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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

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8. Security Considerations

Security issues are not discussed in this memo.

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