           Definitions of Managed Objects for the Fourth Version of the
                 Border Gateway Protocol (BGP-4) using SMIv2

Status of this Memo

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

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 [1, 2].

2. The SNMPv2 Network Management Framework

   The SNMPv2 Network Management Framework consists of four major
   components. They are:

      RFC 1442 which defines the SMI, the mechanisms used for describing
      and naming objects for the purpose of management.

      STD 17, RFC 1213 defines MIB-II, the core set of managed objects
      forthe Internet suite of protocols.

      RFC 1445 which defines the administrative and other architectural
      aspects of the framework.

      RFC 1448 which defines the protocol used for network access to
      managed objects.

   The Framework permits new objects to be defined for the purpose of
   experimentation and evaluation.

3. Object Definitions

   Managed objects are accessed via a virtual information store, termed
   the Management Information Base or MIB. Objects in the MIB are
   defined using the subset of Abstract Syntax Notation One (ASN.1)
   defined in the SMI. In particular, each object type is named by an
   OBJECT IDENTIFIER, an administratively assigned name. The object
   type together with an object instance serves to uniquely identify a
   specific instantiation of the object. For human convenience, we
   often use a textual string, termed the descriptor, to refer to the
   object type.

4. 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 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.

5. Definitions

BGP4-MIB DEFINITIONS ::= BEGIN

                IMPORTS
                    MODULE-IDENTITY, OBJECT-TYPE, NOTIFICATION-TYPE,
                    IpAddress, Integer32, Counter32, Gauge32
                        FROM SNMPv2-SMI
                    mib-2
                        FROM RFC1213-MIB;

                bgp MODULE-IDENTITY
                    LAST-UPDATED "9405050000Z"
                    ORGANIZATION "IETF BGP Working Group"
                    CONTACT-INFO
                                 "   John Chu (Editor)
                            Postal: IBM Corp.
                                    P.O.Box 218
                                    Yorktown Heights, NY 10598
                                    US

```
                    Tel: +1 914 945 3156
                    Fax: +1 914 945 2141
                 E-mail: jychu@watson.ibm.com"
            DESCRIPTION
                    "The MIB module for BGP-4."
        ::= { 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."
        ::= { bgp 1 }

    bgpLocalAs OBJECT-TYPE
        SYNTAX     INTEGER (0..65535)
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "The local autonomous system number."
        ::= { 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     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
                        INTEGER,
                    bgpPeerRemoteAddr
                        IpAddress,
                    bgpPeerRemotePort
                        INTEGER,
                    bgpPeerRemoteAs
                        INTEGER,
                    bgpPeerInUpdates
                        Counter32,
                    bgpPeerOutUpdates
                        Counter32,
                    bgpPeerInTotalMessages
                        Counter32,
                    bgpPeerOutTotalMessages
                        Counter32,
                    bgpPeerLastError
                        OCTET STRING,
                    bgpPeerFsmEstablishedTransitions
                        Counter32,
                    bgpPeerFsmEstablishedTime
                        Gauge32,
                    bgpPeerConnectRetryInterval
                        INTEGER,
                    bgpPeerHoldTime
                        INTEGER,
                    bgpPeerKeepAlive
```

```
                    INTEGER,
                bgpPeerHoldTimeConfigured
                    INTEGER,
                bgpPeerKeepAliveConfigured
                    INTEGER,
                bgpPeerMinASOriginationInterval
                    INTEGER,
                bgpPeerMinRouteAdvertisementInterval
                    INTEGER,
                bgpPeerInUpdateElapsedTime
                    Gauge32
                }

        bgpPeerIdentifier OBJECT-TYPE
            SYNTAX      IpAddress
            MAX-ACCESS  read-only
            STATUS      current
            DESCRIPTION
                    "The BGP Identifier of this entry's BGP
                    peer."
            ::= { bgpPeerEntry 1 }

        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."
            ::= { bgpPeerEntry 2 }

        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 Start Event to be generated.
```

                       A transition from 'start' to 'stop' will
                       cause the BGP 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."
                  ::= { bgpPeerEntry 3 }

          bgpPeerNegotiatedVersion OBJECT-TYPE
              SYNTAX   Integer32
              MAX-ACCESS read-only
              STATUS   current
              DESCRIPTION
                      "The negotiated version of BGP running
                      between the two peers."
              ::= { bgpPeerEntry 4 }

          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   INTEGER (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   INTEGER (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   INTEGER (0..65535)
             MAX-ACCESS read-only
             STATUS   current
             DESCRIPTION
                     "The remote autonomous system number."
             ::= { bgpPeerEntry 9 }

         bgpPeerInUpdates 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."
             ::= { bgpPeerEntry 10 }

         bgpPeerOutUpdates 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."
             ::= { bgpPeerEntry 11 }

         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.
                     This object should be initialized to zero

                       when the connection is established."
                 ::= { bgpPeerEntry 12 }

          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. This
                       object should be initialized to zero when
                       the connection is established."
                 ::= { bgpPeerEntry 13 }

          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."
                 ::= { bgpPeerEntry 14 }

          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."
                 ::= { bgpPeerEntry 15 }

          bgpPeerFsmEstablishedTime OBJECT-TYPE
              SYNTAX   Gauge32
              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."

```
                    ::= { bgpPeerEntry 16 }

            bgpPeerConnectRetryInterval OBJECT-TYPE
                SYNTAX     INTEGER (1..65535)
                MAX-ACCESS read-write
                STATUS     current
                DESCRIPTION
                        "Time interval in seconds for the
                        ConnectRetry timer.  The suggested value
                        for this timer is 120 seconds."
                ::= { bgpPeerEntry 17 }

            bgpPeerHoldTime OBJECT-TYPE
                SYNTAX     INTEGER  ( 0 | 3..65535 )
                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 lease three seconds
                        if it is not zero (0) in which case the
                        Hold Timer has not been established with
                        the peer, or, the value of
                        bgpPeerHoldTimeConfigured is zero (0)."
                ::= { bgpPeerEntry 18 }

            bgpPeerKeepAlive OBJECT-TYPE
                SYNTAX     INTEGER ( 0 | 1..21845 )
                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 value of this object is zero (0),
                        it indicates that the KeepAlive timer has
                        not been established with the peer, or,
                        the value of bgpPeerKeepAliveConfigured is
                        zero (0)."
```

```
                    ::= { bgpPeerEntry 19 }

            bgpPeerHoldTimeConfigured OBJECT-TYPE
                SYNTAX      INTEGER ( 0 | 3..65535 )
                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."
                ::= { bgpPeerEntry 20 }

            bgpPeerKeepAliveConfigured OBJECT-TYPE
                SYNTAX      INTEGER ( 0 | 1..21845 )
                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."
                ::= { bgpPeerEntry 21 }
```

```
                bgpPeerMinASOriginationInterval OBJECT-TYPE
                    SYNTAX     INTEGER (1..65535)
                    MAX-ACCESS read-write
                    STATUS     current
                    DESCRIPTION
                            "Time interval in seconds for the
                            MinASOriginationInterval timer.
                            The suggested value for this timer is 15
                            seconds."
                    ::= { bgpPeerEntry 22 }

                bgpPeerMinRouteAdvertisementInterval OBJECT-TYPE
                    SYNTAX     INTEGER (1..65535)
                    MAX-ACCESS read-write
                    STATUS     current
                    DESCRIPTION
                            "Time interval in seconds for the
                            MinRouteAdvertisementInterval timer.
                            The suggested value for this timer is 30
                            seconds."
                    ::= { bgpPeerEntry 23 }

                bgpPeerInUpdateElapsedTime OBJECT-TYPE
                    SYNTAX     Gauge32
                    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)."
                    ::= { bgpPeerEntry 24 }



                bgpIdentifier OBJECT-TYPE
                    SYNTAX     IpAddress
                    MAX-ACCESS read-only
                    STATUS     current
                    DESCRIPTION
                            "The BGP Identifier of local system."
                    ::= { bgp 4 }
```

```
            -- 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 deprecated.

            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."
            ::= { bgpPathAttrEntry 2 }

        bgpPathAttrOrigin OBJECT-TYPE
            SYNTAX      INTEGER {
                        igp(1),-- networks are interior
                        egp(2),-- networks learned via EGP
                        incomplete(3) -- undetermined
                    }
            MAX-ACCESS read-only
            STATUS      obsolete
            DESCRIPTION
                "The ultimate origin of the path information."
            ::= { 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;"
            ::= { 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."
            ::= { 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."
                    ::= { 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
                        INTEGER,
                    bgp4PathAttrIpAddrPrefix
                        IpAddress,
                    bgp4PathAttrOrigin
                        INTEGER,
                    bgp4PathAttrASPathSegment
```

```
                    OCTET STRING,
                bgp4PathAttrNextHop
                    IpAddress,
                bgp4PathAttrMultiExitDisc
                    INTEGER,
                bgp4PathAttrLocalPref
                    INTEGER,
                bgp4PathAttrAtomicAggregate
                    INTEGER,
                bgp4PathAttrAggregatorAS
                    INTEGER,
                bgp4PathAttrAggregatorAddr
                    IpAddress,
                bgp4PathAttrCalcLocalPref
                    INTEGER,
                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     INTEGER (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."
            ::= { bgp4PathAttrEntry 3 }

        bgp4PathAttrOrigin OBJECT-TYPE
            SYNTAX      INTEGER {
                                igp(1),-- networks are interior
                                egp(2),-- networks learned
                                        -- via EGP
                                incomplete(3) -- undetermined
                               }
            MAX-ACCESS read-only
            STATUS      current
            DESCRIPTION
                    "The ultimate origin of the path
                    information."
            ::= { 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;"
             ::= { 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."
             ::= { bgp4PathAttrEntry 6 }

     bgp4PathAttrMultiExitDisc OBJECT-TYPE
         SYNTAX      INTEGER (-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."
             ::= { bgp4PathAttrEntry 7 }

     bgp4PathAttrLocalPref OBJECT-TYPE
         SYNTAX      INTEGER (-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."
             ::= { bgp4PathAttrEntry 8 }

     bgp4PathAttrAtomicAggregate OBJECT-TYPE
         SYNTAX      INTEGER {
                         lessSpecificRrouteNotSelected(1),
                         lessSpecificRouteSelected(2)
                     }
         MAX-ACCESS read-only
         STATUS      current
         DESCRIPTION
                 "Whether or not the local system has
                 selected a less specific route without
                 selecting a more specific route."
             ::= { bgp4PathAttrEntry 9 }
```

```
        bgp4PathAttrAggregatorAS OBJECT-TYPE
            SYNTAX     INTEGER (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."
            ::= { 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."
            ::= { bgp4PathAttrEntry 11 }

        bgp4PathAttrCalcLocalPref OBJECT-TYPE
            SYNTAX     INTEGER (-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."
            ::= { 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."
            ::= { 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.  Size zero (0)
                             indicates the absence of such
                             attribute(s).  Octets beyond the maximum
                             size, if any, are not recorded by this
                             object."
                    ::= { bgp4PathAttrEntry 14 }


            -- Traps.

            bgpTraps                  OBJECT IDENTIFIER ::= { bgp 7 }

            bgpEstablished NOTIFICATION-TYPE
                OBJECTS { bgpPeerLastError,
                          bgpPeerState       }
                STATUS  current
                DESCRIPTION
                        "The BGP Established event is generated when
                        the BGP FSM enters the ESTABLISHED state."
                ::= { bgpTraps 1 }

            bgpBackwardTransition NOTIFICATION-TYPE
                OBJECTS { bgpPeerLastError,
                          bgpPeerState       }
                STATUS  current
                DESCRIPTION
                        "The BGPBackwardTransition Event is generated
                        when the BGP FSM moves from a higher numbered
                        state to a lower numbered state."
                ::= { bgpTraps 2 }

    END
```

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7. References

   [1] Rekhter, Y., and T. Li, "A Border Gateway Protocol 4 (BGP-4)",
       RFC 1654, T.J. Watson Research Center, IBM Corp., cisco Systems,
       July 1994.

   [2] Rekhter, Y., and P. Gross, Editors, "Application of the Border
       Gateway Protocol in the Internet", RFC 1655 T.J. Watson Research
       Center, IBM Corp., MCI, July 1994.

8. Security Considerations

   Security issues are not discussed in this memo.

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