Network Working Group
INTERNET DRAFT

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Definitions of Managed Objects
for the Fourth Version of Border Gateway Protocol (BGP-4)
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Abstract

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in the Internet community In particular, it describes managed objects used for managing the Border Gateway Protocol Version 4 or lower.

The origin of this memo is from RFC 1269 "Definitions of Managed Objects for the Border Gateway Protocol (Version 3)", which was

updated to support BGP-4 in RFC 1657. This memo fixes errors introduced when the MIB module was converted to use the SMIv2 language. This memo also updates references to the current SNMP framework documents.

This memo is intended to document deployed implementations of this MIB module in a historical context, provide clarifications of some items and also note errors where the MIB module fails to fully represent the BGP protocol. Work is currently in progress to replace this MIB module with a new one representing the current state of the BGP protocol and its extensions.

This document obsoletes RFC 1269 and RFC 1657.

Distribution of this memo is unlimited. Please forward comments to idr@ietf.org.

Table of Contents

1. Introduction

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular, it describes managed objects used for managing the Border Gateway Protocol Version 4 or lower [BGP, BGP4APP].

This memo obsoletes RFC 1657 and RFC 1269.

2. The Internet-Standard Management Framework

For a detailed overview of the documents that describe the current Internet-Standard Management Framework, please refer to section 7 of RFC 3410 [RFC3410].

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. MIB objects are generally accessed through the Simple Network Management Protocol (SNMP). Objects in the MIB are defined using the mechanisms defined in the Structure of Management Information (SMI). This memo specifies a MIB module that is compliant to the SMIv2, which is described in STD 58, RFC 2578 [RFC2578], STD 58, RFC 2579 [RFC2579] and STD 58, RFC 2580 [RFC2580].

3. Overview

These objects are used to control and manage a BGP-4 implementation.

Apart from a few system-wide scalar objects, this MIB is broken into three tables: the BGP Peer Table, the BGP Received Path Attribute Table, and the BGP-4 Received Path Attribute Table. The BGP Peer Table contains information about state and current activity of connections with the BGP peers. The BGP Received Path Attribute Table contains path attributes received from all peers running BGP version 3 or less. The BGP-4 Received Path Attribute Table contains path attributes received from all BGP-4 peers. The actual attributes used in determining a route are a subset of the received attribute tables after local routing policy has been applied.

4. Definitions

```
    BGP4-MIB DEFINITIONS ::= BEGIN

        IMPORTS
            MODULE-IDENTITY, OBJECT-TYPE, NOTIFICATION-TYPE,
            IpAddress, Integer32, Counter32, Gauge32, mib-2
                FROM SNMPv2-SMI
            MODULE-COMPLIANCE, OBJECT-GROUP, NOTIFICATION-GROUP
                FROM SNMPv2-CONF;


        bgp MODULE-IDENTITY
            LAST-UPDATED "200408310000Z"
            ORGANIZATION "IETF IDR Working Group"
            CONTACT-INFO "E-mail:  idr@ietf.org

                          Jeffrey Haas, Susan Hares  (Editors)
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                          E-mail: jhaas@nexthop.com
                                  skh@nexthop.com"

            DESCRIPTION
                    "The MIB module for the BGP-4 protocol.

                     Copyright (C) The Internet Society (2004).  This version
                     of this MIB module is part of RFC yyyy;  see the RFC
                     itself for full legal notices."

-- RFC Ed.: replace yyyy with actual RFC number & remove this note

            REVISION "200408310000Z"
            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,
                    bgp4PathAttrASPathSegement.
                 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) to initialize 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.
                    Appliciations should not assume counters to have
                    started at zero.

                  Published as RFC yyyy."
-- RFC Ed.: replace yyyy with actual RFC number & remove this note

            REVISION "199405050000Z"
            DESCRIPTION
                    "Translated to SMIv2 and published as RFC 1657."

            REVISION "199110261839Z"
            DESCRIPTION
                    "Initial version, published as RFC 1269."

            ::= { mib-2 15 }


        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 yyyy, Section 4.2."
            ::= { bgp 1 }

-- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification

        bgpLocalAs OBJECT-TYPE
            SYNTAX     Integer32 (0..65535)
            MAX-ACCESS read-only
            STATUS     current
            DESCRIPTION
                    "The local autonomous system number."
            REFERENCE
                     "RFC yyyy, Section 4.2, 'My Autonomous System'."
            ::= { bgp 2 }
-- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification


        -- 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     current
            DESCRIPTION
                    "BGP peer table.  This table contains,
                     one entry per BGP peer, information about the
                     connections with BGP peers."
            ::= { bgp 3 }


        bgpPeerEntry OBJECT-TYPE
            SYNTAX     BgpPeerEntry
            MAX-ACCESS not-accessible
            STATUS     current
            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
```

```
                }

        bgpPeerIdentifier OBJECT-TYPE
            SYNTAX     IpAddress
            MAX-ACCESS read-only
            STATUS     current
            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 yyyy, Section 4.2, 'BGP Identifier'."
            ::= { bgpPeerEntry 1 }
-- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification

        bgpPeerState 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 yyyy, Section 8.2.2."
            ::= { bgpPeerEntry 2 }

-- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification

        bgpPeerAdminStatus OBJECT-TYPE
            SYNTAX     INTEGER {
                               stop(1),
                               start(2)
                       }
            MAX-ACCESS read-write
            STATUS     current
            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 yyyy, Section 8.1.2."
            ::= { bgpPeerEntry 3 }
-- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification


        bgpPeerNegotiatedVersion OBJECT-TYPE
            SYNTAX     Integer32
            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
                    bgpPeerState is in the openconfirm or the
                    established state.

                    Note that legal values for this object are
                    between 0 and 255."
            REFERENCE
                    "RFC yyyy, Section 4.2.
                    RFC yyyy, Section 7."
            ::= { bgpPeerEntry 4 }

-- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification

        bgpPeerLocalAddr OBJECT-TYPE
            SYNTAX     IpAddress
            MAX-ACCESS read-only
            STATUS     current
            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     current
            DESCRIPTION
```

```
                    "The local port for the TCP connection between
                     the BGP peers."
                ::= { bgpPeerEntry 6 }


            bgpPeerRemoteAddr OBJECT-TYPE
                SYNTAX     IpAddress
                MAX-ACCESS read-only
                STATUS     current
                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     current
                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     current
                DESCRIPTION
                        "The remote autonomous system number."
                REFERENCE
                        "RFC yyyy, Section 4.2."
                ::= { bgpPeerEntry 9 }
    -- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification


            bgpPeerInUpdates OBJECT-TYPE
                SYNTAX     Counter32
                MAX-ACCESS read-only
                STATUS     current
                DESCRIPTION
                        "The number of BGP UPDATE messages
```

```
                    received on this connection."
            REFERENCE
                    "RFC yyyy, Section 4.3."
            ::= { bgpPeerEntry 10 }
-- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification


        bgpPeerOutUpdates OBJECT-TYPE
            SYNTAX     Counter32
            MAX-ACCESS read-only
            STATUS     current
            DESCRIPTION
                    "The number of BGP UPDATE messages
                     transmitted on this connection."
            REFERENCE
                    "RFC yyyy, Section 4.3."
            ::= { bgpPeerEntry 11 }
-- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification


        bgpPeerInTotalMessages OBJECT-TYPE
            SYNTAX     Counter32
            MAX-ACCESS read-only
            STATUS     current
            DESCRIPTION
                    "The total number of messages received
                     from the remote peer on this connection."
            REFERENCE
                    "RFC yyyy, Section 4."
            ::= { bgpPeerEntry 12 }
-- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification


        bgpPeerOutTotalMessages OBJECT-TYPE
            SYNTAX     Counter32
            MAX-ACCESS read-only
            STATUS     current
            DESCRIPTION
                    "The total number of messages transmitted to
                     the remote peer on this connection."
            REFERENCE
                    "RFC yyyy, Section 4."
            ::= { bgpPeerEntry 13 }
-- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification


        bgpPeerLastError OBJECT-TYPE
            SYNTAX     OCTET STRING (SIZE (2))
```

```
            MAX-ACCESS read-only
            STATUS     current
            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 yyyy, Section 4.5."
            ::= { bgpPeerEntry 14 }
-- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification


        bgpPeerFsmEstablishedTransitions 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."
            REFERENCE
                    "RFC yyyy, Section 8."
            ::= { bgpPeerEntry 15 }
-- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification


        bgpPeerFsmEstablishedTime 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 the router is
                     booted."
            REFERENCE
                    "RFC yyyy, Section 8."
            ::= { bgpPeerEntry 16 }
-- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification
```

```
        bgpPeerConnectRetryInterval OBJECT-TYPE
            SYNTAX     Integer32 (1..65535)
            UNITS      "seconds"
            MAX-ACCESS read-write
            STATUS     current
            DESCRIPTION
                    "Time interval in seconds for the
                     ConnectRetry timer.  The suggested value
                     for this timer is 120 seconds."
            REFERENCE
                    "RFC yyyy, Section 8.2.2.  This is the value used
                     to initialize the 'ConnectRetryTimer'."
            ::= { bgpPeerEntry 17 }
-- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification


        bgpPeerHoldTime OBJECT-TYPE
            SYNTAX     Integer32  ( 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 by using the smaller of the
                     value 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 yyyy, Section 4.2."
-- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification
            ::= { bgpPeerEntry 18 }


        bgpPeerKeepAlive OBJECT-TYPE
            SYNTAX     Integer32 ( 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
                     bgpPeerHoldTime, it has the same proportion
                     as what bgpPeerKeepAliveConfigured has when
                     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 yyyy, Section 4.4."
-- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification
            ::= { bgpPeerEntry 19 }


        bgpPeerHoldTimeConfigured OBJECT-TYPE
            SYNTAX     Integer32 ( 0 | 3..65535 )
            UNITS      "seconds"
            MAX-ACCESS read-write
            STATUS     current
            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) in which
                     case the Hold Time is NOT to be
                     established with the peer.  The suggested
                     value for this timer is 90 seconds."
            REFERENCE
                    "RFC yyyy, Section 4.2."
-- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification
            ::= { bgpPeerEntry 20 }
```

```
        bgpPeerKeepAliveConfigured OBJECT-TYPE
            SYNTAX     Integer32 ( 0 | 1..21845 )
            UNITS      "seconds"
            MAX-ACCESS read-write
            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 configured to be one
                     third of that of
                     bgpPeerHoldTimeConfigured.
                     If the value of this object is zero (0),
                     no periodical 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 yyyy, Section 4.4."
-- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification
            ::= { bgpPeerEntry 21 }


        bgpPeerMinASOriginationInterval OBJECT-TYPE
            SYNTAX     Integer32 (1..65535)
            UNITS      "seconds"
            MAX-ACCESS read-write
            STATUS     current
            DESCRIPTION
                    "Time interval in seconds for the
                     MinASOriginationInterval timer.
                     The suggested value for this timer is 15
                     seconds."
            REFERENCE
                    "RFC yyyy, Section 9.2.1.2."
-- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification
            ::= { bgpPeerEntry 22 }


        bgpPeerMinRouteAdvertisementInterval OBJECT-TYPE
```

```
            SYNTAX     Integer32 (1..65535)
```

```
            UNITS      "seconds"
            MAX-ACCESS read-write
            STATUS     current
            DESCRIPTION
                    "Time interval in seconds for the
                     MinRouteAdvertisementInterval timer.
                     The suggested value for this timer is 30
                     seconds."
            REFERENCE
                    "RFC yyyy, Section 9.2.1.1."
-- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification
            ::= { bgpPeerEntry 23 }


        bgpPeerInUpdateElapsedTime 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 yyyy, Section 4.3.
                     RFC yyyy, Section 8.2.2, Established state."
-- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification
            ::= { bgpPeerEntry 24 }


        bgpIdentifier OBJECT-TYPE
            SYNTAX     IpAddress
            MAX-ACCESS read-only
            STATUS     current
            DESCRIPTION
                    "The BGP Identifier of the local system."
            REFERENCE
                    "RFC yyyy, Section 4.2."
-- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification
            ::= { bgp 4 }


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

```
        -- functionality with 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 ASs 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, path
        -- attributes received from all peers running BGP-4.


        bgp4PathAttrTable OBJECT-TYPE
            SYNTAX     SEQUENCE OF Bgp4PathAttrEntry
            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."
            ::= { bgp 6 }


        bgp4PathAttrEntry OBJECT-TYPE
            SYNTAX     Bgp4PathAttrEntry
            MAX-ACCESS not-accessible
```

```
        STATUS     current
        DESCRIPTION
                "Information about a path to a network."
        INDEX { bgp4PathAttrIpAddrPrefix,
                bgp4PathAttrIpAddrPrefixLen,
                bgp4PathAttrPeer            }
        ::= { bgp4PathAttrTable 1 }


    Bgp4PathAttrEntry ::= SEQUENCE {
        bgp4PathAttrPeer
             IpAddress,
        bgp4PathAttrIpAddrPrefixLen
             Integer32,
        bgp4PathAttrIpAddrPrefix
             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     current
        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     current
            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     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
                     bgp4PathAttrIpAddrPrefixLen.
                     Any bits beyond the length specified by
                     bgp4PathAttrIpAddrPrefixLen are zeroed."
            REFERENCE
                    "RFC yyyy, Section 4.3."
-- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification
            ::= { 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     current
            DESCRIPTION
                    "The ultimate origin of the path
                     information."
            REFERENCE
```

"RFC yyyy, Section 4.3.

```
                    RFC yyyy, Section 5.1.1."
-- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification
            ::= { bgp4PathAttrEntry 4 }


        bgp4PathAttrASPathSegment OBJECT-TYPE
            SYNTAX     OCTET STRING (SIZE (2..255))
            MAX-ACCESS read-only
            STATUS     current
            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 which has two
                     possible values:
                         1      AS_SET: unordered set of ASs a
                                     route in the UPDATE message
                                     has traversed

                         2      AS_SEQUENCE: ordered set of ASs
                                     a route in the UPDATE message
                                     has traversed.

                     The length is a 1-octet field containing the
                     number of ASs 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 value 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 yyyy, Section 4.3.
                     RFC yyyy, Section 5.1.2."
-- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification
            ::= { bgp4PathAttrEntry 5 }
```

```
        bgp4PathAttrNextHop OBJECT-TYPE
            SYNTAX     IpAddress
            MAX-ACCESS read-only
            STATUS     current
            DESCRIPTION
                    "The address of the border router that
                     should be used for the destination
                     network.  This address is the nexthop
                     address received in the UPDATE packet."
            REFERENCE
                    "RFC yyyy, Section 4.3.
                     RFC yyyy, Section 5.1.3."
-- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification
            ::= { bgp4PathAttrEntry 6 }


        bgp4PathAttrMultiExitDisc OBJECT-TYPE
            SYNTAX     Integer32 (-1..2147483647)
            MAX-ACCESS read-only
            STATUS     current
            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 and thus this
                       object cannot represent the full
                       range of the protocol."
            REFERENCE
                    "RFC yyyy, Section 4.3.
                     RFC yyyy, Section 5.1.4."
-- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification
            ::= { bgp4PathAttrEntry 7 }


        bgp4PathAttrLocalPref OBJECT-TYPE
            SYNTAX     Integer32 (-1..2147483647)
            MAX-ACCESS read-only
            STATUS     current
            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 yyyy, Section 4.3.
                     RFC yyyy, Section 5.1.5."
-- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification
            ::= { bgp4PathAttrEntry 8 }


        bgp4PathAttrAtomicAggregate OBJECT-TYPE
            SYNTAX     INTEGER {
                           lessSpecificRouteNotSelected(1),
                               -- Typo corrected from RFC 1657
                           lessSpecificRouteSelected(2)
                         }
            MAX-ACCESS read-only
            STATUS     current
            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 yyyy, Sections 5.1.6 and 9.1.4."
-- RFC Ed.: Replace yyyy with latest BGP RFC
            ::= { bgp4PathAttrEntry 9 }


        bgp4PathAttrAggregatorAS OBJECT-TYPE
            SYNTAX     Integer32 (0..65535)
            MAX-ACCESS read-only
            STATUS     current
            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 yyyy, Section 5.1.7.
                     RFC yyyy, Section 9.2.2.2."
-- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification
            ::= { bgp4PathAttrEntry 10 }


        bgp4PathAttrAggregatorAddr OBJECT-TYPE
            SYNTAX     IpAddress
            MAX-ACCESS read-only
            STATUS     current
            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 yyyy, Section 5.1.7.
                     RFC yyyy, Section 9.2.2.2."
-- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification
            ::= { bgp4PathAttrEntry 11 }


        bgp4PathAttrCalcLocalPref OBJECT-TYPE
            SYNTAX     Integer32 (-1..2147483647)
            MAX-ACCESS read-only
            STATUS     current
            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 yyyy, Section 9.1.1."
-- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification
            ::= { 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     current
            DESCRIPTION
                    "An indication of whether or not this route
                     was chosen as the best BGP4 route for this
                     destination."
            REFERENCE
                    "RFC yyyy, Section 9.1.2."
-- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification
            ::= { bgp4PathAttrEntry 13 }


        bgp4PathAttrUnknown OBJECT-TYPE
            SYNTAX     OCTET STRING (SIZE(0..255))
            MAX-ACCESS read-only
            STATUS     current
            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."
            ::= { 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.
```

```
        bgpNotification OBJECT IDENTIFIER ::= { bgp 0 }


        bgpEstablishedNotification NOTIFICATION-TYPE
            OBJECTS { bgpPeerRemoteAddr,
                      bgpPeerLastError,
                      bgpPeerState      }
            STATUS  current
            DESCRIPTION
                    "The BGP Established event is generated when
                     the BGP FSM enters the ESTABLISHED state.

                     This Notification replaces the bgpEstablished
                     Notification."
            ::= { bgpNotification 1 }


        bgpBackwardTransNotification NOTIFICATION-TYPE
            OBJECTS { bgpPeerRemoteAddr,
                      bgpPeerLastError,
                      bgpPeerState      }
            STATUS  current
            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."
            ::= { 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 BGP Established 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 }


    -- Conformance information


    bgp4MIBConformance OBJECT IDENTIFIER
        ::= { bgp 8 }
    bgp4MIBCompliances OBJECT IDENTIFIER
                ::= { bgp4MIBConformance 1 }
    bgp4MIBGroups      OBJECT IDENTIFIER
        ::= { bgp4MIBConformance 2 }


    -- Compliance statements


    bgp4MIBCompliance MODULE-COMPLIANCE
        STATUS  current
        DESCRIPTION
                "The compliance statement for entities which
                 implement the BGP4 mib."
        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  deprecated
            DESCRIPTION
                    "The compliance statement documenting deprecated
                     objects in the BGP4 mib."
            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  current
            DESCRIPTION
                    "A collection of objects providing
                     information on global BGP state."
            ::= { 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  current
    DESCRIPTION
            "A collection of objects for managing
             BGP peers."
    ::= { 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,
              bgp4PathAttrIpAddrPrefixLen,
              bgp4PathAttrIpAddrPrefix,
              bgp4PathAttrOrigin,
              bgp4PathAttrASPathSegment,
```

```
                    bgp4PathAttrNextHop,
```

```
                    bgp4PathAttrMultiExitDisc,
                    bgp4PathAttrLocalPref,
                    bgp4PathAttrAtomicAggregate,
                    bgp4PathAttrAggregatorAS,
                    bgp4PathAttrAggregatorAddr,
                    bgp4PathAttrCalcLocalPref,
                    bgp4PathAttrBest,
                    bgp4PathAttrUnknown }
        STATUS  current
        DESCRIPTION
                "A collection of objects for managing
                 BGP path entries."
        ::= { 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"
        ::= { bgp4MIBGroups 5 }

    bgp4MIBNotificationGroup NOTIFICATION-GROUP
        NOTIFICATIONS { bgpEstablishedNotification,
                        bgpBackwardTransNotification }
        STATUS current
        DESCRIPTION
                "A collection of notifications for signaling
                 changes in BGP peer relationships.

                 Obsoletes bgp4MIBTrapGroup."
        ::= { bgp4MIBGroups 6 }


END
```

5. Intellectual Property

The IETF takes no position regarding the validity or scope of any intellectual property or other rights that might be claimed to pertain to the implementation or use of the technology described in this document or the extent to which any license under such rights might or might not be available; neither does it represent that it has made any effort to identify any such rights. Information on the IETF's procedures with respect to rights in standards-track and standards-related documentation can be found in BCP-11. Copies of claims of rights made available for publication and any assurances of licenses to be made available, or the result of an attempt made to obtain a general license or permission for the use of such proprietary rights by implementors or users of this specification can be obtained from the IETF Secretariat.

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6. Security Considerations

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 several management objects defined in this MIB that have a MAX-ACCESS clause of read-write and/or read-create. Such objects should be considered sensitive or vulnerable in most network environments. The support for SET operations in a non-secure environment without proper protection can have a negative effect on network operations. These objects include:

- o 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.

- o 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.

- o 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.

- o 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."

There are a number of managed objects in this MIB that contain sensitive information regarding the operation of a network. For example, a BGP peer's local and remote addresses might be sensitive for ISPs who want to keep interface addresses on routers confidential to prevent router addresses used for a denial of service attack or spoofing.

Therefore, it is important in most environments to control read access to these objects and possibly to even encrypt the values of these object when sending them over the network via SNMP.

SNMPv1 by itself is not a secure environment. Even if the network itself is secure (for example by using IPSec), there is still 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.

It is recommended that the implementers consider the security features as provided by the SNMPv3 framework.[REF] Specifically, the implementation and use of the User-based Security Model [REF] and the View-based Access Control Model [REF] is recommended to provide appropriate security controls.

It is then an operator/user responsibility to ensure that the SNMP entity giving access to an instance of this MIB, is properly configured to give access to the objects only to those principals (users) that have legitimate rights to indeed GET or SET (change/create/delete) them.

7. Acknowledgements

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8. IANA Considerations

This document presents no new IANA considerations.

9. Normative References

[BGP4] Rekhter, Y., Li, T., Hares, S., "A Border Gateway Protocol 4 (BGP-4)", RFC yyyy, zzzz 2004.

-- RFC Ed.: Replace yyyy with latest BGP RFC and zzzz with its
-- month of publication

[BGP4APP] Rekhter, Y., Gross, P., "Application of the Border Gateway Protocol in the Internet", RFC 1772, March 1995.

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[RFC2579] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M., and S. Waldbusser, "Textual Conventions for SMIv2", STD 58, RFC 2579, April 1999.

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

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