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Cable Gateway Addressing Management Information Base for CableHome compliant Residential Gateways

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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 of Network Address Translation and transparent bridging functionality within a CableHome compliant residential gateway.

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].

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[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].

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](#)) [22], a TFTP server ([RFC1350](#)) [23], 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 CAP (CableHome Address Portal)

The logical function within the Cable Gateway Device which provides the NAT/NAPT routing and transparent bridging functions.

3. Overview

This MIB provides a set of objects required for the management of CAP NAT/NAPT and transparent bridging functions within CableHome compliant Residential Gateways (RG). The MIB is derived from the CableHome Specification.

Depending on the configuration of the CAP, a CableHome RG will perform either standard NAT Network Address Translation or NAPT Network Address Port Translation. It is also possible to configure the CableHome RG to provide only NAT/NAPT functions, transparent bridging functions, or a combination of the two.

The NAT/NAPT function of the CableHome RG generally translates traffic to and from privately addressed devices in the home network to one (NAPT) or more (NAT) public addresses that are provisioned into the RG for this purpose.

In order for the CableHome RG to support devices and applications that are NAT/NAPT intolerant, the RG also supports a type of transparent bridging, which we call Passthrough, by configuring the RG to bridge traffic for all devices on the home network or to bridge traffic to and from particular hardware addresses on the home network.

3.1 Structure of the MIB

This MIB is structured into two groups:

1. The cabhCapBase group provides a mechanism to define the inactivity timeouts for TCP, UDP, and ICMP traffic types. It also provides a mechanism to set the Primary Packet-handling Mode of the RG to either NAT, NAPT, or Passthrough. Finally, this group provides a means to reset most MIB values defined in this MIB to their factory defaults.

2. The cabhCapMap group contains information pertaining to the NAT/NAPT routing and transparent bridging (Passthrough) functions of the RG. The cabhCapMap group consists of two tables:

- cabhCapMappingTable: Allows for creating and monitoring static and dynamic NAT and NAPT mappings.

- cabhCapPassthroughTable: Allows for configuring the RG to transparently bridge traffic based on hardware addresses of devices on the home network.

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-CAP-MIB DEFINITIONS ::= BEGIN

IMPORTS

MODULE-IDENTITY,
OBJECT-TYPE,
Unsigned32,
mib-2 FROM SNMPv2-SMI
TEXTUAL-CONVENTION,
TimeStamp,
TruthValue,
RowStatus,
PhysAddress FROM SNMPv2-TC
OBJECT-GROUP,
MODULE-COMPLIANCE FROM SNMPv2-CONF
InetAddressType,
InetAddress,
InetPortNumber FROM INET-ADDRESS-MIB;

cabhCapMib MODULE-IDENTITY

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DESCRIPTION

"This MIB module supplies the basic management objects for the CableHome Addressing Portal (CAP) portion of the PS database.

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of this MIB module is part of RFC xxxx; see the RFC

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```
        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

CabhCapPacketMode ::= TEXTUAL-CONVENTION
    STATUS      current
    DESCRIPTION
        "The data type established when a binding/mapping is
        established."
    SYNTAX      INTEGER {
        napt(1),          -- NAT with port translation
        nat(2),           -- Basic NAT
        passthrough(3)    -- Pass Through External Address
    }

cabhCapObjects      OBJECT IDENTIFIER ::= { cabhCapMib 1 }
cabhCapBase         OBJECT IDENTIFIER ::= { cabhCapObjects 1 }
cabhCapMap          OBJECT IDENTIFIER ::= { cabhCapObjects 2 }

--=====
--
--    General CAP Parameters
--
--=====

cabhCapTcpTimeWait OBJECT-TYPE
    SYNTAX Unsigned32
    UNITS "seconds"
    MAX-ACCESS read-write
    STATUS current
    DESCRIPTION
        "This object is the maximum inactivity time to wait
        before assuming TCP session is terminated. It has no
        relation to the TCP session TIME_WAIT state referred
        to in [RFC793]"
    DEFVAL { 300 }
    ::= { cabhCapBase 1 }

cabhCapUdpTimeWait OBJECT-TYPE
    SYNTAX      Unsigned32
    UNITS       "seconds"
```



```
MAX-ACCESS    read-write
STATUS        current
DESCRIPTION
    "The inactivity time to wait before destroying CAP
    mappings for UDP."
DEFVAL { 300 } -- 5 minutes
::={ cabhCapBase 2 }
```

cabhCapIcmpTimeWait OBJECT-TYPE

```
SYNTAX        Unsigned32
UNITS         "seconds"
MAX-ACCESS    read-write
STATUS        current
DESCRIPTION
    "The inactivity time to wait before destroying CAP
    mappings for ICMP."
DEFVAL { 300 } -- 5 minutes
::= { cabhCapBase 3 }
```

cabhCapPrimaryMode OBJECT-TYPE

```
SYNTAX        CabhCapPacketMode
MAX-ACCESS    read-write
STATUS        current
DESCRIPTION
    "The Primary Packet Handling Mode to be used."
DEFVAL { napt }
::= { cabhCapBase 4 }
```

cabhCapSetToFactory OBJECT-TYPE

```
SYNTAX        TruthValue
MAX-ACCESS    read-write
STATUS        current
DESCRIPTION
    "Reading this object always returns false(2). When the
    cabhCapSetToFactory object is set to true(1), the PS must
    take the following actions:

    1. Clear all entries in the cabhCapMappingTable and
       cabhCapPassthroughTable.
    2. Reset the following objects to their factory default
       values:
       cabhCapTcpTimeWait,
       cabhCapUdpTimeWait,
       cabhCapIcmpTimeWait,
       cabhCapPrimaryMode"
    ::= { cabhCapBase 5 }
```

cabhCapLastSetToFactory OBJECT-TYPE

SYNTAX

TimeStamp

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MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of sysUpTime when cabhCapSetToFactory was last set to true. Zero if never reset."

::= { cabhCapBase 6 }

```
--=====
--
-- cabhCapMappingTable (CAP Mapping Table)
--
-- The cabhCapMappingTable contains the info for all CAP mappings.
--
--=====
```

cabhCapMappingTable OBJECT-TYPE

SYNTAX SEQUENCE OF CabhCapMappingEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This table contains IP address mappings between private network addresses, or network addresses and port numbers/ICMP sequence numbers, assigned to devices on the subscriber's home LAN, and network addresses, or network addresses and port numbers/ICMP sequence number, assigned by the cable operator, presumed to be on a separate subnetwork than the private IP addresses.

The CAP Mapping Table is used by the CableHome Address Portal (CAP) function of the PS to make packet forwarding decisions."

::= { cabhCapMap 1 }

cabhCapMappingEntry OBJECT-TYPE

SYNTAX CabhCapMappingEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"List of the private IP (LAN) address - to - cable operator assigned IP (WAN) address mappings stored in the PS and used by the PS to make packet forwarding decisions."

INDEX { cabhCapMappingIndex }

::= { cabhCapMappingTable 1 }

CabhCapMappingEntry ::= SEQUENCE {

cabhCapMappingIndex	INTEGER,
cabhCapMappingWanAddrType	InetAddressType,
cabhCapMappingWanAddr	InetAddress,
cabhCapMappingWanPort	InetPortNumber,

cabhCapMappingLanAddrType InetAddressType,

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cabhCapMappingLanAddr	InetAddress,
cabhCapMappingLanPort	InetPortNumber,
cabhCapMappingMethod	INTEGER,
cabhCapMappingProtocol	INTEGER,
cabhCapMappingRowStatus	RowStatus

}

cabhCapMappingIndex OBJECT-TYPE

SYNTAX INTEGER (1..65535)

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The Index into the CAP Mapping Table."

::= { cabhCapMappingEntry 1 }

cabhCapMappingWanAddrType OBJECT-TYPE

SYNTAX InetAddressType

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The IP address type assigned on the WAN side"

DEFVAL { ipv4 }

::= { cabhCapMappingEntry 2 }

cabhCapMappingWanAddr OBJECT-TYPE

SYNTAX InetAddress

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The IP address assigned by the cable operator's address (DHCP) server, and comprising the WAN-side IP address of the CAP Mapping tuple. This object is populated either dynamically by LAN-to-WAN outbound traffic or statically by the cable operator."

::= { cabhCapMappingEntry 3 }

cabhCapMappingWanPort OBJECT-TYPE

SYNTAX InetPortNumber

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The TCP/UDP port number or ICMP sequence number on the WAN side. A port number of 0 indicates a NAT mapping. A non-zero port number indicates an NAPT mapping."

DEFVAL { 0 }

::= { cabhCapMappingEntry 4 }

cabhCapMappingLanAddrType OBJECT-TYPE

SYNTAX InetAddressType

MAX-ACCESS read-create

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STATUS current
DESCRIPTION
 "The IP address type assigned on the LAN side."
DEFVAL { ipv4 }
::= { cabhCapMappingEntry 5 }

cabhCapMappingLanAddr OBJECT-TYPE

SYNTAX InetAddress
MAX-ACCESS read-create
STATUS current
DESCRIPTION
 "The IP address assigned by the DHCP server function of
 the PS (CableHome DHCP Server, CDS), and comprising the
 LAN-side IP address of the CAP Mapping tuple.
 This object is populated either dynamically as a result
 of LAN-to-WAN outbound traffic or statically by the cable
 operator."
::= { cabhCapMappingEntry 6 }

cabhCapMappingLanPort OBJECT-TYPE

SYNTAX InetPortNumber
MAX-ACCESS read-create
STATUS current
DESCRIPTION
 "The TCP/UDP port number or ICMP sequence number on the
 LAN side. A port number/sequence number of 0 indicates
 a NAT mapping. A non-zero port number/sequence number
 indicates a NAPT mapping."
DEFVAL { 0 }
::= { cabhCapMappingEntry 7 }

cabhCapMappingMethod OBJECT-TYPE

SYNTAX INTEGER {
 static(1),
 dynamic(2)
}
MAX-ACCESS read-only
STATUS current
DESCRIPTION
 "Indicates how this mapping was created. Static means
 that it was provisioned, and dynamic means that it was
 handled by the PS itself."
::= { cabhCapMappingEntry 8 }

cabhCapMappingProtocol OBJECT-TYPE

SYNTAX INTEGER {
 other(1), -- any other protocol; e.g. IGMP
 icmp(2),
 udp(3),

tcp(4)

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```
    }
MAX-ACCESS read-create
STATUS current
DESCRIPTION
    "The protocol for this mapping."
::= { cabhCapMappingEntry 9 }
```

cabhCapMappingRowStatus OBJECT-TYPE

```
SYNTAX RowStatus
MAX-ACCESS read-create
STATUS current
DESCRIPTION
```

"The RowStatus interlock for the creation and deletion of a cabhCapMappingTable entry. Changing the value of the IP address or port number columns of the CAP Mapping Table may have an effect on active traffic, so the PS will prevent modification of this table's columns and return an inconsistentValue error when cabhCapMappingRowStatus object is active(1).

The PS must not allow RowStatus to be set to notInService(2) by a manager.

A newly created row cannot be set to active(1) until the corresponding instances of cabhCapMappingWanAddrType, cabhCapMappingWanAddr, cabhCapMappingLanAddrType, cabhCapMappingLanAddr, and cabhCapMappingProtocol have been set.

When Primary Packet-handling Mode is NAPT (cabhCapPrimaryMode is napt(1)), required behavior with respect to the cabhCapMappingRowStatus object is dependent upon the version of CableHome specification implemented in the product:

- In CableHome 1.0 compliant products configured for NAPT Primary Packet-handling Mode, a newly provisioned row can not be set to active(1) until a non-zero value has been set for cabhCapMappingWanPort and cabhCapMappingLanPort objects.
- Products compliant to CableHome specifications later than CableHome 1.0 are not subject to the cabhCapMappingWanPort and cabhCapMappingLanPort restrictions imposed on CableHome 1.0 compliant products. In CableHome 1.1 and later compliant devices configured to operate in NAPT Primary Packet-handling Mode, provisioned rows can be set to active(1) regardless of whether the value to which

cabhCapMappingWanPort and cabhCapMappingLanPort have

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been set is zero or nonzero.

When Primary Packet-handling Mode is NAT
(cabhCapPrimaryMode is nat(2)), a newly created row
cannot be set to active(1) if a non-zero value of
cabhCapMappingWanPort and cabhCapMappingLanPort have
been set."

::={ cabhCapMappingEntry 10 }

```

=====
--
-- cabhCapPassthroughTable (CAP Passthrough Table)
--
-- The cabhCapPassthroughTable contains the MAC Addresses for all
-- LAN-IP Devices which will be configured as passthrough.
--
=====

```

cabhCapPassthroughTable OBJECT-TYPE

SYNTAX SEQUENCE OF CabhCapPassthroughEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This table contains MAC addresses for LAN-IP Devices
which are configured as passthrough mode."

::= { cabhCapMap 2 }

cabhCapPassthroughEntry OBJECT-TYPE

SYNTAX CabhCapPassthroughEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"List of hardware addresses of LAN IP Devices which are
configured for passthrough mode."

INDEX {cabhCapPassthroughIndex}

::= {cabhCapPassthroughTable 1}

CabhCapPassthroughEntry::=SEQUENCE {

cabhCapPassthroughIndex INTEGER,

cabhCapPassthroughMacAddr PhysAddress,

cabhCapPassthroughRowStatus RowStatus

}

cabhCapPassthroughIndex OBJECT-TYPE

SYNTAX INTEGER (1..65535)

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The index into the CAP Passthrough Table."

::= { cabhCapPassthroughEntry 1 }

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```
cabhCapPassthroughMacAddr      OBJECT-TYPE
    SYNTAX      PhysAddress (SIZE(0..16))
    MAX-ACCESS   read-create
    STATUS      current
    DESCRIPTION
        "Hardware address of the LAN-IP Device to be configured
        as passthrough mode."
    ::= {cabhCapPassthroughEntry 2}

cabhCapPassthroughRowStatus     OBJECT-TYPE
    SYNTAX      RowStatus
    MAX-ACCESS   read-create
    STATUS      current
    DESCRIPTION
        "The RowStatus interlock for the creation and deletion
        of a cabhCapPassthroughTable entry. Any writable object
        in each row can be modified at any time while the row is
        active(1)."
    ::= { cabhCapPassthroughEntry 3 }

--
-- notification group is for future extension.
--

cabhCapNotification      OBJECT IDENTIFIER ::= { cabhCapMib 2 0 }
cabhCapConformance       OBJECT IDENTIFIER ::= { cabhCapMib 3 }
cabhCapCompliances       OBJECT IDENTIFIER ::= { cabhCapConformance 1 }
cabhCapGroups            OBJECT IDENTIFIER ::= { cabhCapConformance 2 }

--
-- Notification Group
--

-- compliance statements

cabhCapBasicCompliance MODULE-COMPLIANCE
    STATUS      current
    DESCRIPTION
        "The compliance statement for devices that implement the
        CableHome Portal Services functionality"
    MODULE      --cabhCapMib

-- unconditionally mandatory groups

MANDATORY-GROUPS {
    cabhCapGroup
}
```


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

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

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

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

::= { cabhCapCompliances 1 }

cabhCapGroup OBJECT-GROUP

OBJECTS {
cabhCapTcpTimeWait,
cabhCapUdpTimeWait,
cabhCapIcmpTimeWait,
cabhCapPrimaryMode,
cabhCapSetToFactory,
cabhCapLastSetToFactory,
cabhCapMappingWanAddrType,
cabhCapMappingWanAddr,
cabhCapMappingWanPort,
cabhCapMappingLanAddrType,
cabhCapMappingLanAddr,
cabhCapMappingLanPort,
cabhCapMappingMethod,
cabhCapMappingProtocol,
cabhCapMappingRowStatus,
cabhCapPassthroughMacAddr,
cabhCapPassthroughRowStatus
}

STATUS current

DESCRIPTION

"Group of objects for CableHome CAP MIB."

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```
::= { cabhCapGroups 1 }
```

END

5. Acknowledgements

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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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10. Intellectual Property

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