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

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols. In particular it defines objects for managing the Border Gateway Protocol’s Community extension.
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1. Introduction

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols. In particular, it defines objects for managing the Border Gateway Protocol's Community extension. [RFC1997].

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. Conventions

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

4. Overview

The BGP-4 MIB, Version 2, provides for an extension mechanism by which BGP extensions can have MIBs created under the BGP-4 MIB subtree. This MIB documents the objects for managing the BGP-4 Community extension as documented in [RFC1997].

5. Structure of the MIB Module

5.1. Global Scalars

- bgpCommunityTotal - The total number of community sets managed by this system.

5.2. Tables

- bgpCommunityAfPathAttrTable - This table provides access to a human-readable version of the community associated with BGP reachability and also an index into the bgpCommunityElementTable which can be used for a canonical version of that set of
communities.

- bgpCommunityElementTable - This table provides canonical access to a set of community values.
- bgpCommunitySetTable - This table provides additional information about a set of communities.

5.3. Textual Conventions

- BgpCommunityTC - The representation of a BGP Community.

6. Relationship to Other MIB Modules

6.1. Relationship to the BGP-4 MIB, Second Version

The BGP-4 MIB provides the bgpExtensions point which is used in the root OID for this module.

Additionally, as BGP communities are properties of the Path Attributes set sent for reachability, the base BGP-4 MIB provides the index for this table, bgpAfPathAttrIndex.

Note well that bgpAfPathAttrIndex is meant to be distinct for each received set of Path Attributes.

6.2. MIB modules required for IMPORTS

The following MIB module IMPORTS objects from SNMPv2-SMI [RFC2578], SNMPv2-TC [RFC2579], SNMPv2-CONF [RFC2580] and the BGP-4 MIB, Version 2.

7. Definitions

BGP4-COMMUNITY-MIB DEFINITIONS ::= BEGIN

IMPORTS
   MODULE-IDENTITY, OBJECT-TYPE, Gauge32, Unsigned32
   FROM SNMPv2-SMI
   TEXTUAL-CONVENTION
   FROM SNMPv2-TC
   MODULE-COMPLIANCE, OBJECT-GROUP
   FROM SNMPv2-CONF
SnmpAdminString
   FROM SNMP-FRAMEWORK-MIB
   bgpExtensions, bgpAfPathAttrIndex
   FROM BGP4-MIB;
This MIB module defines additional management objects
Specifically, it adds objects for the management of the
BGP Community PATH_ATTRIBUTE as documented in RFC 1997.

::= { bgpExtensions 1 }

--
-- Textual Conventions
--

BgpCommunityTC ::= TEXTUAL-CONVENTION
  DISPLAY-HINT "2d:"
  STATUS current
  DESCRIPTION
    "The representation of a BGP Community."
  SYNTAX OCTET STRING(SIZE(4))

--
-- BGP Community Scalars
--

bgpCommunityTotal OBJECT-TYPE
  SYNTAX Unsigned32
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION
    "The total number of community sets managed by
    this system."
  ::= { bgpCommunity 1 }

--
-- BGP Communities per-NLRI entry.
--

bgpCommunityAfPathAttrTable OBJECT-TYPE
  SYNTAX SEQUENCE OF BgpCommunityAfPathAttrEntry
  MAX-ACCESS not-accessible
  STATUS current
  DESCRIPTION
    "The BGP-4 Path Attribute Community Table contains the
    per network path (NLRI) data on the community membership
    advertised with a route. The absence of row data for a
given index value for bgpCommunityPathAttrIndex
indicates a lack of this attribute information for the
indicated network path."
::= { bgpCommunity 2 }

bgpCommunityAfPathAttrEntry OBJECT-TYPE
SYNTAX BgpCommunityAfPathAttrEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Information about a community association
provided with a path to a network."
INDEX { bgpAfPathAttrIndex
}
::= { bgpCommunityAfPathAttrTable 1 }

BgpCommunityAfPathAttrEntry ::= SEQUENCE {
  bgpCommunityString
    SnmpAdminString,
  bgpCommunityIndex
    Unsigned32
}

bgpCommunityString OBJECT-TYPE
SYNTAX SnmpAdminString
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This is a string depicting the set of communities
associated with a given NLRI. The format of this
string is implementation-dependent and should be
designed for operator readability.

Note that SnmpAdminString is only capable of
representing a maximum of 255 characters. This may
lead to the string being truncated in the presence of a
large community set. The bgpCommunityTable will give
access to the full community set.

It is RECOMMENDED that for rows sharing the same value
in bgpCommunityTableIndex that the bgpCommunityString
also be identical."
::= { bgpCommunityAfPathAttrEntry 1 }

bgpCommunityIndex OBJECT-TYPE
SYNTAX Unsigned32
MAX-ACCESS read-only
This value is an index for the sub-components of a community set in the bgpCommunityElementTable. It is assigned by the agent at the point of creation of the bgpCommunityElementTable row entry. While its value is guaranteed to be unique at any time, it is otherwise opaque to the management application with respect to its value or the contiguity of the bgpCommunityTableIndex row instance values across rows of the bgpCommunityTable.

Additionally, this value, which represents a distinct set of communities, is used as an index in the bgpCommunitySetTable.

It is particularly important to note that there may be a many-to-one relationship between this object for a given set of indices to a particular bgpCommunityTableIndex. This is because many NLRI may share the same community set.

::= { bgpCommunityAfPathAttrEntry 2 }

-- Table of a Community Set’s Components
--

bgpCommunityElementTable OBJECT-TYPE
SYNTAX SEQUENCE OF BgpCommunityElementEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"The bgpCommunityElementTable allows individual sub-components of a community set to be examined in a canonical fashion."
::= { bgpCommunity 3 }

bgpCommunityElementEntry OBJECT-TYPE
SYNTAX BgpCommunityElementEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Information about sub-components for a set of communities."
INDEX {
  bgpCommunityIndex,
  bgpCommunityElementIndex
}
::= { bgpCommunityElementTable 1 }

BgpCommunityElementEntry ::= SEQUENCE {
  bgpCommunityElementIndex
    Unsigned32,
  bgpCommunityElementValue
    BgpCommunityTC,
  bgpCommunityElementWellKnown
    INTEGER
}

bgpCommunityElementIndex OBJECT-TYPE
SYNTAX Unsigned32
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
  "An integer index for a row in this table."
::= { bgpCommunityElementEntry 1 }

bgpCommunityElementValue OBJECT-TYPE
SYNTAX BgpCommunityTC
MAX-ACCESS read-only
STATUS current
DESCRIPTION
  "A value representing a community. There are certain
   4-octet long values which could be returned in this
   columnar row data that carry additional semantics."
REFERENCE
  "RFC 1997 - BGP Community Attribute"
::= { bgpCommunityElementEntry 2 }

bgpCommunityElementWellKnown OBJECT-TYPE
SYNTAX INTEGER {
  notWellKnown(1),
  noExport(2),
  noAdvertise(3),
  noExportSubconfed(4),
  noPeer(5)
}
MAX-ACCESS read-only
STATUS current
DESCRIPTION
  "In the case that a given community is a ‘well-known’
   community, this object is set to the appropriate
   value."
REFERENCE
  "RFC 1997, ‘Well-Known Communities’.
   RFC 3765, NOPEER Community for Border Gateway Protocol."
::= { bgpCommunityElementEntry 3 }

--

-- Table of a Community Set’s common properties.
--

bgpCommunitySetTable OBJECT-TYPE
SYNTAX SEQUENCE OF BgpCommunitySetEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"This table tracks properties that a given set of communities, as identified by a bgpCommunityIndex, may share."
::= { bgpCommunity 4 }

bgpCommunitySetEntry OBJECT-TYPE
SYNTAX BgpCommunitySetEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Properties shared by a given set of communities."
INDEX { bgpCommunityIndex }
::= { bgpCommunitySetTable 1 }

BgpCommunitySetEntry ::= SEQUENCE {
  bgpCommunitySetReferences Gauge32
}

bgpCommunitySetReferences OBJECT-TYPE
SYNTAX Gauge32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Some implementation may track the number of times that a distinct community set is referenced. One example of this is a set of NLRI that share the same set of communities.

The implementation of this object is completely OPTIONAL."
::= { bgpCommunitySetEntry 1 }

--
-- Conformance Information

bgpCommunityConformance
   OBJECT IDENTIFIER ::= { bgpCommunity 5 }

bgpCommunityMIBCompliances OBJECT IDENTIFIER ::= 
   { bgpCommunityConformance 1 }

bgpCommunityMIBGroups OBJECT IDENTIFIER ::= 
   { bgpCommunityConformance 2 }

bgpCommunityMIBCompliance MODULE-COMPLIANCE
   STATUS current
   DESCRIPTION
      "The compliance statement for entities which implement the BGP4 mib."
   MODULE -- this module
   MANDATORY-GROUPS {
      bgpCommunityRequiredGroup
   }
   GROUP bgpCommunityRequiredGroup
   DESCRIPTION
      "All members of this GROUP MUST be implemented to support this MIB."
   GROUP bgpCommunityOptionalGroup
   DESCRIPTION
      "Members of this GROUP MAY be implemented. Individual objects with implementation dependencies will be documented in the DESCRIPTION clauses for those objects."
   ::= { bgpCommunityMIBCompliances 1 }

bgpCommunityRequiredGroup OBJECT-GROUP
   OBJECTS {
      bgpCommunityTotal,
      bgpCommunityString,
      bgpCommunityIndex,
      bgpCommunityElementValue,
      bgpCommunityElementWellKnown
   }
   STATUS current
   DESCRIPTION
      "Objects associated with BGP communities that are
required to be implemented in this MIB."
::= { bgpCommunityMIBGroups 1 }

bgpCommunityOptionalGroup OBJECT-GROUP

OBJECTS {
    bgpCommunitySetReferences
}

STATUS current

DESCRIPTION
"Objects associated with BGP communities that may
optionally be implemented in this MIB."
::= { bgpCommunityMIBGroups 2 }

END

8. Security Considerations

Some of the readable objects in this MIB module (i.e., objects with a
MAX-ACCESS other than not-accessible) may be considered sensitive or
vulnerable in some network environments. It is thus important to
control even GET and/or NOTIFY access to these objects and possibly
to even encrypt the values of these objects when sending them over
the network via SNMP. These are the tables and objects and their
sensitivity/vulnerability:

- bgpCommunityElementValue, bgpCommunityElementWellKnown - BGP
  Communities may be used to implement routing policy for ISPs and
  that routing policy may reflect business relationships. Inadvertent
disclosure of this information inadvertently expose
  sensitive information about those business relationships.

SNMP versions prior to SNMPv3 did not include adequate security.
Even if the network itself is secure (for example by using IPSec),
even then, there is 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 module.

It is RECOMMENDED that implementers consider the security features as
provided by the SNMPv3 framework (see [RFC3410], section 8),
including full support for the SNMPv3 cryptographic mechanisms (for
authentication and privacy).

Further, deployment of SNMP versions prior to SNMPv3 is NOT
RECOMMENDED. Instead, it is RECOMMENDED to deploy SNMPv3 and to
enable cryptographic security. It is then a customer/operator
responsibility to ensure that the SNMP entity giving access to an
instance of this MIB module 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.
9.  IANA Considerations

   This memo includes no request to IANA.

10. Acknowledgements

   The BGP-4 MIB extension mechanism owes thanks to Wayne Tackabury and
   the OPS Working Group MIB Doctors. An earlier form of this extension
   mechanism was originally attempted with Mathew Richardson and Shane
   Wright, formerly of NextHop Technologies.

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11.1.  Normative References

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