AS path which are part of the same sequence or set (as determined by the row value of bgpAsPathType, which should be the same value for each bgpAsPathTable entry indexed by the same bgpAsPathIndex."
REFERENCE
 "RFC 4271, Sections 4.3 and 5.1.2."
::= { bgpAsPathTableEntry 1 }

bgpAsPathElementIndex OBJECT-TYPE
SYNTAX Unsigned32
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
 "A per-AS element index. This will index a particular AS within a sequence or set of autonomous systems in an AS path."
REFERENCE
 "RFC 4271, Sections 4.3 and 5.1.2."
::= { bgpAsPathTableEntry 2 }

bgpAsPathType OBJECT-TYPE
SYNTAX INTEGER {
 asSet(1),
 asSequence(2),
 confedSequence(3),
 confedSet(4)
}
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "The path segment type advertised for the per-AS element. Note that all asPath row instances for a given bgpAsPathIndex index will have their bgpAsPathType set to the same value. The values for bgpAsPathType are interpreted as defined in the base BGP document and the BGP AS Confederations document."
REFERENCE
 "RFC 4271, Sections 4.3 and 5.1.2,
 RFC 5065 - BGP AS Confederations"
::= { bgpAsPathTableEntry 3 }

bgpAsPathElementValue OBJECT-TYPE
SYNTAX InetAutonomousSystemNumber

```

MAX-ACCESS read-only
STATUS current
DESCRIPTION
    "An AS the NLRI traversed in the propagation of its
    advertisement. This value is to be interpreted in
    the context of the segment type of the bgpAsPathType
    in the same conceptual row."
 ::= { bgpAsPathTableEntry 4 }

```

```

-- BGP 4 Path unknown attribute. There is one row in
-- this table for each attribute not known by this BGP
-- implementation (or agent instrumentation), but provided
-- from a peer.

```

```

bgpAfPathAttrUnknownTable OBJECT-TYPE
    SYNTAX SEQUENCE OF BgpAfPathAttrUnknownEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "The BGP-4 Path Attribute Unknown Table
        contains the per network path (NLRI)
        data on the path attributes advertised
        with a route but not known to the local BGP
        implementation or not otherwise capable of being
        returned from this agent.

        The absence of row data for a given index value for
        bgpAfPathAttrIndex indicates a lack of such unknown
        attribute information for the indicated network path
        (as indexed by that bgpAfPathAttrIndex value in the
        bgpAfPathAttrTable)."
```

REFERENCE

```

    "RFC 4271, Sections 4.3 and 5."
 ::= { bgpRib 7 }

```

```

bgpAfPathAttrUnknownEntry OBJECT-TYPE
    SYNTAX BgpAfPathAttrUnknownEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "Information about an unknown attribute
        provided with a path to a network."
    INDEX {
        bgpAfPathAttrUnknownIndex,
        bgpAfPathAttrUnknownCode
    }
 ::= { bgpAfPathAttrUnknownTable 1 }

```

```

BgpAfPathAttrUnknownEntry ::= SEQUENCE {

```

```

    bgpAfPathAttrUnknownCode
        Unsigned32,
    bgpAfPathAttrUnknownFlags
        OCTET STRING,
    bgpAfPathAttrUnknownValue
        OCTET STRING
}

bgpAfPathAttrUnknownCode OBJECT-TYPE
    SYNTAX Unsigned32
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
        "The path attribute code advertised with this unknown
        attribute by the peer."
    ::= { bgpAfPathAttrUnknownEntry 1 }

-- Maximum size of the following is derived as
-- 4096 max message size
-- - 16 BGP message marker bytes
-- - 2 BGP message size
-- - 1 BGP message type (UPDATE with unknown attr)
-- - 2 UPDATE routes length (even assuming no routes)
-- - 2 UPDATE path attributes length
-- - 1 path attribute flag octet
-- - 2 unknown path attr type (in bgpAfPathAttrUnknownCode)
-- -----
-- 4070 bytes maximum per-message attribute value data

bgpAfPathAttrUnknownFlags OBJECT-TYPE
    SYNTAX BgpPathAttrFlagsTC
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "The flags of the unknown path attribute."
    ::= { bgpAfPathAttrUnknownEntry 2 }

bgpAfPathAttrUnknownValue OBJECT-TYPE
    SYNTAX OCTET STRING (SIZE(0..4070))
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "Value of path attribute not understood
        by the base BGP-4 document.

        Per RFC 2578, Section 7.1.2, some implementations
        may have limitations dealing with OCTET STRINGS
        larger than 255. Thus, this data may be truncated.

```

```

        Octets beyond the maximum size, if any,
        are not recorded by this row object."
 ::= { bgpAfPathAttrUnknownEntry 3 }

--
-- Mount point for extensions
--

bgpExtensions OBJECT IDENTIFIER ::= { bgp 12 }

--
-- Notifications
--

bgpNotification OBJECT IDENTIFIER ::= { bgp 0 }

-- bgpNotification 1 and 2 have been deprecated and are
-- documented elsewhere in this MIB

bgpAfEstablishedNotification NOTIFICATION-TYPE
    OBJECTS {
        bgpPeerAfPeerState,
        bgpPeerAfLocalPort,
        bgpPeerAfRemotePort
    }
    STATUS current
    DESCRIPTION
        "The BGP Established event is generated when
        the BGP FSM enters the established state."
    ::= { bgpNotification 3 }

bgpAfBackwardTransNotification NOTIFICATION-TYPE
    OBJECTS {
        bgpPeerAfPeerState,
        bgpPeerAfLocalPort,
        bgpPeerAfRemotePort,
        bgpPeerAfLastErrorReceived,
        bgpPeerAfLastErrorReceivedText
    }
    STATUS current
    DESCRIPTION
        "The BGPBackwardTransition Event is generated
        when the BGP FSM moves from a higher numbered
        state to a lower numbered state.

        Due to the nature of the BGP state machine, an implementation MAY
        rate limit the generation of this event. An implementation MAY
        also generate this notification ONLY when the state machine moves
        out of the established state. An implementation should document
        its specific behavior."

```

```

        ::= { bgpNotification 4 }

--
-- Conformance Information
--

bgpConformance
    OBJECT IDENTIFIER ::= { bgp 8 }

bgp4MIBCompliances OBJECT IDENTIFIER ::=
    { bgpConformance 1 }

bgp4MIBGroups OBJECT IDENTIFIER ::=
    { bgpConformance 2 }

-- bgp4MIBCompliances 1 through 3 have been deprecated and are
-- documented elsewhere in this MIB.

bgpAfMIBCompliance MODULE-COMPLIANCE
    STATUS current
    DESCRIPTION
        "The compliance statement for entities which
        implement the BGP4 mib."
    MODULE -- this module
    MANDATORY-GROUPS {
        bgpTimersGroup,
        bgpCountersGroup,
        bgpAsPathGroup,
        bgpBaseGroup,
        bgpErrorsGroup,
        bgpPeerAfGroup,
        bgpAfPathAttributesGroup
    }
    GROUP bgpAfMIBGlobalsGroup
    DESCRIPTION
        "This group is mandatory for all agent implementations."
    GROUP bgpTimersGroup
    DESCRIPTION
        "This group is mandatory for all agent implementations."
    GROUP bgpCountersGroup
    DESCRIPTION
        "This group is mandatory for all agent implementations."
    GROUP bgpAsPathGroup
    DESCRIPTION
        "This group is mandatory for all agent implementations."
    GROUP bgpBaseGroup
    DESCRIPTION
        "This group is mandatory for all agent implementations."
    GROUP bgpErrorsGroup

```

```

DESCRIPTION
    "This group is mandatory for all agent implementations."
GROUP bgpPeerAfGroup
DESCRIPTION
    "This group is mandatory for all agent implementations."
GROUP bgpAfPathAttributesGroup
DESCRIPTION
    "This group is mandatory for all agent implementations."
GROUP bgpAfMIBNotificationGroup
DESCRIPTION
    "Implementation of BGP Notifications are completely
    optional in this MIB."
::= { bgp4MIBCompliances 4 }

```

bgpAfMIBDeprecatedCompliances MODULE-COMPLIANCE

```

STATUS deprecated
DESCRIPTION
    "The compliance statement for entities which
    implement the BGP4 mib."
MODULE -- this module
GROUP bgpAfMIBOldGlobalsGroup
DESCRIPTION
    "Implementation of the bgp4MIBGlobalsGroup is OPTIONAL.
    If it is implemented, then bgp4MIBGlobalsGroup,
    bgp4MIBPeerGroup, bgp4MIBPathAttrGroup and
    bgp4MIBNotificationGroup MUST all be implemented."
GROUP bgp4MIBPeerGroup
DESCRIPTION
    "Implementation of the bgp4MIBPeerGroup is OPTIONAL.
    If it is implemented, then bgp4MIBGlobalsGroup,
    bgp4MIBPeerGroup, bgp4MIBPathAttrGroup and
    bgp4MIBNotificationGroup MUST all be implemented."
GROUP bgp4MIBPathAttrGroup
DESCRIPTION
    "Implementation of the bgp4MIBPathAttrGroup is OPTIONAL.
    If it is implemented, then bgp4MIBGlobalsGroup,
    bgp4MIBPeerGroup, bgp4MIBPathAttrGroup and
    bgp4MIBNotificationGroup MUST all be implemented."
GROUP bgp4MIBNotificationGroup
DESCRIPTION
    "Implementation of the bgp4MIBNotificationGroup is OPTIONAL.
    If it is implemented, then bgp4MIBGlobalsGroup,
    bgp4MIBPeerGroup, bgp4MIBPathAttrGroup and
    bgp4MIBNotificationGroup MUST all be implemented."
::= { bgp4MIBCompliances 5 }

```

```

-- bgp4MIBGroups 1 through 7 have been deprecated and are documented
-- elsewhere in this MIB.

```

bgpAfMIBGlobalsGroup OBJECT-GROUP
OBJECTS { bgpVersion,
 bgpIdentifier }
STATUS current
DESCRIPTION
 "A collection of objects providing information on global
 BGP state. This group covers objects that overlap the
 old bgp4MIBGlobalsGroup that are still current."
::= { bgp4MIBGroups 8 }

bgpAfMIBOldGlobalsGroup OBJECT-GROUP
OBJECTS { bgpLocalAs }
STATUS deprecated
DESCRIPTION
 "A collection of objects providing information on global
 BGP state. This group covers objects that overlap the
 old bgp4MIBGlobalsGroup that are deprecated."
::= { bgp4MIBGroups 9 }

bgpTimersGroup OBJECT-GROUP
OBJECTS {
 bgpPeerAfFsmEstablishedTime,
 bgpPeerAfInUpdatesElapsedTime,
 bgpPeerAfConnectRetryInterval,
 bgpPeerAfHoldTimeConfigured,
 bgpPeerAfKeepAliveConfigured,
 bgpPeerAfMinASOrigInterval,
 bgpPeerAfMinRouteAdverInterval,
 bgpPeerAfHoldTime,
 bgpPeerAfKeepAlive
}
STATUS current
DESCRIPTION
 "Objects associated with BGP peering timers."
::= { bgp4MIBGroups 10 }

bgpCountersGroup OBJECT-GROUP
OBJECTS {
 bgpPeerAfInUpdates,
 bgpPeerAfOutUpdates,
 bgpPeerAfInTotalMessages,
 bgpPeerAfOutTotalMessages,
 bgpPeerAfFsmEstablishedTrans,
 bgpPrefixInPrefixes,
 bgpPrefixInPrefixesAccepted,
 bgpPrefixOutPrefixes
}
STATUS current
DESCRIPTION

```

        "Objects to count discrete events and exchanges on BGP
        sessions."
        ::= { bgp4MIBGroups 11 }

bgpAsPathGroup OBJECT-GROUP
    OBJECTS {
        bgpAsPathType,
        bgpAsPathElementValue
    }
    STATUS current
    DESCRIPTION
        "Objects to report AS paths received on BGP NLRIs."
        ::= { bgp4MIBGroups 12 }

bgpBaseGroup OBJECT-GROUP
    OBJECTS {
        bgpLocalAsNew
    }
    STATUS current
    DESCRIPTION
        "Basic objects in local BGP implementation."
        ::= { bgp4MIBGroups 13 }

bgpErrorsGroup OBJECT-GROUP
    OBJECTS {
        bgpPeerAfLastErrorReceived,
        bgpPeerAfLastErrorReceivedData,
        bgpPeerAfLastErrorReceivedTime,
        bgpPeerAfLastErrorReceivedText,
        bgpPeerAfLastErrorSent,
        bgpPeerAfLastErrorSentData,
        bgpPeerAfLastErrorSentTime,
        bgpPeerAfLastErrorSentText
    }
    STATUS current
    DESCRIPTION
        "Errors received on BGP peering sessions."
        ::= { bgp4MIBGroups 14 }

bgpPeerAfGroup OBJECT-GROUP
    OBJECTS {
        bgpPeerAfIdentifier,
        bgpPeerAfPeerState,
        bgpPeerAfAdminStatus,
        bgpPeerAfConfiguredVersion,
        bgpPeerAfNegotiatedVersion,
        bgpPeerAfLocalPort,
        bgpPeerAfLocalAs,
        bgpPeerAfRemotePort,

```

```

        bgpPeerAfRemoteAs
    }
    STATUS current
    DESCRIPTION
        "Core object types on BGP peering sessions."
    ::= { bgp4MIBGroups 15 }

```

bgpAfPathAttributesGroup OBJECT-GROUP

```

    OBJECTS {
        bgpAfPathAttrCount,
        bgpAsPathCalcLength,
        bgpAsPathElementValue,
        bgpAsPathIndex,
        bgpAsPathString,
        bgpAsPathType,
        bgpNlriBest,
        bgpNlriCalcLocalPref,
        bgpAdjRibsOutRoute,
        bgpAfPathAttrAggregatorAS,
        bgpAfPathAttrAggregatorAddr,
        bgpAfPathAttrAtomicAggregate,
        bgpAfPathAttrIndex,
        bgpAfPathAttrLocalPref,
        bgpAfPathAttrMed,
        bgpAfPathAttrMedPresent,
        bgpAfPathAttrNextHop,
        bgpAfPathAttrNextHopAddrType,
        bgpAfPathAttrLinkLocalNextHop,
        bgpAfPathAttrOrigin,
        bgpAfPathAttrUnknownIndex,
        bgpAfPathAttrUnknownFlags,
        bgpAfPathAttrUnknownValue
    }
    STATUS current
    DESCRIPTION
        "Attributes received on BGP peering sessions."
    ::= { bgp4MIBGroups 16 }

```

```

-- =====
--
-- Objects that are deprecated from RFC 4273 follow below.
--
-- =====

```

bgpLocalAs OBJECT-TYPE

```

    SYNTAX      Integer32 (0..65535)
    MAX-ACCESS  read-only
    STATUS      deprecated

```

DESCRIPTION

"The local autonomous system number.

This object has been replaced with bgpLocalAsNew which can accomodate 4-byte AS numbers. When the Local AS number cannot be represented by a 2-byte number, this object should return the AS_TRANS value, 23456."

REFERENCE

"RFC 4271, Section 4.2, 'My Autonomous System'.

RFC 4893, BGP Support for Four-octet AS Number Space."

::= { bgp 2 }

-- BGP Peer table. This table contains, one entry per

-- BGP peer, information about the BGP peer.

bgpPeerTable OBJECT-TYPE

SYNTAX SEQUENCE OF BgpPeerEntry

MAX-ACCESS not-accessible

STATUS deprecated

DESCRIPTION

"BGP peer table. This table contains, one entry per BGP peer, information about the connections with BGP peers.

This table has been replaced with BgpPeerAfTable."

::= { bgp 3 }

bgpPeerEntry OBJECT-TYPE

SYNTAX BgpPeerEntry

MAX-ACCESS not-accessible

STATUS deprecated

DESCRIPTION

"Entry containing information about the connection with a BGP peer."

INDEX { bgpPeerRemoteAddr }

::= { bgpPeerTable 1 }

BgpPeerEntry ::= SEQUENCE {

bgpPeerIdentifier

IpAddress,

bgpPeerState

INTEGER,

bgpPeerAdminStatus

INTEGER,

bgpPeerNegotiatedVersion

Integer32,

```

    bgpPeerLocalAddr
        IPAddress,
    bgpPeerLocalPort
        Integer32,
    bgpPeerRemoteAddr
        IPAddress,
    bgpPeerRemotePort
        Integer32,
    bgpPeerRemoteAs
        Integer32,
    bgpPeerInUpdates
        Counter32,
    bgpPeerOutUpdates
        Counter32,
    bgpPeerInTotalMessages
        Counter32,
    bgpPeerOutTotalMessages
        Counter32,
    bgpPeerLastError
        OCTET STRING,
    bgpPeerFsmEstablishedTransitions
        Counter32,
    bgpPeerFsmEstablishedTime
        Gauge32,
    bgpPeerConnectRetryInterval
        Integer32,
    bgpPeerHoldTime
        Integer32,
    bgpPeerKeepAlive
        Integer32,
    bgpPeerHoldTimeConfigured
        Integer32,
    bgpPeerKeepAliveConfigured
        Integer32,
    bgpPeerMinASOriginationInterval
        Integer32,
    bgpPeerMinRouteAdvertisementInterval
        Integer32,
    bgpPeerInUpdateElapsedTime
        Gauge32
}

```

bgpPeerIdentifier OBJECT-TYPE

SYNTAX IPAddress

MAX-ACCESS read-only

STATUS deprecated

DESCRIPTION

"The BGP Identifier of this entry's BGP peer.
This entry MUST be 0.0.0.0 unless the

bgpPeerState is in the openconfirm or the established state."

REFERENCE

"RFC 4271, Section 4.2, 'BGP Identifier'."

::= { bgpPeerEntry 1 }

bgpPeerState OBJECT-TYPE

SYNTAX INTEGER {
idle(1),
connect(2),
active(3),
opensent(4),
openconfirm(5),
established(6)
}

MAX-ACCESS read-only

STATUS deprecated

DESCRIPTION

"The BGP peer connection state."

REFERENCE

"RFC 4271, Section 8.2.2."

::= { bgpPeerEntry 2 }

bgpPeerAdminStatus OBJECT-TYPE

SYNTAX INTEGER {
stop(1),
start(2)
}

MAX-ACCESS read-write

STATUS deprecated

DESCRIPTION

"The desired state of the BGP connection.

A transition from 'stop' to 'start' will cause the BGP Manual Start Event to be generated.

A transition from 'start' to 'stop' will cause the BGP Manual Stop Event to be generated.

This parameter can be used to restart BGP peer connections. Care should be used in providing write access to this object without adequate authentication."

REFERENCE

"RFC 4271, Section 8.1.2."

::= { bgpPeerEntry 3 }

bgpPeerNegotiatedVersion OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-only

STATUS deprecated

DESCRIPTION

"The negotiated version of BGP running between the two peers.

This entry MUST be zero (0) unless the bgpPeerState is in the openconfirm or the established state.

Note that legal values for this object are between 0 and 255."

REFERENCE

"RFC 4271, Section 4.2.

RFC 4271, Section 7."

::= { bgpPeerEntry 4 }

bgpPeerLocalAddr OBJECT-TYPE

SYNTAX IPAddress

MAX-ACCESS read-only

STATUS deprecated

DESCRIPTION

"The local IP address of this entry's BGP connection."

::= { bgpPeerEntry 5 }

bgpPeerLocalPort OBJECT-TYPE

SYNTAX Integer32 (0..65535)

MAX-ACCESS read-only

STATUS deprecated

DESCRIPTION

"The local port for the TCP connection between the BGP peers."

::= { bgpPeerEntry 6 }

bgpPeerRemoteAddr OBJECT-TYPE

SYNTAX IPAddress

MAX-ACCESS read-only

STATUS deprecated

DESCRIPTION

"The remote IP address of this entry's BGP peer."

::= { bgpPeerEntry 7 }

bgpPeerRemotePort OBJECT-TYPE

SYNTAX Integer32 (0..65535)

MAX-ACCESS read-only

STATUS deprecated

DESCRIPTION

"The remote port for the TCP connection between the BGP peers. Note that the

```
        objects bgpPeerLocalAddr,  
        bgpPeerLocalPort, bgpPeerRemoteAddr, and  
        bgpPeerRemotePort provide the appropriate  
        reference to the standard MIB TCP  
        connection table."  
 ::= { bgpPeerEntry 8 }
```

bgpPeerRemoteAs OBJECT-TYPE

```
SYNTAX      Integer32 (0..65535)  
MAX-ACCESS  read-only  
STATUS      deprecated  
DESCRIPTION  
    "The remote autonomous system number received in  
    the BGP OPEN message."  
REFERENCE  
    "RFC 4271, Section 4.2."  
 ::= { bgpPeerEntry 9 }
```

bgpPeerInUpdates OBJECT-TYPE

```
SYNTAX      Counter32  
MAX-ACCESS  read-only  
STATUS      deprecated  
DESCRIPTION  
    "The number of BGP UPDATE messages  
    received on this connection."  
REFERENCE  
    "RFC 4271, Section 4.3."  
 ::= { bgpPeerEntry 10 }
```

bgpPeerOutUpdates OBJECT-TYPE

```
SYNTAX      Counter32  
MAX-ACCESS  read-only  
STATUS      deprecated  
DESCRIPTION  
    "The number of BGP UPDATE messages  
    transmitted on this connection."  
REFERENCE  
    "RFC 4271, Section 4.3."  
 ::= { bgpPeerEntry 11 }
```

bgpPeerInTotalMessages OBJECT-TYPE

```
SYNTAX      Counter32  
MAX-ACCESS  read-only  
STATUS      deprecated  
DESCRIPTION  
    "The total number of messages received  
    from the remote peer on this connection."  
REFERENCE  
    "RFC 4271, Section 4."
```

::= { bgpPeerEntry 12 }

bgpPeerOutTotalMessages OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS deprecated

DESCRIPTION

"The total number of messages transmitted to the remote peer on this connection."

REFERENCE

"RFC 4271, Section 4."

::= { bgpPeerEntry 13 }

bgpPeerLastError OBJECT-TYPE

SYNTAX OCTET STRING (SIZE (2))

MAX-ACCESS read-only

STATUS deprecated

DESCRIPTION

"The last error code and subcode seen by this peer on this connection. If no error has occurred, this field is zero. Otherwise, the first byte of this two byte OCTET STRING contains the error code, and the second byte contains the subcode."

REFERENCE

"RFC 4271, Section 4.5."

::= { bgpPeerEntry 14 }

bgpPeerFsmEstablishedTransitions OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS deprecated

DESCRIPTION

"The total number of times the BGP FSM transitioned into the established state for this peer."

REFERENCE

"RFC 4271, Section 8."

::= { bgpPeerEntry 15 }

bgpPeerFsmEstablishedTime OBJECT-TYPE

SYNTAX Gauge32

UNITS "seconds"

MAX-ACCESS read-only

STATUS deprecated

DESCRIPTION

"This timer indicates how long (in seconds) this peer has been in the established state or how long

since this peer was last in the established state. It is set to zero when a new peer is configured or when the router is booted."

REFERENCE

"RFC 4271, Section 8."

::= { bgpPeerEntry 16 }

bgpPeerConnectRetryInterval OBJECT-TYPE

SYNTAX Integer32 (1..65535)

UNITS "seconds"

MAX-ACCESS read-write

STATUS deprecated

DESCRIPTION

"Time interval (in seconds) for the ConnectRetry timer. The suggested value for this timer is 120 seconds."

REFERENCE

"RFC 4271, Section 8.2.2. This is the value used to initialize the 'ConnectRetryTimer'."

::= { bgpPeerEntry 17 }

bgpPeerHoldTime OBJECT-TYPE

SYNTAX Integer32 (0 | 3..65535)

UNITS "seconds"

MAX-ACCESS read-only

STATUS deprecated

DESCRIPTION

"Time interval (in seconds) for the Hold Timer established with the peer. The value of this object is calculated by this BGP speaker, using the smaller of the values in bgpPeerHoldTimeConfigured and the Hold Time received in the OPEN message.

This value must be at least three seconds if it is not zero (0).

If the Hold Timer has not been established with the peer this object MUST have a value of zero (0).

If the bgpPeerHoldTimeConfigured object has a value of (0), then this object MUST have a value of (0)."

REFERENCE

"RFC 4271, Section 4.2."

::= { bgpPeerEntry 18 }

bgpPeerKeepAlive OBJECT-TYPE

SYNTAX Integer32 (0 | 1..21845)

UNITS "seconds"

MAX-ACCESS read-only

STATUS deprecated

DESCRIPTION

"Time interval (in seconds) for the KeepAlive timer established with the peer. The value of this object is calculated by this BGP speaker such that, when compared with bgpPeerHoldTime, it has the same proportion that bgpPeerKeepAliveConfigured has, compared with bgpPeerHoldTimeConfigured.

If the KeepAlive timer has not been established with the peer, this object MUST have a value of zero (0).

If the of bgpPeerKeepAliveConfigured object has a value of (0), then this object MUST have a value of (0)."

REFERENCE

"RFC 4271, Section 4.4."

::= { bgpPeerEntry 19 }

bgpPeerHoldTimeConfigured OBJECT-TYPE

SYNTAX Integer32 (0 | 3..65535)

UNITS "seconds"

MAX-ACCESS read-write

STATUS deprecated

DESCRIPTION

"Time interval (in seconds) for the Hold Time configured for this BGP speaker with this peer. This value is placed in an OPEN message sent to this peer by this BGP speaker, and is compared with the Hold Time field in an OPEN message received from the peer when determining the Hold Time (bgpPeerHoldTime) with the peer. This value must not be less than three seconds if it is not zero (0). If it is zero (0), the Hold Time is NOT to be established with the peer. The suggested value for this timer is 90 seconds."

REFERENCE

"RFC 4271, Section 4.2.

RFC 4271, Section 10."

::= { bgpPeerEntry 20 }

bgpPeerKeepAliveConfigured OBJECT-TYPE

SYNTAX Integer32 (0 | 1..21845)

UNITS "seconds"

MAX-ACCESS read-write

STATUS deprecated

DESCRIPTION

"Time interval (in seconds) for the KeepAlive timer configured for this BGP speaker with this peer. The value of this object will only determine the KEEPALIVE messages' frequency relative to the value specified in bgpPeerHoldTimeConfigured; the actual time interval for the KEEPALIVE messages is indicated by bgpPeerKeepAlive. A reasonable maximum value for this timer would be one third of that of bgpPeerHoldTimeConfigured. If the value of this object is zero (0), no periodic KEEPALIVE messages are sent to the peer after the BGP connection has been established. The suggested value for this timer is 30 seconds."

REFERENCE

"RFC 4271, Section 4.4.

RFC 4271, Section 10."

::= { bgpPeerEntry 21 }

bgpPeerMinASOriginationInterval OBJECT-TYPE

SYNTAX Integer32 (1..65535)

UNITS "seconds"

MAX-ACCESS read-write

STATUS deprecated

DESCRIPTION

"Time interval (in seconds) for the MinASOriginationInterval timer. The suggested value for this timer is 15 seconds."

REFERENCE

"RFC 4271, Section 9.2.1.2.

RFC 4271, Section 10."

::= { bgpPeerEntry 22 }

bgpPeerMinRouteAdvertisementInterval OBJECT-TYPE

SYNTAX Integer32 (1..65535)

UNITS "seconds"

MAX-ACCESS read-write

STATUS deprecated

DESCRIPTION

"Time interval (in seconds) for the
MinRouteAdvertisementInterval timer.
The suggested value for this timer is 30
seconds for EBGP connections and 5
seconds for IBGP connections."

REFERENCE

"RFC 4271, Section 9.2.1.1.
RFC 4271, Section 10."

::= { bgpPeerEntry 23 }

bgpPeerInUpdateElapsedTime OBJECT-TYPE

SYNTAX Gauge32

UNITS "seconds"

MAX-ACCESS read-only

STATUS deprecated

DESCRIPTION

"Elapsed time (in seconds) since the last BGP
UPDATE message was received from the peer.
Each time bgpPeerInUpdates is incremented,
the value of this object is set to zero (0)."

REFERENCE

"RFC 4271, Section 4.3.
RFC 4271, Section 8.2.2, Established state."

::= { bgpPeerEntry 24 }

-- BGP Received Path Attribute Table. This table contains
-- one entry per path to a network, and path attributes
-- received from all peers running BGP version 3 or less.
-- This table is obsolete, having been replaced in
-- functionality by the bgp4PathAttrTable.

bgpRcvdPathAttrTable OBJECT-TYPE

SYNTAX SEQUENCE OF BgpPathAttrEntry

MAX-ACCESS not-accessible

STATUS obsolete

DESCRIPTION

"The BGP Received Path Attribute Table
contains information about paths to
destination networks, received from all
peers running BGP version 3 or less."

::= { bgp 5 }

bgpPathAttrEntry OBJECT-TYPE

SYNTAX BgpPathAttrEntry

MAX-ACCESS not-accessible

STATUS obsolete

DESCRIPTION

"Information about a path to a network."

```

INDEX { bgpPathAttrDestNetwork,
        bgpPathAttrPeer      }
::= { bgpRcvdPathAttrTable 1 }

```

```

BgpPathAttrEntry ::= SEQUENCE {
    bgpPathAttrPeer
        IPAddress,
    bgpPathAttrDestNetwork
        IPAddress,
    bgpPathAttrOrigin
        INTEGER,
    bgpPathAttrASPath
        OCTET STRING,
    bgpPathAttrNextHop
        IPAddress,
    bgpPathAttrInterASMetric
        Integer32
}

```

```

bgpPathAttrPeer OBJECT-TYPE
    SYNTAX      IPAddress
    MAX-ACCESS  read-only
    STATUS      obsolete
    DESCRIPTION
        "The IP address of the peer where the path
        information was learned."
    ::= { bgpPathAttrEntry 1 }

```

```

bgpPathAttrDestNetwork OBJECT-TYPE
    SYNTAX      IPAddress
    MAX-ACCESS  read-only
    STATUS      obsolete
    DESCRIPTION
        "The address of the destination network."
    REFERENCE
        "RFC 1267, Section 4.3."
    ::= { bgpPathAttrEntry 2 }

```

```

bgpPathAttrOrigin OBJECT-TYPE
    SYNTAX      INTEGER {
        igp(1), -- networks are interior
        egp(2), -- networks learned via the
                -- EGP protocol
        incomplete(3) -- networks that
                -- are learned by some other
                -- means
    }
    MAX-ACCESS  read-only
    STATUS      obsolete

```

DESCRIPTION

"The ultimate origin of the path information."

REFERENCE

"RFC 1267, Section 4.3.

RFC 1267, Section 5."

::= { bgpPathAttrEntry 3 }

bgpPathAttrASPath OBJECT-TYPE

SYNTAX OCTET STRING (SIZE (2..255))

MAX-ACCESS read-only

STATUS obsolete

DESCRIPTION

"The set of ASes that must be traversed to reach the network. This object is probably best represented as SEQUENCE OF INTEGER. For SMI compatibility, though, it is represented as OCTET STRING. Each AS is represented as a pair of octets according to the following algorithm:

first-byte-of-pair = ASNumber / 256;

second-byte-of-pair = ASNumber & 255;"

REFERENCE

"RFC 1267, Section 4.3.

RFC 1267, Section 5."

::= { bgpPathAttrEntry 4 }

bgpPathAttrNextHop OBJECT-TYPE

SYNTAX IPAddress

MAX-ACCESS read-only

STATUS obsolete

DESCRIPTION

"The address of the border router that should be used for the destination network."

REFERENCE

"RFC 1267, Section 4.3.

RFC 1267, Section 5."

::= { bgpPathAttrEntry 5 }

bgpPathAttrInterASMetric OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-only

STATUS obsolete

DESCRIPTION

"The optional inter-AS metric. If this attribute has not been provided for this route, the value for this object is 0."

REFERENCE

"RFC 1267, Section 4.3.

RFC 1267, Section 5."

```
::= { bgpPathAttrEntry 6 }
```

```
-- BGP-4 Received Path Attribute Table. This table  
-- contains one entry per path to a network, and path  
-- attributes received from all peers running BGP-4.
```

```
bgp4PathAttrTable OBJECT-TYPE
```

```
SYNTAX      SEQUENCE OF Bgp4PathAttrEntry
```

```
MAX-ACCESS not-accessible
```

```
STATUS      deprecated
```

```
DESCRIPTION
```

```
    "The BGP-4 Received Path Attribute Table  
    contains information about paths to  
    destination networks, received from all  
    BGP4 peers.
```

```
    This table has been replaced by the functionality  
    provided under the bgpRib OID."
```

```
::= { bgp 6 }
```

```
bgp4PathAttrEntry OBJECT-TYPE
```

```
SYNTAX      Bgp4PathAttrEntry
```

```
MAX-ACCESS not-accessible
```

```
STATUS      deprecated
```

```
DESCRIPTION
```

```
    "Information about a path to a network."
```

```
INDEX { bgp4PathAttrIpAddressPrefix,  
        bgp4PathAttrIpAddressPrefixLen,  
        bgp4PathAttrPeer          }
```

```
::= { bgp4PathAttrTable 1 }
```

```
Bgp4PathAttrEntry ::= SEQUENCE {
```

```
    bgp4PathAttrPeer
```

```
        IpAddress,
```

```
    bgp4PathAttrIpAddressPrefixLen
```

```
        Integer32,
```

```
    bgp4PathAttrIpAddressPrefix
```

```
        IpAddress,
```

```
    bgp4PathAttrOrigin
```

```
        INTEGER,
```

```
    bgp4PathAttrASPathSegment
```

```
        OCTET STRING,
```

```
    bgp4PathAttrNextHop
```

```
        IpAddress,
```

```
    bgp4PathAttrMultiExitDisc
```

```
        Integer32,
```

```
    bgp4PathAttrLocalPref
```

```
        Integer32,
```

```
    bgp4PathAttrAtomicAggregate
```

```

        INTEGER,
    bgp4PathAttrAggregatorAS
        Integer32,
    bgp4PathAttrAggregatorAddr
        IPAddress,
    bgp4PathAttrCalcLocalPref
        Integer32,
    bgp4PathAttrBest
        INTEGER,
    bgp4PathAttrUnknown
        OCTET STRING
}

bgp4PathAttrPeer OBJECT-TYPE
    SYNTAX      IPAddress
    MAX-ACCESS  read-only
    STATUS      deprecated
    DESCRIPTION
        "The IP address of the peer where the path
        information was learned."
    ::= { bgp4PathAttrEntry 1 }

bgp4PathAttrIpAddrPrefixLen OBJECT-TYPE
    SYNTAX      Integer32 (0..32)
    MAX-ACCESS  read-only
    STATUS      deprecated
    DESCRIPTION
        "Length in bits of the IP address prefix in
        the Network Layer Reachability
        Information field."
    ::= { bgp4PathAttrEntry 2 }

bgp4PathAttrIpAddrPrefix OBJECT-TYPE
    SYNTAX      IPAddress
    MAX-ACCESS  read-only
    STATUS      deprecated
    DESCRIPTION
        "An IP address prefix in the Network Layer
        Reachability Information field.  This object
        is an IP address containing the prefix with
        length specified by
        bgp4PathAttrIpAddrPrefixLen.
        Any bits beyond the length specified by
        bgp4PathAttrIpAddrPrefixLen are zeroed."
    REFERENCE
        "RFC 4271, Section 4.3."
    ::= { bgp4PathAttrEntry 3 }

bgp4PathAttrOrigin OBJECT-TYPE

```

```

SYNTAX      INTEGER {
                igp(1), -- networks are interior
                egp(2), -- networks learned via the
                        -- EGP protocol
                incomplete(3) -- networks that
                        -- are learned by some other
                        -- means
            }
MAX-ACCESS  read-only
STATUS      deprecated
DESCRIPTION
    "The ultimate origin of the path
    information."
REFERENCE
    "RFC 4271, Section 4.3.
    RFC 4271, Section 5.1.1."
 ::= { bgp4PathAttrEntry 4 }

```

bgp4PathAttrASPathSegment OBJECT-TYPE

```

SYNTAX      OCTET STRING (SIZE (2..255))
MAX-ACCESS  read-only
STATUS      deprecated
DESCRIPTION

```

"The sequence of AS path segments. Each AS path segment is represented by a triple <type, length, value>.

The type is a 1-octet field that has two possible values:

- 1 AS_SET: unordered set of ASes that a route in the UPDATE message has traversed
- 2 AS_SEQUENCE: ordered set of ASes that a route in the UPDATE message has traversed.

The length is a 1-octet field containing the number of ASes in the value field.

The value field contains one or more AS numbers. Each AS is represented in the octet string as a pair of octets according to the following algorithm:

```

first-byte-of-pair = ASNumber / 256;
second-byte-of-pair = ASNumber & 255;

```

Known Issues:

- o BGP Confederations will result in a type of either 3 or 4.
- o An AS Path may be longer than 255 octets. This may result in this object containing a truncated AS Path."

REFERENCE

"RFC 4271, Section 4.3.
RFC 4271, Section 5.1.2."

::= { bgp4PathAttrEntry 5 }

bgp4PathAttrNextHop OBJECT-TYPE

SYNTAX IpAddress
MAX-ACCESS read-only
STATUS deprecated
DESCRIPTION

"The address of the border router that should be used for the destination network. This address is the NEXT_HOP address received in the UPDATE packet."

REFERENCE

"RFC 4271, Section 4.3.
RFC 4271, Section 5.1.3."

::= { bgp4PathAttrEntry 6 }

bgp4PathAttrMultiExitDisc OBJECT-TYPE

SYNTAX Integer32 (-1..2147483647)
MAX-ACCESS read-only
STATUS deprecated
DESCRIPTION

"This metric is used to discriminate between multiple exit points to an adjacent autonomous system. A value of -1 indicates the absence of this attribute.

Known Issues:

- o The BGP-4 specification uses an unsigned 32 bit number. Thus, this object cannot represent the full range of the protocol."

REFERENCE

"RFC 4271, Section 4.3.
RFC 4271, Section 5.1.4."

::= { bgp4PathAttrEntry 7 }

bgp4PathAttrLocalPref OBJECT-TYPE

SYNTAX Integer32 (-1..2147483647)
MAX-ACCESS read-only
STATUS deprecated
DESCRIPTION

"The originating BGP4 speaker's degree of preference for an advertised route. A value of -1 indicates the absence of this attribute.

Known Issues:

- o The BGP-4 specification uses an unsigned 32 bit number and thus this object cannot represent the full range of the protocol."

REFERENCE

"RFC 4271, Section 4.3.

RFC 4271, Section 5.1.5."

::= { bgp4PathAttrEntry 8 }

bgp4PathAttrAtomicAggregate OBJECT-TYPE

SYNTAX INTEGER {
lessSpecificRouteNotSelected(1),
-- Typo corrected from RFC 1657
lessSpecificRouteSelected(2)
}

MAX-ACCESS read-only

STATUS deprecated

DESCRIPTION

"If the ATOMIC_AGGREGATE attribute is present in the Path Attributes then this object MUST have a value of 'lessSpecificRouteNotSelected'.

If the ATOMIC_AGGREGATE attribute is missing in the Path Attributes then this object MUST have a value of 'lessSpecificRouteSelected'.

Note that ATOMIC_AGGREGATE is now a primarily informational attribute."

REFERENCE

"RFC 4271, Sections 5.1.6 and 9.1.4."

::= { bgp4PathAttrEntry 9 }

bgp4PathAttrAggregatorAS OBJECT-TYPE

SYNTAX Integer32 (0..65535)

MAX-ACCESS read-only

STATUS deprecated

DESCRIPTION

"The AS number of the last BGP4 speaker that performed route aggregation. A value of zero (0) indicates the absence of this attribute.

Note that propagation of AS of zero is illegal

in the Internet."

REFERENCE

"RFC 4271, Section 5.1.7.

RFC 4271, Section 9.2.2.2."

::= { bgp4PathAttrEntry 10 }

bgp4PathAttrAggregatorAddr OBJECT-TYPE

SYNTAX IPAddress

MAX-ACCESS read-only

STATUS deprecated

DESCRIPTION

"The IP address of the last BGP4 speaker that performed route aggregation. A value of 0.0.0.0 indicates the absence of this attribute."

REFERENCE

"RFC 4271, Section 5.1.7.

RFC 4271, Section 9.2.2.2."

::= { bgp4PathAttrEntry 11 }

bgp4PathAttrCalcLocalPref OBJECT-TYPE

SYNTAX Integer32 (-1..2147483647)

MAX-ACCESS read-only

STATUS deprecated

DESCRIPTION

"The degree of preference calculated by the receiving BGP4 speaker for an advertised route. A value of -1 indicates the absence of this attribute.

Known Issues:

- o The BGP-4 specification uses an unsigned 32 bit number and thus this object cannot represent the full range of the protocol."

REFERENCE

"RFC 4271, Section 9.1.1."

::= { bgp4PathAttrEntry 12 }

bgp4PathAttrBest OBJECT-TYPE

SYNTAX INTEGER {
false(1), -- not chosen as best route
true(2) -- chosen as best route
}

MAX-ACCESS read-only

STATUS deprecated

DESCRIPTION

"An indication of whether this route was chosen as the best BGP4 route for this

```
destination."
REFERENCE
    "RFC 4271, Section 9.1.2."
::= { bgp4PathAttrEntry 13 }
```

bgp4PathAttrUnknown OBJECT-TYPE

```
SYNTAX      OCTET STRING (SIZE(0..255))
MAX-ACCESS  read-only
STATUS      deprecated
DESCRIPTION
```

"One or more path attributes not understood by this BGP4 speaker.

Path attributes are recorded in the Update Path attribute format of type, length, value.

Size zero (0) indicates the absence of such attributes.

Octets beyond the maximum size, if any, are not recorded by this object.

Known Issues:

- o Attributes understood by this speaker, but not represented in this MIB, are unavailable to the agent."

```
REFERENCE
    "RFC 4271, Section 5."
::= { bgp4PathAttrEntry 14 }
```

```
-- Traps.
-- Note that in RFC 1657, bgpTraps was incorrectly
-- assigned a value of { bgp 7 } and each of the
-- traps had the bgpPeerRemoteAddr object inappropriately
-- removed from their OBJECTS clause. The following
-- definitions restore the semantics of the traps as
-- they were initially defined in RFC 1269.
```

bgpEstablishedNotification NOTIFICATION-TYPE

```
OBJECTS { bgpPeerRemoteAddr,
          bgpPeerLastError,
          bgpPeerState      }
```

STATUS deprecated

DESCRIPTION

"The bgpEstablishedNotification event is generated when the BGP FSM enters the established state.

This Notification replaces the bgpEstablished Notification and has been replaced by

```

        bgpAfEstablishedNotification."
    ::= { bgpNotification 1 }

bgpBackwardTransNotification NOTIFICATION-TYPE
    OBJECTS { bgpPeerRemoteAddr,
               bgpPeerLastError,
               bgpPeerState      }
    STATUS deprecated
    DESCRIPTION
        "The bgpBackwardTransNotification event is
        generated when the BGP FSM moves from a higher
        numbered state to a lower numbered state.

        This Notification replaces the
        bgpBackwardsTransition Notification and has
        been replaced by bgpAfBackwardsNotification."
    ::= { bgpNotification 2 }

-- { bgp 7 } is deprecated. Do not allocate new objects or
-- notifications underneath this branch.

bgpTraps          OBJECT IDENTIFIER ::= { bgp 7 } -- deprecated

bgpEstablished NOTIFICATION-TYPE
    OBJECTS { bgpPeerLastError,
               bgpPeerState      }
    STATUS deprecated
    DESCRIPTION
        "The bgpEstablished event is generated when
        the BGP FSM enters the established state.

        This Notification has been replaced by the
        bgpEstablishedNotification Notification."
    ::= { bgpTraps 1 }

bgpBackwardTransition NOTIFICATION-TYPE
    OBJECTS { bgpPeerLastError,
               bgpPeerState      }
    STATUS deprecated
    DESCRIPTION
        "The bgpBackwardTransition event is generated
        when the BGP FSM moves from a higher numbered
        state to a lower numbered state.

        This Notification has been replaced by the
        bgpBackwardTransNotification Notification."
    ::= { bgpTraps 2 }

-- Obsolete Compliance statements

```

```

bgp4MIBCompliance MODULE-COMPLIANCE
    STATUS  obsolete
    DESCRIPTION
        "The compliance statement for entities which
        implement the BGP4 mib.

        This compliance statement is obsoleted by
        bgpAfMIBCompliance."
    MODULE  -- this module
        MANDATORY-GROUPS { bgp4MIBGlobalsGroup,
                            bgp4MIBPeerGroup,
                            bgp4MIBPathAttrGroup }
        GROUP  bgp4MIBNotificationGroup
        DESCRIPTION
            "Implementation of BGP Notifications are
            completely optional in this MIB."
    ::= { bgp4MIBCompliances 1 }

bgp4MIBDeprecatedCompliances MODULE-COMPLIANCE
    STATUS  obsolete
    DESCRIPTION
        "The compliance statement documenting deprecated
        objects in the BGP4 mib.

        This compliance statement is obsoleted
        by bgpAfMIBCompliance."
    MODULE  -- this module
        GROUP  bgp4MIBTrapGroup
        DESCRIPTION
            "Group containing TRAP objects that were
            improperly converted from SMiv1 in RFC 1657.
            The proper semantics have been restored
            with the objects in bgp4MIBNotificationGroup."
    ::= { bgp4MIBCompliances 2 }

bgp4MIBObsoleteCompliances MODULE-COMPLIANCE
    STATUS  obsolete
    DESCRIPTION
        "The compliance statement documenting obsolete
        objects in the BGP4 mib."
    MODULE  -- this module
        GROUP  bgpRcvdPathAttrGroup
        DESCRIPTION
            "Group containing objects relevant to BGP-3
            and earlier objects."
    ::= { bgp4MIBCompliances 3 }

-- Units of conformance

```

```

bgp4MIBGlobalsGroup OBJECT-GROUP
    OBJECTS { bgpVersion,
               bgpLocalAs,
               bgpIdentifier }
    STATUS obsolete
    DESCRIPTION
        "A collection of objects providing
        information on global BGP state.

        This group has been replaced by
        bgpAfMIBGlobalsGroup and bgpAfMIBOldGlobalsGroup."
    ::= { bgp4MIBGroups 1 }

bgp4MIBPeerGroup OBJECT-GROUP
    OBJECTS { bgpPeerIdentifier,
               bgpPeerState,
               bgpPeerAdminStatus,
               bgpPeerNegotiatedVersion,
               bgpPeerLocalAddr,
               bgpPeerLocalPort,
               bgpPeerRemoteAddr,
               bgpPeerRemotePort,
               bgpPeerRemoteAs,
               bgpPeerInUpdates,
               bgpPeerOutUpdates,
               bgpPeerInTotalMessages,
               bgpPeerOutTotalMessages,
               bgpPeerLastError,
               bgpPeerFsmEstablishedTransitions,
               bgpPeerFsmEstablishedTime,
               bgpPeerConnectRetryInterval,
               bgpPeerHoldTime,
               bgpPeerKeepAlive,
               bgpPeerHoldTimeConfigured,
               bgpPeerKeepAliveConfigured,
               bgpPeerMinASOriginationInterval,
               bgpPeerMinRouteAdvertisementInterval,
               bgpPeerInUpdateElapsedTime }
    STATUS deprecated
    DESCRIPTION
        "A collection of objects for managing BGP peers
        from the previous version of this MIB. The
        individual objects are deprecated and their support
        is OPTIONAL."
    ::= { bgp4MIBGroups 2 }

bgpRcvdPathAttrGroup OBJECT-GROUP
    OBJECTS { bgpPathAttrPeer,

```

```

        bgpPathAttrDestNetwork,
        bgpPathAttrOrigin,
        bgpPathAttrASPath,
        bgpPathAttrNextHop,
        bgpPathAttrInterASMetric }
STATUS   obsolete
DESCRIPTION
    "A collection of objects for managing BGP-3 and
    earlier path entries.

    This conformance group, like BGP-3, is obsolete."
 ::= { bgp4MIBGroups 3 }

```

```

bgp4MIBPathAttrGroup OBJECT-GROUP
OBJECTS { bgp4PathAttrPeer,
          bgp4PathAttrIpAddressPrefixLen,
          bgp4PathAttrIpAddressPrefix,
          bgp4PathAttrOrigin,
          bgp4PathAttrASPathSegment,
          bgp4PathAttrNextHop,
          bgp4PathAttrMultiExitDisc,
          bgp4PathAttrLocalPref,
          bgp4PathAttrAtomicAggregate,
          bgp4PathAttrAggregatorAS,
          bgp4PathAttrAggregatorAddr,
          bgp4PathAttrCalcLocalPref,
          bgp4PathAttrBest,
          bgp4PathAttrUnknown }
STATUS   deprecated
DESCRIPTION
    "A collection of objects for managing BGP path
    entries from the previous version of this MIB.  This
    individual objects are deprecated and their support
    is OPTIONAL."
 ::= { bgp4MIBGroups 4 }

```

```

bgp4MIBTrapGroup NOTIFICATION-GROUP
NOTIFICATIONS { bgpEstablished,
                bgpBackwardTransition }
STATUS   deprecated
DESCRIPTION
    "A collection of notifications for signaling
    changes in BGP peer relationships.

    Obsoleted by bgp4MIBNotificationGroup.  Support of
    the objects in this group is OPTIONAL."
 ::= { bgp4MIBGroups 5 }

```

```

bgp4MIBNotificationGroup NOTIFICATION-GROUP

```

```

        NOTIFICATIONS { bgpEstablishedNotification,
                        bgpBackwardTransNotification }
    STATUS deprecated
    DESCRIPTION
        "A collection of notifications for signaling
        changes in BGP peer relationships.

        Obsoletes bgp4MIBTrapGroup.  Obsoleted by
        bgpAfMIBNotificationGroup.  Support for objects in
        this group is OPTIONAL."
    ::= { bgp4MIBGroups 6 }

bgpAfMIBNotificationGroup NOTIFICATION-GROUP
    NOTIFICATIONS { bgpAfEstablishedNotification,
                    bgpAfBackwardTransNotification }
    STATUS current
    DESCRIPTION
        "A collection of notifications for signaling
        changes in BGP peer relationships.

        Obsoletes bgp4MIBNotificationGroup."
    ::= { bgp4MIBGroups 7 }

END

```

8. Security Considerations

[TOC](#)

This MIB relates to a system providing inter-domain routing. As such, improper manipulation of the objects represented by this MIB may result in denial of service to a large number of end-users.

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:

bgpPeerAdminStatus - Improper change of bgpPeerAdminStatus, from start to stop, can cause significant disruption of the connectivity to those portions of the Internet reached via the applicable remote BGP peer.

bgpPeerConnectRetryInterval - Improper change of this object can cause connections to be disrupted for extremely long time periods when otherwise they would be restored in a relatively short period of time.

bgpPeerHoldTimeConfigured, bgpPeerKeepAliveConfigured - Misconfiguration of these objects can make BGP sessions more fragile and less resilient to denial of service attacks on the inter-domain routing system.

bgpPeerMinASOriginationInterval, bgpPeerMinRouteAdvertisementInterval - Misconfiguration of these objects may adversely affect global Internet convergence of the routes advertised by this BGP speaker. This may result in long-lived routing loops and blackholes for the portions of the Internet that utilize these routes.

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:

- *bgpPeerAfLocalAddrType, bgpPeerAfLocalAddr, bgpPeerAfLocalPort, bgpPeerAfRemoteAddrType, bgpPeerAfRemoteAddr, bgpPeerAfRemotePort, bgpPeerLocalAddr, bgpPeerLocalPort, bgpPeerRemoteAddr, bgpPeerRemotePort - A BGP peer's local and remote addresses might be sensitive for ISPs who want to keep interface addresses on routers confidential in order to prevent router addresses used for a denial of service attack or spoofing. Note that other tables which share elements of these objects as indexes may similarly expose sensitive information.

- *bgpNlriTable, bgpAdjRibsOutTable, bgpAfPathAttrTable, bgpAsPathTable, bgpRcvdPathAttrTable, bgp4PathAttrTable - A BGP peer's routing information may be sensitive for ISPs as the contents of their routing tables may expose details related to business relationships as implemented in Internet routing.

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

9. IANA Considerations

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This document includes an OID, `bgpExtensions`, which defines a name space for future BGP extensions. IANA is requested to create a new registry for new OIDs under `bgpExtensions` that will define the root OID of future MIB modules for bgp extensions. The assignment OIDs should be done based upon IDR working group consensus.

10. Contributors

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