Internet-Draft
draft-ietf-ipcdn-cable-gateway-qos-mib-00.txt
Expires: December 2003

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June 2003

Cable Gateway Quality of Service (QoS) Management Information Base for CableHome compliant Residential Gateways

Status of this Memo

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Abstract

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in the Internet community.

In particular, it defines a basic set of managed objects for SNMP-based management for prioritized Quality of Service functionality within a LAN, between a CableHome residential gateway device and CableHome compliant LAN host devices.

This memo specifies a MIB module in a manner that is compliant to the SNMP SMIv2 [5][6][7]. The set of objects is consistent with the SNMP framework and existing SNMP standards.

Conventions used in this document

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 [2].

Table of Contents

1. 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 [12].

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 [7], STD 58, RFC 2579 [8] and STD 58, RFC 2580 [9].

2. Glossary

The terms in this document are derived either from normal cable system usage, from normal residential gateway operation, or from the documents associated with the CableHome Specifications [21] & [22].

2.1 CATV

Originally "Community Antenna Television", now used to refer to any cable or hybrid fiber and cable system used to deliver video signals to a community.

2.2 CableHome Residential Gateway

A CableHome Residential gateway passes data traffic between the cable operator's broadband data network (the Wide Area Network, WAN) and the Local Area Network (LAN) in the cable data service subscriber's residence or business. In addition to passing traffic between the WAN and LAN, the CableHome Residential Gateway provides several services including a DHCP client and a DHCP server (RFC2131) [23], a TFTP server (RFC1350) [24], management services as enabled by SNMPv1/v2c/v3 agent compliant with the RFCs listed in Section 1, and security services including stateful packet inspection firewall functionality and software code image verification using techniques.

2.3 Portal Services

A logical element aggregating the set of CableHome-specified functionality in a CableHome compliant cable gateway device.

2.4 Boundary Point (BP)

A logical element aggregating the set of CableHome-specified functionality in a CableHome compliant LAN host device (LAN IP Device).

2.5 Application Identifiers

The port number assigned by the Internet Assigned Numbers Authority (IANA) to an application, used by CableHome-specified elements to identify an application.

3. Overview

This MIB entity supports basic traffic prioritization and queuing for CableHome compliant devices. The MIB is derived from the CableHome 1.1 specification [22]. Support for traffic prioritization and queuing is provided through four tables. These tables and their use is summarized below and described in detail in the CableHome 1.1 specification [22].

Applications running on CableHome compliant devices are identified with their IANA-assigned UDP/TCP port number. Service providers have the ability to configure the priority for any application by associating a priority number with the port number in a table implemented in the cable gateway device (Application Priority Master Table). When CableHome compliant LAN host devices acquire a network address lease, they communicate to the cable gateway device the list of applications implemented on the LAN host. This information is recorded in two other tables in the cable gateway device (BP Application Priority Table and Destination Priority Table). Portal Services functions refer to the Application Priority Master Table and reply to the LAN host device(s) with the priority assigned to their applications.

The cable gateway device maintains a queue for each LAN interface, and each interface supports a particular number of priority levels. A fourth table, the PS Interface Attributes Table, maintains this information.

3.1 Structure of the MIB

This MIB entity contains one group:

The cabhPriorityQosGroup group contains the mechanisms needed for CableHome compliant cable gateway devices and LAN hosts to identify and communicate applications needing prioritized queuing and media access. The cabhPriortyQosGroup contains the following tables:

cabhPriorityQosMasterTable
Allows the service provider to provision the residential gateway with a list of supported applications and a priority value for each. The Portal Services refers to this table when acting as a proxy for the service provider, to provide application priorities to Boundary Point elements.

cabhPriorityQosBpTable
Contains the list of application identifiers for each BP element in the LAN. These values are acquired by the PS during the BP Discovery process as described in [22].

cabhPriorityQosBpDestTable
Contains a list of destination IP addresses for each BP, each of which can be provisioned for a special priority for a specified application. Applications are identified by their IANA-assigned port number.

cabhPriorityQosPsIfAttribTable
Identifies the number of queues and the number of media access priorities for each LAN interface. LAN interfaces are identified by their ifIndex.

3.2 Management Requirements

In addition to the explicit requirements in this specification, the Cable Gateway MUST support all applicable CableHome and IETF requirements and MIB objects.

4. MIB Definitions

```
CABH-IETF-QOS-MIB DEFINITIONS ::= BEGIN

IMPORTS
   MODULE-IDENTITY,
   OBJECT-TYPE,
   Unsigned32,
   mib-2
                          FROM SNMPv2-SMI

   TimeStamp,
   TruthValue,
   RowStatus              FROM SNMPv2-TC

   OBJECT-GROUP,
   MODULE-COMPLIANCE      FROM SNMPv2-CONF

   InetPortNumber,
   InetAddressType,
   InetAddress            FROM INET-ADDRESS-MIB

   ifIndex                FROM IF-MIB;
```

```
   cabhQosMib MODULE-IDENTITY
       LAST-UPDATED    "200306210000Z" -- Jun 21, 2003
       ORGANIZATION    "IETF IPCDN Working Group"
       CONTACT-INFO
               "Kevin Luehrs
               Postal: Cable Television Laboratories, Inc.
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               U.S.A.
               Phone:  +1 303-661-9100
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               IETF IPCDN Working Group
               General Discussion: ipcdn@ietf.org
               Subscribe: http://www.ietf.org/mailman/listinfo/ipcdn
               Archive: ftp://ftp.ietf.org/ietf-mail-archive/ipcdn
               Co-chairs: Richard Woundy,
                          Richard_Woundy@cable.comcast.com
                          Jean-Francois Mule, jf.mule@cablelabs.com"

       DESCRIPTION
               "This MIB module supplies parameters for the
               configuration and monitoring of CableHome
               prioritized QoS capability.

               Copyright (C) The Internet Society (2003). This version
               of this MIB module is part of RFC xxxx; see the RFC
               itself for full legal notices."
       REVISION         "200306210000Z" -- Jun 21, 2003
       DESCRIPTION
               "Initial version, published as RFC xxxx."
                -- RFC editor to assign xxxx
       ::= { mib-2 xx }
     -- xx to be assigned by IANA

   -- Textual conventions

   cabhQosMibObjects         OBJECT IDENTIFIER ::= { cabhQosMib 1}
   cabhPriorityQosMibObjects OBJECT IDENTIFIER ::=
                                       { cabhQosMibObjects 1 }
   cabhPriorityQosBase       OBJECT IDENTIFIER ::=
                                       { cabhPriorityQosMibObjects 1 }
   cabhPriorityQosBp         OBJECT IDENTIFIER ::=
                                       { cabhPriorityQosMibObjects 2 }
   cabhPriorityQosPs         OBJECT IDENTIFIER ::=
                                       { cabhPriorityQosMibObjects 3 }

      -- future parametric QOS
```

```
      -- cabhParamQosMibObjects  OBJECT IDENTIFIER ::=
```

```
      --                                        { cabhQosMibObjects 2 }

      --================================================================
      --
      --  Application Priority Master Table
      --
      --  The cabhPriorityQosMasterTable contains the list of
      --  application priorities provisioned by the cable operator.
      --  Applications are identified by the IANA "well-known" port
      --  numbers  assigned to them.
      --
      --================================================================
   cabhPriorityQosMasterTable  OBJECT-TYPE
       SYNTAX SEQUENCE OF CabhPriorityQosMasterEntry
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION
               "This table contains a list of mappings for Application
               IDs to Default CableHome Priorities."
        ::= { cabhPriorityQosBase 1  }

   cabhPriorityQosMasterEntry OBJECT-TYPE
       SYNTAX CabhPriorityQosMasterEntry
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION
               "An entry for mapping Application IDs to Default
               CableHome Priorities."
       INDEX { cabhPriorityQosMasterApplicationId }
       ::= { cabhPriorityQosMasterTable 1 }


   CabhPriorityQosMasterEntry ::= SEQUENCE {
       cabhPriorityQosMasterApplicationId       Unsigned32,
       cabhPriorityQosMasterDefaultCHPriority   Unsigned32,
       cabhPriorityQosMasterRowStatus           RowStatus
       }

   cabhPriorityQosMasterApplicationId       OBJECT-TYPE
       SYNTAX                  Unsigned32 (1..65535)
       MAX-ACCESS              not-accessible
       STATUS                  current
       DESCRIPTION
               "The IANA well-known port number identifying an
               application."
       ::= { cabhPriorityQosMasterEntry 1 }


   cabhPriorityQosMasterDefaultCHPriority       OBJECT-TYPE
```

SYNTAX Unsigned32 (0..7)

```
        MAX-ACCESS              read-create
        STATUS                  current
        DESCRIPTION
                "The PriorityQos priority assigned to the application."
        ::= { cabhPriorityQosMasterEntry 2 }

    cabhPriorityQosMasterRowStatus  OBJECT-TYPE
        SYNTAX                  RowStatus
        MAX-ACCESS              read-create
        STATUS                  current
        DESCRIPTION
                "The Row Status interlock for creation and deletion of
                row entries. Specifying only this object (with the
                appropriate index) on a PS is sufficient to create a row
                with default values. There is no restrictions to change
                the value of cabhPriorityQosMasterDefaultCHPriority in a
                row while this object is set to active."
        ::= { cabhPriorityQosMasterEntry 3 }



    -- ================================================================
    --
    --  SetToFactory Object
    --
    -- This object is used to clear some of the QoS MIB tables
    --
    -- ================================================================

    cabhPriorityQosSetToFactory OBJECT-TYPE
        SYNTAX TruthValue
        MAX-ACCESS read-write
        STATUS current
        DESCRIPTION
                "When this object is set to true(1), the PS MUST  clear
                all the entries in the cabhPriorityQosBpTable and
                cabhPriorityQosBpDestTable. Reading this object always
                returns false(2)."
        ::= { cabhPriorityQosBase 2 }

    cabhPriorityQosLastSetToFactory OBJECT-TYPE
        SYNTAX TimeStamp
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION
                "The value of sysUpTime when cabhPriorityQosSetToFactory
                was last set to true. Zero if never reset."
        ::= { cabhPriorityQosBase 3 }
```

```
    --================================================================
    --
    --  BP Application Priority Table
    --
    --  The cabhPriorityQosBpTable contains the list of
    --  BPs, the applications implemented on each, and the priority
    --  assigned to each application.
    --
    --================================================================

   cabhPriorityQosBpTable OBJECT-TYPE
       SYNTAX SEQUENCE OF CabhPriorityQosBpEntry
       MAX-ACCESS not-accessible
       STATUS current
       DESCRIPTION
               "This table contains the priorities for each of the
               discovered CableHome Host (BP) applications and related
               data."
            ::= {cabhPriorityQosBp 1}

   cabhPriorityQosBpEntry OBJECT-TYPE
       SYNTAX      CabhPriorityQosBpEntry
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION
               "List of applications entries.

               Implementors need to be aware that if the size
               of cabhPriorityQosBpIpAddr exceeds 113 octets then OIDs
               of column instances in this table will have more
               than 128 sub-identifiers and cannot be accessed
               using SNMPv1, SNMPv2c, or SNMPv3."
       INDEX { cabhPriorityQosMasterApplicationId,
               cabhPriorityQosBpIpAddrType, cabhPriorityQosBpIpAddr }
       ::= { cabhPriorityQosBpTable 1 }

   CabhPriorityQosBpEntry ::= SEQUENCE {
       cabhPriorityQosBpIpAddrType         InetAddressType,
       cabhPriorityQosBpIpAddr             InetAddress,
       cabhPriorityQosBpApplicationId      Unsigned32,
       cabhPriorityQosBpDefaultCHPriority  Unsigned32,
       cabhPriorityQosBpIndex              Unsigned32
       }

   cabhPriorityQosBpIpAddrType   OBJECT-TYPE
       SYNTAX      InetAddressType
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION
```

"The type of the IP address assigned to a particular BP

```
                element."
        ::= { cabhPriorityQosBpEntry 1 }


    cabhPriorityQosBpIpAddr    OBJECT-TYPE
        SYNTAX      InetAddress
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The IP address assigned to a particular BP element."
        ::= { cabhPriorityQosBpEntry 2 }

    cabhPriorityQosBpApplicationId   OBJECT-TYPE
        SYNTAX      Unsigned32 (1..65535)
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The IANA well-known port number assigned to a particular
                application implemented on the CableHome Host device in
                which this BP resides."
          ::= { cabhPriorityQosBpEntry 3 }


    cabhPriorityQosBpDefaultCHPriority  OBJECT-TYPE
        SYNTAX      Unsigned32 (0..7)
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The PriorityQos priority assigned to a particular
                application implemented on CableHome Host device in which
                this BP resides. The PS populates this entry according to
                the Application Priority Master Table."
          ::= { cabhPriorityQosBpEntry 4 }

    cabhPriorityQosBpIndex  OBJECT-TYPE
        SYNTAX      Unsigned32 (1..65535)
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The unique identifier for a particular row in the BP
                Application Priority Table. This identifier is used as
                an index into the 'nested' Destination Priority Table."
        ::= { cabhPriorityQosBpEntry 5 }


       --================================================================
       --
       --  Destination Priority Table
       --
```

```
      --  The cabhPriorityQosDestListTable contains the list of
```

```
      --  provisioned destinations (IP address and port number) to
      --  which a BP can send traffic with a special PriorityQos
      --  priority. Any application listed in the BP Application
      --  Priority Table can be provisioned with a Destination
      --  Priority Table.
      --
      --================================================================

   cabhPriorityQosBpDestTable OBJECT-TYPE
       SYNTAX SEQUENCE OF CabhPriorityQosBpDestEntry
       MAX-ACCESS     not-accessible
       STATUS      current
       DESCRIPTION
               "This table contains the priorities based on destination
               IP address and port number. It is indexed with a unique
               identifier for rows in the BP Application Priority
               Table."
       ::= {cabhPriorityQosBp 2}

   cabhPriorityQosBpDestEntry OBJECT-TYPE
       SYNTAX      CabhPriorityQosBpDestEntry
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION
               "List of Destination IP addresses and port numbers
               for an application to which special PriorityQos
               priority is provisioned.

               Implementors need to be aware that if the size
               of cabhPriorityQosBpIpAddr exceeds 112 octets then OIDs
               of column instances in this table will have more
               than 128 sub-identifiers and cannot be accessed
               using SNMPv1, SNMPv2c, or SNMPv3."
       INDEX { cabhPriorityQosMasterApplicationId,
               cabhPriorityQosBpIpAddrType,
               cabhPriorityQosBpIpAddr,
               cabhPriorityQosBpDestIndex }
      ::= { cabhPriorityQosBpDestTable 1 }

   CabhPriorityQosBpDestEntry ::= SEQUENCE {
       cabhPriorityQosBpDestIndex            Unsigned32,
       cabhPriorityQosBpDestIpAddrType       InetAddressType,
       cabhPriorityQosBpDestIpAddr           InetAddress,
       cabhPriorityQosBpDestPort             InetPortNumber,
       cabhPriorityQosBpDestIpPortPriority   Unsigned32
       }

   cabhPriorityQosBpDestIndex OBJECT-TYPE
       SYNTAX      Unsigned32 (1..65535)
```

```
        MAX-ACCESS  not-accessible
```

```
        STATUS      current
        DESCRIPTION
                "The locally unique index into the Destination
                Priority Table."
        ::= { cabhPriorityQosBpDestEntry 1 }

    cabhPriorityQosBpDestIpAddrType     OBJECT-TYPE
        SYNTAX      InetAddressType
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The type of the Destination IP Address."
        ::= { cabhPriorityQosBpDestEntry 2 }

    cabhPriorityQosBpDestIpAddr   OBJECT-TYPE
        SYNTAX      InetAddress
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The Destination IP address of the LAN IP Device of an
                application to which special PriorityQos priority is
                assigned."
          ::= { cabhPriorityQosBpDestEntry 3 }

    cabhPriorityQosBpDestPort     OBJECT-TYPE
        SYNTAX      InetPortNumber
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The port number of an application to which special
                PriorityQos priority is assigned."
          ::= { cabhPriorityQosBpDestEntry 4 }

    cabhPriorityQosBpDestIpPortPriority    OBJECT-TYPE
        SYNTAX      Unsigned32 (1..8)
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The PriorityQos priority assigned to a particular
                application in another LAN IP Device."
        ::= { cabhPriorityQosBpDestEntry 5 }


       --================================================================
       --
       --  PS Interface Attributes Table
       --
       --  The cabhPriorityQosPsIfAttribTable contains the number of
       --  media access priorities and number of queues associated with
```

-- each LAN interface in the Residential Gateway.

```
      --
      --================================================================

   cabhPriorityQosPsIfAttribTable   OBJECT-TYPE
       SYNTAX SEQUENCE OF CabhPriorityQosPsIfAttribEntry
       MAX-ACCESS   not-accessible
       STATUS    current
       DESCRIPTION
               "This table contains the number of media access
               priorities and number of queues associated with each
               LAN interface in the Residential Gateway."
            ::= { cabhPriorityQosPs 1  }

   cabhPriorityQosPsIfAttribEntry      OBJECT-TYPE
       SYNTAX    CabhPriorityQosPsIfAttribEntry
       MAX-ACCESS   not-accessible
       STATUS    current
       DESCRIPTION
               "Number of media access priorities and number of queues
               for each LAN interface in the Residential Gateway. This
               table applies only to interfaces through which data
               flows."
       INDEX { ifIndex }
       ::= { cabhPriorityQosPsIfAttribTable 1 }

   CabhPriorityQosPsIfAttribEntry ::= SEQUENCE {
       cabhPriorityQosPsIfAttribIfNumPriorities   Unsigned32,
       cabhPriorityQosPsIfAttribIfNumQueues       Unsigned32
       }

   cabhPriorityQosPsIfAttribIfNumPriorities OBJECT-TYPE
       SYNTAX     Unsigned32 (1..8)
           MAX-ACCESS read-only
           STATUS     current
           DESCRIPTION
                   "The number of media access priorities supported by
                   this LAN interface."
       ::= { cabhPriorityQosPsIfAttribEntry 1 }

   cabhPriorityQosPsIfAttribIfNumQueues OBJECT-TYPE
       SYNTAX     Unsigned32 (1..8)
       MAX-ACCESS read-only
       STATUS     current
       DESCRIPTION
               "The number of queues associated with this LAN
               interface."
       ::= { cabhPriorityQosPsIfAttribEntry 2 }
```

```
      -- Placeholder for notifications/traps.
```

```
      --

   cabhQosNotification         OBJECT IDENTIFIER  ::= { cabhQosMib 2 }
   cabhPriorityQosNotification OBJECT IDENTIFIER  ::=
                                          { cabhQosNotification 1 }



      --
      -- Conformance definitions
      --
   cabhQosConformance          OBJECT IDENTIFIER  ::= { cabhQosMib 3 }
   cabhPriorityQosConformance  OBJECT IDENTIFIER  ::=
                                           { cabhQosConformance 1 }
   cabhPriorityQosGroups       OBJECT IDENTIFIER  ::=
                                  { cabhPriorityQosConformance 1 }
   cabhPriorityQosCompliances  OBJECT IDENTIFIER  ::=
                                  { cabhPriorityQosConformance 2 }


      -- ==================

      -- compliance statements

   cabhPriorityQosCompliance MODULE-COMPLIANCE
       STATUS     current
       DESCRIPTION
               "The compliance statement for devices that implement
               CableHome 1.1 PriorityQos capability."
       MODULE   --cabhPriorityQosMib

      -- unconditionally mandatory groups

   MANDATORY-GROUPS {
       cabhPriorityQosGroup
       }

   OBJECT cabhPriorityQosBpIpAddrType
          SYNTAX InetAddressType { ipv4(1) }
          DESCRIPTION
              "An implementation is only required to support IPv4
               addresses."

   OBJECT cabhPriorityQosBpIpAddr
          SYNTAX  InetAddress (SIZE(4))
          DESCRIPTION
              "An implementation is only required to support IPv4
               addresses."

   OBJECT cabhPriorityQosBpDestIpAddrType
```

```
          SYNTAX InetAddressType { ipv4(1) }
          DESCRIPTION
              "An implementation is only required to support IPv4
               addresses."

   OBJECT cabhPriorityQosBpDestIpAddr
          SYNTAX  InetAddress (SIZE(4))
          DESCRIPTION
              "An implementation is only required to support IPv4
               addresses."

      ::= { cabhPriorityQosCompliances 1}


   cabhPriorityQosGroup OBJECT-GROUP
       OBJECTS {
           cabhPriorityQosMasterDefaultCHPriority,
           cabhPriorityQosMasterRowStatus,
           cabhPriorityQosSetToFactory,
           cabhPriorityQosLastSetToFactory,
           cabhPriorityQosBpIpAddrType,
           cabhPriorityQosBpIpAddr,
           cabhPriorityQosBpApplicationId,
           cabhPriorityQosBpDefaultCHPriority,
           cabhPriorityQosBpIndex,
           cabhPriorityQosBpDestIpAddrType,
           cabhPriorityQosBpDestIpAddr,
           cabhPriorityQosBpDestPort,
           cabhPriorityQosBpDestIpPortPriority,
           cabhPriorityQosPsIfAttribIfNumPriorities,
           cabhPriorityQosPsIfAttribIfNumQueues
       }
       STATUS    current
       DESCRIPTION
               "Group of objects for CableHome Application Priority
               MIB."
       ::= { cabhPriorityQosGroups 1 }
      END
```

5. Acknowlegements

Stephen Palm - Broadcom
Diego Mazzola - Texas Instruments
James Hinsey - Broadcom

Funding for the RFC Editor function is currently provided by the
Internet Society.

6. Formal Syntax

The following syntax specification uses the augmented Backus-Naur Form (BNF) as described in RFC-2234 [3].

7. Security Considerations

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

It is thus important to control even GET access to these objects and possibly to even encrypt the values of these objects when sending them over the network via SNMP. Not all versions of SNMP provide features for such a secure environment.

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.

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