

Network Working Group  
INTERNET DRAFT

Editors of this version:  
J. Haas  
S. Hares  
NextHop Technologies  
April 2004

**Definitions of Managed Objects  
for the Fourth Version of Border Gateway Protocol (BGP-4)**  
<[draft-ietf-idr-bgp4-mib-14.txt](#)>

Status of this Memo

This document is an Internet-Draft and is in full conformance with all provisions of [Section 10 of RFC 2026](#).

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF), its areas, and its working groups. Note that other groups may also distribute working documents as Internet-Drafts.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

The list of current Internet-Drafts can be accessed at <http://www.ietf.org/ietf/1id-abstracts>.

The list of Internet-Draft Shadow Directories can be accessed at <http://www.ietf.org/shadow.html>.

Copyright Notice

Copyright (C) The Internet Society (2004). All Rights Reserved.

Abstract

This memo is an extension to the SNMP MIB. It obsoletes [RFC 1657](#) and [RFC 1269](#).

The origin of this memo is from [RFC 1269](#) "Definitions of Managed Objects for the Border Gateway Protocol (Version 3)", which was updated to support BGP-4 in [RFC 1657](#). This memo fixes errors introduced when the MIB was converted to use the SNMPv2 SMI, as well

Expires September 2004

[Page 1]

as updates references to the current SNMP framework documents.

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

Distribution of this memo is unlimited. Please forward comments to [idr@ietf.org](mailto:idr@ietf.org).

## Table of Contents

<a href="#">1.</a>	<a href="#">Introduction .....</a>	<a href="#">3</a>
<a href="#">2.</a>	<a href="#">The Internet-Standard Management Framework .....</a>	<a href="#">3</a>
<a href="#">3.</a>	<a href="#">Overview .....</a>	<a href="#">3</a>
<a href="#">4.</a>	<a href="#">Definitions .....</a>	<a href="#">4</a>
<a href="#">5.</a>	<a href="#">Intellectual Property .....</a>	<a href="#">30</a>
<a href="#">6.</a>	<a href="#">Security Considerations .....</a>	<a href="#">31</a>
<a href="#">7.</a>	<a href="#">Acknowledgements .....</a>	<a href="#">33</a>
<a href="#">8.</a>	<a href="#">Normative References .....</a>	<a href="#">34</a>
<a href="#">9.</a>	<a href="#">Editors' Address .....</a>	<a href="#">35</a>
<a href="#">10.</a>	<a href="#">Full Copyright Statement .....</a>	<a href="#">35</a>



## **1. Introduction**

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

This memo obsoletes [RFC 1657](#) and [RFC 1269](#).

## **2. The Internet-Standard Management Framework**

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

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. MIB objects are generally accessed through the Simple Network Management Protocol (SNMP). Objects in the MIB are defined using the mechanisms defined in the Structure of Management Information (SMI). This memo specifies a MIB module that is compliant to the SMIV2, which is described in STD 58, [RFC 2578](#) [[RFC2578](#)], STD 58, [RFC 2579](#) [[RFC2579](#)] and STD 58, [RFC 2580](#) [[RFC2580](#)].

## **3. Overview**

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

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



#### [4.](#) Definitions

BGP4-MIB DEFINITIONS ::= BEGIN

IMPORTS

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

bgp MODULE-IDENTITY

LAST-UPDATED "200404220000Z"  
ORGANIZATION "IETF IDR Working Group"  
CONTACT-INFO "E-mail: [idr@ietf.org](mailto:idr@ietf.org)

Jeffrey Haas, Susan Hares (Editors)  
NextHop Technologies  
825 Victors Way  
Suite 100  
Ann Arbor, MI 48108-2738  
Tel: +1 734 222-1600  
Fax: +1 734 222-1602  
E-mail: [jhaas@nexthop.com](mailto:jhaas@nexthop.com)  
[skh@nexthop.com](mailto:skh@nexthop.com)"

DESCRIPTION

"The MIB module for the BGP-4 protocol.

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

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

REVISION "200404220000Z"

DESCRIPTION

"Changes from [RFC 1657](#):

- 1) Fixed the definitions of the traps to  
make them equivalent to their initial  
definition in [RFC 1269](#).
- 2) Added compliance and conformance info.
- 3) Updated information for the values of

Expires September 2004

[Page 4]



bgpPeerNegotiatedVersion, bgp4PathAttrLocalPref,  
 bgp4PathAttrCalcLocalPref, bgp4PathAttrMultiExitDisc,  
 bgp4PathAttrASPathSegment.

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

Published as RFC yyyy."

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

REVISION "199405050000Z"

DESCRIPTION

"Translated to SMIV2 and published as [RFC 1657](#)."

REVISION "199110261839Z"

DESCRIPTION

"Initial version, published as [RFC 1269](#)."

::= { mib-2 15 }

bgpVersion OBJECT-TYPE

SYNTAX OCTET STRING (SIZE (1..255))

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Vector of supported BGP protocol version numbers. Each peer negotiates the version from this vector. Versions are identified via the string of bits contained within this object. The first octet contains bits 0 to 7, the second octet contains bits 8 to 15, and so on, with the most significant bit referring to the lowest bit number in the

octet (e.g., the MSB of the first octet

refers to bit 0). If a bit, i, is present and set, then the version (i+1) of the BGP is supported."

::= { bgp 1 }

bgpLocalAs OBJECT-TYPE

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

bgpPeerIdentifier OBJECT-TYPE

SYNTAX        IPAddress

MAX-ACCESS read-only

Expires September 2004

[Page 7]

STATUS current  
DESCRIPTION  
    "The BGP Identifier of this entry's BGP peer.  
    This entry MUST be 0.0.0.0 unless the  
    bgpPeerState is in the openconfirm or the  
    established state."  
::= { 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 Manual Start Event to be generated.  
    A transition from 'start' to 'stop' will cause  
    the BGP Manual Stop Event to be generated.  
    This parameter can be used to restart BGP peer  
    connections. Care should be used in providing  
    write access to this object without adequate  
    authentication."  
::= { bgpPeerEntry 3 }

bgpPeerNegotiatedVersion OBJECT-TYPE  
SYNTAX Integer32

MAX-ACCESS read-only

Expires September 2004

[Page 8]



STATUS current  
DESCRIPTION  
    "The negotiated version of BGP running between  
    the two peers.  
  
    This entry MUST be zero (0) unless the  
    bgpPeerState is in the openconfirm or the  
    established state.  
  
    Note that legal values for this object are  
    between 0 and 255."  
REFERENCE  
    "RFC yyyy, [section 4.2](#)."  
 ::= { bgpPeerEntry 4 }

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

bgpPeerLocalAddr OBJECT-TYPE  
SYNTAX IPAddress  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
    "The local IP address of this entry's BGP  
    connection."  
 ::= { bgpPeerEntry 5 }

bgpPeerLocalPort OBJECT-TYPE  
SYNTAX Integer32 (0..65535)  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
    "The local port for the TCP connection between  
    the BGP peers."  
 ::= { bgpPeerEntry 6 }

bgpPeerRemoteAddr OBJECT-TYPE  
SYNTAX IPAddress  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
    "The remote IP address of this entry's BGP  
    peer."  
 ::= { bgpPeerEntry 7 }

bgpPeerRemotePort OBJECT-TYPE



SYNTAX Integer32 (0..65535)  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
    "The remote port for the TCP connection  
    between the BGP peers. Note that the  
    objects bgpPeerLocalAddr,  
    bgpPeerLocalPort, bgpPeerRemoteAddr and  
    bgpPeerRemotePort provide the appropriate  
    reference to the standard MIB TCP  
    connection table."  
 ::= { bgpPeerEntry 8 }

bgpPeerRemoteAs OBJECT-TYPE  
SYNTAX Integer32 (0..65535)  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
    "The remote autonomous system number."  
 ::= { bgpPeerEntry 9 }

bgpPeerInUpdates OBJECT-TYPE  
SYNTAX Counter32  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
    "The number of BGP UPDATE messages  
    received on this connection."  
 ::= { bgpPeerEntry 10 }

bgpPeerOutUpdates OBJECT-TYPE  
SYNTAX Counter32  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
    "The number of BGP UPDATE messages  
    transmitted on this connection."  
 ::= { 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."  
 ::= { 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."  
 ::= { 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  
        for this peer."  
 ::= { 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 Integer32 (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 Integer32 ( 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).

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

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

REFERENCE

"RFC yyyy, [Section 4.2](#)"

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

::= { bgpPeerEntry 18 }

bgpPeerKeepAlive OBJECT-TYPE

SYNTAX Integer32 ( 0 | 1..21845 )





MAX-ACCESS read-only

STATUS current

DESCRIPTION

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

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

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

REFERENCE

"RFC yyyy, [Section 4.4](#)"

-- RFC Ed.: replace yyyy with actual RFC number for the new BGP specification  
::= { bgpPeerEntry 19 }

bgpPeerHoldTimeConfigured OBJECT-TYPE

SYNTAX Integer32 ( 0 | 3..65535 )

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 Integer32 ( 0 | 1..21845 )

MAX-ACCESS read-write

Expires September 2004

[Page 13]

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 Integer32 (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 Integer32 (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

Expires September 2004

[Page 14]

```
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 }
```

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

```
bgpRcvdPathAttrTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF BgpPathAttrEntry
    MAX-ACCESS  not-accessible
    STATUS      obsolete
    DESCRIPTION
        "The BGP Received Path Attribute Table
        contains information about paths to
        destination networks received from all
        peers running BGP version 3 or less."
```

```
::= { bgp 5 }
```

```
bgpPathAttrEntry OBJECT-TYPE
    SYNTAX      BgpPathAttrEntry
    MAX-ACCESS  not-accessible
    STATUS      obsolete
    DESCRIPTION
        "Information about a path to a network."
```

```
INDEX { bgpPathAttrDestNetwork,
        bgpPathAttrPeer          }
```

```
::= { bgpRcvdPathAttrTable 1 }
```



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

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

```
bgpPathAttrDestNetwork OBJECT-TYPE  
    SYNTAX      IPAddress  
    MAX-ACCESS  read-only  
    STATUS      obsolete  
    DESCRIPTION  
        "The address of the destination network."  
    ::= { bgpPathAttrEntry 2 }
```

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

"The ultimate origin of the path information."

Expires September 2004

[Page 16]



```
::= { 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  
        Integer32,  
    bgp4PathAttrIpAddressPrefix  
        IpAddress,  
    bgp4PathAttrOrigin  
        INTEGER,  
    bgp4PathAttrASPathSegment  
        OCTET STRING,  
    bgp4PathAttrNextHop  
        IpAddress,  
    bgp4PathAttrMultiExitDisc  
        Integer32,  
    bgp4PathAttrLocalPref  
        Integer32,  
    bgp4PathAttrAtomicAggregate  
        INTEGER,  
    bgp4PathAttrAggregatorAS  
        Integer32,  
    bgp4PathAttrAggregatorAddr  
        IpAddress,  
    bgp4PathAttrCalcLocalPref

Integer32,

Expires September 2004

[Page 18]

```
    bgp4PathAttrBest
        INTEGER,
    bgp4PathAttrUnknown
        OCTET STRING
}
```

bgp4PathAttrPeer OBJECT-TYPE

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

bgp4PathAttrIpAddrPrefixLen OBJECT-TYPE

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

bgp4PathAttrIpAddrPrefix OBJECT-TYPE

```
SYNTAX      IPAddress
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "An IP address prefix in the Network Layer
    Reachability Information field. This object
    is an IP address containing the prefix with
    length specified by
    bgp4PathAttrIpAddrPrefixLen.
    Any bits beyond the length specified by
    bgp4PathAttrIpAddrPrefixLen are zeroed."
 ::= { bgp4PathAttrEntry 3 }
```

bgp4PathAttrOrigin OBJECT-TYPE

```
SYNTAX      INTEGER {
    igp(1), -- networks are interior
    egp(2), -- networks learned via the
    -- EGP protocol
}
```



```
        incomplete(3) -- networks that
                        -- are learned by some other
                        -- means
    }
    MAX-ACCESS read-only
    STATUS      current
    DESCRIPTION
        "The ultimate origin of the path
        information."
    ::= { bgp4PathAttrEntry 4 }
```

bgp4PathAttrASPathSegment OBJECT-TYPE

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

MAX-ACCESS read-only

STATUS current

DESCRIPTION

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

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

- 1 AS\_SET: unordered set of ASs a route in the UPDATE message has traversed
- 2 AS\_SEQUENCE: ordered set of ASs a route in the UPDATE message has traversed.

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

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

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

Known Issues:

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





```
::= { bgp4PathAttrEntry 5 }
```

bgp4PathAttrNextHop OBJECT-TYPE

SYNTAX       IpAddress

MAX-ACCESS   read-only

STATUS       current

DESCRIPTION

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

```
::= { bgp4PathAttrEntry 6 }
```

bgp4PathAttrMultiExitDisc OBJECT-TYPE

SYNTAX       Integer32 (-1..2147483647)

MAX-ACCESS   read-only

STATUS       current

DESCRIPTION

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

Known Issues:

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

```
::= { bgp4PathAttrEntry 7 }
```

bgp4PathAttrLocalPref OBJECT-TYPE

SYNTAX       Integer32 (-1..2147483647)

MAX-ACCESS   read-only

STATUS       current

DESCRIPTION

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

Known Issues:

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



```
::= { bgp4PathAttrEntry 8 }
```

bgp4PathAttrAtomicAggregate OBJECT-TYPE

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

MAX-ACCESS read-only

STATUS current

DESCRIPTION

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

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

Note that ATOMIC\_AGGREGATE has been deprecated  
in the BGP specification."

REFERENCE

"RFC yyyy, Sections [5.1.6](#) and [9.1.4](#)."

-- RFC Ed.: Replace yyyy with latest BGP RFC

```
::= { bgp4PathAttrEntry 9 }
```

bgp4PathAttrAggregatorAS OBJECT-TYPE

```
SYNTAX      Integer32 (0..65535)
```

MAX-ACCESS read-only

STATUS current

DESCRIPTION

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

Note that propagation of AS of zero is illegal  
in the Internet."

```
::= { 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 Integer32 (-1..2147483647)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

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

Known Issues:

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

::= { bgp4PathAttrEntry 12 }

bgp4PathAttrBest OBJECT-TYPE

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

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"An indication of whether or not this route was chosen as the best BGP4 route for this destination."

::= { bgp4PathAttrEntry 13 }

bgp4PathAttrUnknown OBJECT-TYPE

SYNTAX OCTET STRING (SIZE(0..255))

MAX-ACCESS read-only

STATUS current

DESCRIPTION

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

Path attributes are recorded in the Update Path



attribute format of type, length, value.

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

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

Known Issues:

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

::= { bgp4PathAttrEntry 14 }

-- Traps.

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

bgpNotification OBJECT IDENTIFIER ::= { bgp 0 }

bgpEstablishedNotification NOTIFICATION-TYPE

OBJECTS { bgpPeerRemoteAddr,  
          bgpPeerLastError,  
          bgpPeerState      }

STATUS current

DESCRIPTION

"The BGP Established event is generated when  
the BGP FSM enters the ESTABLISHED state.

This Notification replaces the bgpEstablished  
Notification."

::= { bgpNotification 1 }

bgpBackwardTransNotification NOTIFICATION-TYPE

OBJECTS { bgpPeerRemoteAddr,  
          bgpPeerLastError,  
          bgpPeerState      }





```
STATUS current
DESCRIPTION
    "The BGPBackwardTransNotification Event is
    generated when the BGP FSM moves from a higher
    numbered state to a lower numbered state.

    This Notification replaces the
    bgpBackwardsTransition Notification."
 ::= { bgpNotification 2 }

-- { bgp 7 } is obsoleted

bgpTraps          OBJECT IDENTIFIER ::= { bgp 7 }

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

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

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

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

-- Conformance information

bgp4MIBConformance OBJECT IDENTIFIER
```



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

-- Compliance statements

bgp4MIBCompliance MODULE-COMPLIANCE
    STATUS current
    DESCRIPTION
        "The compliance statement for entities which
        implement the BGP4 mib."
    MODULE -- this module
        MANDATORY-GROUPS { bgp4MIBGlobalsGroup,
                            bgp4MIBPeerGroup,
                            bgp4MIBPathAttrGroup }
        GROUP bgp4MIBNotificationGroup
    DESCRIPTION
        "Implementation of BGP Notifications are
        completely optional in this MIB."
    ::= { bgp4MIBCompliances 1 }

bgp4MIBDeprecatedCompliances MODULE-COMPLIANCE
    STATUS deprecated
    DESCRIPTION
        "The compliance statement documenting deprecated
        objects in the BGP4 mib."
    MODULE -- this module
        GROUP bgp4MIBTrapGroup
    DESCRIPTION
        "Group containing TRAP objects that were
        improperly converted from SMIV1 in RFC 1657.
        The proper semantics have been restored
        with the objects in bgp4MIBNotificationGroup."
    ::= { bgp4MIBCompliances 2 }

bgp4MIBObsoleteCompliances MODULE-COMPLIANCE
    STATUS obsolete
    DESCRIPTION
        "The compliance statement documenting obsolete
        objects in the BGP4 mib."
    MODULE -- this module
        GROUP bgpRcvdPathAttrGroup
```



## DESCRIPTION

"Group containing objects relevant to BGP-3  
and earlier objects."

::= { bgp4MIBCompliances 3 }

-- Units of conformance

## bgp4MIBGlobalsGroup OBJECT-GROUP

OBJECTS { bgpVersion,  
          bgpLocalAs,  
          bgpIdentifier }

STATUS current

## DESCRIPTION

"A collection of objects providing  
information on global BGP state."

::= { bgp4MIBGroups 1 }

## bgp4MIBPeerGroup OBJECT-GROUP

OBJECTS { bgpPeerIdentifier,  
          bgpPeerState,  
          bgpPeerAdminStatus,  
          bgpPeerNegotiatedVersion,  
          bgpPeerLocalAddr,  
          bgpPeerLocalPort,  
          bgpPeerRemoteAddr,  
          bgpPeerRemotePort,  
          bgpPeerRemoteAs,  
          bgpPeerInUpdates,  
          bgpPeerOutUpdates,  
          bgpPeerInTotalMessages,  
          bgpPeerOutTotalMessages,  
          bgpPeerLastError,  
          bgpPeerFsmEstablishedTransitions,  
          bgpPeerFsmEstablishedTime,  
          bgpPeerConnectRetryInterval,  
          bgpPeerHoldTime,  
          bgpPeerKeepAlive,  
          bgpPeerHoldTimeConfigured,  
          bgpPeerKeepAliveConfigured,  
          bgpPeerMinASOriginationInterval,  
          bgpPeerMinRouteAdvertisementInterval,  
          bgpPeerInUpdateElapsedTime }

STATUS current

## DESCRIPTION

"A collection of objects for managing

BGP peers."

Expires September 2004

[Page 27]

::= { bgp4MIBGroups 2 }

bgpRcvdPathAttrGroup OBJECT-GROUP

OBJECTS { bgpPathAttrPeer,  
          bgpPathAttrDestNetwork,  
          bgpPathAttrOrigin,  
          bgpPathAttrASPath,  
          bgpPathAttrNextHop,  
          bgpPathAttrInterASMetric }

STATUS obsolete

DESCRIPTION

"A collection of objects for managing BGP-3 and  
earlier path entries.

This conformance group, like BGP-3, is obsolete."

::= { bgp4MIBGroups 3 }

bgp4MIBPathAttrGroup OBJECT-GROUP

OBJECTS { bgp4PathAttrPeer,  
          bgp4PathAttrIpAddrPrefixLen,  
          bgp4PathAttrIpAddrPrefix,  
          bgp4PathAttrOrigin,  
          bgp4PathAttrASPathSegment,  
          bgp4PathAttrNextHop,  
          bgp4PathAttrMultiExitDisc,  
          bgp4PathAttrLocalPref,  
          bgp4PathAttrAtomicAggregate,  
          bgp4PathAttrAggregatorAS,  
          bgp4PathAttrAggregatorAddr,  
          bgp4PathAttrCalcLocalPref,  
          bgp4PathAttrBest,  
          bgp4PathAttrUnknown }

STATUS current

DESCRIPTION

"A collection of objects for managing  
BGP path entries."

::= { bgp4MIBGroups 4 }

bgp4MIBTrapGroup NOTIFICATION-GROUP

NOTIFICATIONS { bgpEstablished,  
                  bgpBackwardTransition }

STATUS deprecated

DESCRIPTION

"A collection of notifications for signaling  
changes in BGP peer relationships.





```
        Obsoleted by bgp4MIBNotificationGroup"
 ::= { bgp4MIBGroups 5 }

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

     Obsoletes bgp4MIBTrapGroup."
 ::= { bgp4MIBGroups 6 }
```

END



## **5. Intellectual Property**

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

The IETF invites any interested party to bring to its attention any copyrights, patents or patent applications, or other proprietary rights which may cover technology that may be required to practice this standard. Please address the information to the IETF Executive Director.



## 6. Security Considerations

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

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

+o bgpPeerAdminStatus

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

+o bgpPeerConnectRetryInterval

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

+o bgpPeerHoldTimeConfigured, bgpPeerKeepAliveConfigured

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

+o bgpPeerMinASOriginationInterval,  
bgpPeerMinRouteAdvertisementInterval

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

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



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

SNMPv1 by itself is not a secure environment. Even if the network itself is secure (for example by using IPSec), there is still no control as to who on the secure network is allowed to access and GET/SET (read/change/create/delete) the objects in this MIB.

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

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





## 7. Acknowledgements

We would like to acknowledge the assistance of all the members of the Inter-Domain Routing Working Group, and particularly the following individuals:

Yakov Rekhter, Juniper Networks  
Rob Coltun, Redback  
Guy Almes, Internet2  
Jeff Honig, BSDi  
Marshall T. Rose, Dover Beach Consulting, Inc.  
Dennis Ferguson, Juniper Networks  
Matt Mathis, PSC  
John Krawczyk, Bay Networks  
Curtis Villamizar, Avici  
Dave LeRoy, Pencom Systems  
Paul Traina, Juniper Networks  
Andrew Partan, MFN  
Robert Snyder, Cisco Systems  
Dimitry Haskin, Nortel  
Peder Chr Norgaard, Telebit Communications A/S  
Joel Halpern, CTO Longitude Systems, Inc.  
Nick Thille, RedBack Networks  
Bert Wijnen, Lucent  
Shane Wright, NextHop Technologies  
Mike McFadden, Riverstone Networks, Inc.  
Jon Saperia, JDS Consulting, Inc.  
Wayne Tackabury, Gold Wire Technology, Inc.  
Bill Fenner, AT&T Research  
RJ Atkinson, Extreme Networks

The origin of this document is from [RFC 1269](#) "Definitions of Managed Objects for the Border Gateway Protocol (Version 3)" written by Steve Willis and John Burruss, which was updated by John Chu to support BGP-4 in [RFC 1657](#). The editors wish to acknowledge the fine work of these original authors.



## **8. Normative References**

- [BGP4]        Rekhter, Y., Li, T., Hares, S., "A Border Gateway Protocol 4 (BGP-4)", RFC yyyy, zzzz 2003.
- RFC Ed.: Replace yyyy with latest BGP RFC and zzzz with its  
-- month of publication
- [BGP4APP]    Rekhter, Y., Gross, P., "Application of the Border Gateway Protocol in the Internet", [RFC 1772](#), March 1995.
- [RFC2578]    McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M., and S. Waldbusser, "Structure of Management Information Version 2 (SMIv2)", STD 58, [RFC 2578](#), April 1999.
- [RFC2579]    McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M., and S. Waldbusser, "Textual Conventions for SMIv2", STD 58, [RFC 2579](#), April 1999.
- [RFC2580]    McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M., and S. Waldbusser, "Conformance Statements for SMIv2", STD 58, [RFC 2580](#), April 1999.



## **9. Editors' Address**

Jeffrey Haas, Susan Hares  
NextHop Technologies  
825 Victor's Way, Suite 100  
Ann Arbor, MI 48103  
Phone: +1 734 222-1600  
Fax: +1 734 222-1602  
Email: jhaas@nexthop.com  
skh@nexthop.com

## **10. Full Copyright Statement**

Copyright (C) The Internet Society (2004). All Rights Reserved.

This document and translations of it may be copied and furnished to others, and derivative works that comment on or otherwise explain it or assist in its implementation may be prepared, copied, published and distributed, in whole or in part, without restriction of any kind, provided that the above copyright notice and this paragraph are included on all such copies and derivative works. However, this document itself may not be modified in any way, such as by removing the copyright notice or references to the Internet Society or other Internet organizations, except as needed for the purpose of developing Internet standards in which case the procedures for copyrights defined in the Internet Standards process must be followed, or as required to translate it into languages other than English.

The limited permissions granted above are perpetual and will not be revoked by the Internet Society or its successors or assigns.

This document and the information contained herein is provided on an "AS IS" basis and THE INTERNET SOCIETY AND THE INTERNET ENGINEERING TASK FORCE DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY THAT THE USE OF THE INFORMATION HEREIN WILL NOT INFRINGE ANY RIGHTS OR ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

