

Network Working Group
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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 for the 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 least 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 { bgp4PathAttrIpAddressPrefix,
            bgp4PathAttrIpAddressPrefixLen,
            bgp4PathAttrPeer
          }
    ::= { bgp4PathAttrTable 1 }

Bgp4PathAttrEntry ::= SEQUENCE {
    bgp4PathAttrPeer
        IpAddress,
    bgp4PathAttrIpAddressPrefixLen
        INTEGER,
    bgp4PathAttrIpAddressPrefix
        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 {
                    lessSpecificRouteNotSelected(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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Joel Halpern, Network Systems Corporation

7. References

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8. Security Considerations

Security issues are not discussed in this memo.

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