

Network Working Group
Request for Comments: 2677
Category: Standards Track

M. Greene
Contractor
J. Cucchiara
IronBridge Networks
J. Luciani
Bay Networks
August 1999

Definitions of Managed Objects for the NBMA Next Hop Resolution Protocol (NHRP)

Status of this Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

Copyright Notice

Copyright (C) The Internet Society (1999). All Rights Reserved.

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 describes managed objects for the Next Hop Resolution Protocol (NHRP) as defined in RFC 2332.

Table of Contents

1 Introduction	2
2 The SNMP Management Framework	2
3 Structure of the MIB	3
3.1 The NHRP General Group	3
3.1.1 The NHRP Cache Table	4
3.1.2 The NHRP Purge Request Table	4
3.2 The NHRP Client Group	4
3.2.1 The NHRP Client Table	4
3.2.2 The NHRP Client Registration Table	5
3.2.3 The NHRP Client NHS Table	5
3.2.4 The NHRP Client Statistics Table	5
3.3 The NHRP Server Group	5
3.3.1 The NHRP Server Table	5
3.3.2 The NHRP Server Cache Table	5
3.3.3 The NHRP Server NHC Table	6

3.3.4 The NHRP Server Statistics Table	6
4 NBMA Next Hop Resolution Protocol MIB Definitions	6
5 IANA Considerations	62
6 Security	62
7 Intellectual Property	63
8 Acknowledgments	63
9 References	64
10 Authors' Addresses	66
11 Full Copyright Statement	67

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 for the Next Hop Resolution Protocol (NHRP) as defined in RFC 2332 [17].

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 [21].

2. The SNMP Management Framework

The SNMP Management Framework presently consists of five major components:

- o An overall architecture, described in RFC 2571 [1].
- o Mechanisms for describing and naming objects and events for the purpose of management. The first version of this Structure of Management Information (SMI) is called SMIV1 and described in STD 16, RFC 1155 [2], STD 16, RFC 1212 [3] and RFC 1215 [4]. The second version, called SMIV2, is described in STD 58, RFC 2578 [5], STD 58, RFC 2579 [6] and STD 58, RFC 2580 [7].
- o Message protocols for transferring management information. The first version of the SNMP message protocol is called SNMPv1 and described in STD 15, RFC 1157 [8]. A second version of the SNMP message protocol, which is not an Internet standards track protocol, is called SNMPv2c and described in RFC 1901 [9] and RFC 1906 [10]. The third version of the message protocol is called SNMPv3 and described in RFC 1906 [10], RFC 2572 [11] and RFC 2574 [12].

- o Protocol operations for accessing management information. The first set of protocol operations and associated PDU formats is described in STD 15, RFC 1157 [8]. A second set of protocol operations and associated PDU formats is described in RFC 1905 [13].
- o A set of fundamental applications described in RFC 2573 [14] and the view-based access control mechanism described in RFC 2575 [15].

A more detailed introduction to the current SNMP Management Framework can be found in RFC 2570 [16].

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. Objects in the MIB are defined using the mechanisms defined in the SMI.

This memo specifies a MIB module that is compliant to the SMIV2. A MIB conforming to the SMIV1 can be produced through the appropriate translations. The resulting translated MIB must be semantically equivalent, except where objects or events are omitted because no translation is possible (use of Counter64). Some machine readable information in SMIV2 will be converted into textual descriptions in SMIV1 during the translation process. However, this loss of machine readable information is not considered to change the semantics of the MIB.

3. Structure of the MIB

The NHRP MIB contains three groups: the General Group, the Client Group, and the Server Group.

3.1. The NHRP General Group

The General Group contains objects that apply to both clients and servers -- in particular the `nhrpNextIndex` scalar object, the NHRP Cache Table and the NHRP Purge Request Table.

The `nhrpNextIndex` scalar object is used to provide unique indices for the `nhrpClientIndex` in the `nhrpClientTable` and the `nhrpServerIndex` in the `nhrpServerTable`. If used consistently, this object may prevent conflicts when multiple managers attempt to create rows simultaneously in the same table.

3.1.1. The NHRP Cache Table

The NHRP Cache Table represents the internetwork layer address to NBMA address cache that is maintained by both NHRP clients and NHRP servers.

The NHRP Cache Table contains an ifIndex as part of the Index Clause. This ifIndex represents the use of a generic ifIndex, such that the value of this ifIndex SHOULD reflect a specific NBMA subnetwork related interface as determined by an implementation. For example, assuming that the NBMA subnetwork is ATM, then it is up to the implementors of this MIB to determine their own ATM interface layering (assuming compliance with the IF-MIB, RFC 2233 [18] and the ATM-MIB, RFC 2515 [19]). In other words, assuming that the NBMA subnetwork is ATM, the ifIndex in the NHRP Cache Table would represent the ifIndex containing or consisting of the VC (or shortcut) denoted by this Table entry.

The indexing scheme for the NHRP Cache Table is very similar to the MPC Ingress Cache Table and the MPS Ingress Cache Table in the

Multiprotocol Over ATM (MPOA) MIB [23]. This MIB and the MPOA MIB were designed to be complementary and non-overlapping. The MPOA MIB should also support this MIB. The MPOA MIB was designed prior to this MIB, and was designed by the LANE/MPOA Working Group in the ATM FORUM. The indexing scheme of the NHRP Cache Table (and the NHRP Server Cache Table) reflect the indexing scheme of the MPC Ingress Cache Table and the MPS Ingress Cache Table. Although, other indexing schemes could have been used for the NHRP Cache Table, a consistent indexing scheme between these tables was thought to be more advantageous from an implementation standpoint.

3.1.2. The NHRP Purge Request Table

The NHRP Purge Request Table is a way to track Purge Request Information.

3.2. The NHRP Client Group

The Client Group contains objects that only apply to NHRP clients (NHCs).

3.2.1. The NHRP Client Table

The NHRP Client Table contains entries for NHRP Next Hop Clients (NHCs) associated with this agent. Each row in the table represents a single NHC. The RequestID used in Registration requests needs to be saved to non-volatile storage. Depending upon the implementation,

this may or may not impact how the StorageType is used. For a complete description of how the Registration RequestID is used, see Section 5.2.3 of [17].

3.2.2. The NHRP Client Registration Table

The NHRP Client Registration Table contains information on registration requests which need to be maintained by the Clients. Each entry in this table represents a single registration request. Note: since the NHRP specification does not mandate a refresh algorithm, this table omits refresh information, however, this table does contain information for all the registration requests which need to be maintained by the NHRP Clients.

3.2.3. The NHRP Client NHS Table

The NHRP Client NHS Table contains the NBMA subnetwork addresses of servers configured for use by the client. By default, the agent will add an entry to this table which corresponds to the client's default router.

3.2.4. The NHRP Client Statistics Table

The NHRP Client Statistics Table contains NHRP statistics maintained by a client. These statistics include counters on requests and replies, as well as counters for errors which are encountered by the Clients.

3.3. The NHRP Server Group

The Server Group contains objects that only apply to NHRP servers (NHSES).

3.3.1. The NHRP Server Table

The NHRP Server Table contains entries for each server associated with this agent.

3.3.2. The NHRP Server Cache Table

The NHRP Server Cache Table contains additional objects that a server keeps for each entry in its cache. This table extends the NHRP Cache Table defined in the General Group.

3.3.3. The NHRP Server NHC Table

This table contains information about all the Clients known to the Servers.

3.3.4. The NHRP Server Statistics Table

The NHRP Server Statistics Table contains NHRP statistics maintained by a server. These statistics include counters on requests and replies, as well as counters for errors which are encountered by the Servers.

4. NBMA Next Hop Resolution Protocol MIB Definitions

NHRP-MIB DEFINITIONS ::= BEGIN

IMPORTS

```

    OBJECT-TYPE, MODULE-IDENTITY, mib-2, Integer32,
    Counter32, Unsigned32
        FROM SNMPv2-SMI
    MODULE-COMPLIANCE, OBJECT-GROUP
        FROM SNMPv2-CONF
    TEXTUAL-CONVENTION, TruthValue, RowStatus, StorageType,
    TimeStamp
        FROM SNMPv2-TC
    ifIndex
        FROM IF-MIB
    AddressFamilyNumbers
        FROM IANA-ADDRESS-FAMILY-NUMBERS-MIB
    ;

```

nhrpMIB MODULE-IDENTITY

```

    LAST-UPDATED "9908260000Z" -- August 26, 1999
    ORGANIZATION "Internetworking Over NBMA (ion) Working Group"
    CONTACT-INFO
        "Maria Greene (maria@xedia.com)
        Contractor

        Joan Cucchiara (joan@ironbridgenetworks.com)
        IronBridge Networks

        James V. Luciani (luciani@baynetworks.com)
        Bay Networks"

```

DESCRIPTION

"This MIB contains managed object definitions for the Next Hop Resolution Protocol, NHRP, as defined in RFC 2332 [17]."

-- revision history

REVISION "9908260000Z" -- August 26, 1999

DESCRIPTION "Initial version, published as RFC 2677."

::= { mib-2 71 }

--*****

-- NHRP Textual Conventions

--*****

NhrpGenAddr ::= TEXTUAL-CONVENTION

STATUS current

DESCRIPTION

"The value of an internetwork layer or NBMA address."

SYNTAX OCTET STRING (SIZE (0..64))

nhrpObjects OBJECT IDENTIFIER ::= { nhrpMIB 1 }

--*****

-- NHRP General (Client and Server) Objects

--*****

nhrpGeneralObjects OBJECT IDENTIFIER ::= { nhrpObjects 1 }

--

-- The following scalar is to be used to
 -- provided indices for the
 -- nhrpClientTable, and/or the nhrpServerTable.
 --

nhrpNextIndex OBJECT-TYPE

SYNTAX Unsigned32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This scalar is used for creating rows in the
 nhrpClientTable and the nhrpServerTable.

The value of this variable is a currently unused value
 for nhrpClientIndex and nhrpServerIndex.

The value returned when reading this variable must be unique for the NHC's and NHS's indices associated with this row. Subsequent attempts to read this variable must return different values.

NOTE: this object exists in the General Group because it is to be used in establishing rows in the nhrpClientTable and the nhrpServerTable. In other words, the value retrieved from this object could become the value of nhrpClientIndex and nhrpServerIndex.

In the situation of an agent re-initialization the value of this object must be saved in non-volatile storage.

This variable will return the special value 0 if no new rows can be created."

```
::= { nhrpGeneralObjects 1 }
```

```
--
-- The NHRP Cache Table
--
```

```
nhrpCacheTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF NhrpCacheEntry
    MAX-ACCESS   not-accessible
    STATUS       current
```

DESCRIPTION

"This table contains mappings between internetwork layer addresses and NBMA subnetwork layer addresses."

```
::= { nhrpGeneralObjects 2 }
```

```
nhrpCacheEntry OBJECT-TYPE
    SYNTAX      NhrpCacheEntry
    MAX-ACCESS   not-accessible
    STATUS       current
```

DESCRIPTION

"A cached mapping between an internetwork layer address and an NBMA address. Entries can be created by the network administrator using the nhrpCacheRowStatus column, or they may be added dynamically based on protocol operation (including NHRP, SCSP, and others, such as ATMARP).

When created based by NHRP protocol operations this entry is largely based on contents contained in the Client Information Entry (CIE).

Zero or more Client Information Entries (CIEs) may be included in the NHRP Packet. For a complete description of the CIE, refer to Section 5.2.0.1 of RFC 2332 [17]."

```

INDEX      {
            nhrpCacheInternetNetworkAddrType,
            nhrpCacheInternetNetworkAddr,
            ifIndex,
            nhrpCacheIndex
          }
 ::= { nhrpCacheTable 1 }

NhrpCacheEntry ::= SEQUENCE {
    nhrpCacheInternetNetworkAddrType    AddressFamilyNumbers,
    nhrpCacheInternetNetworkAddr        NhrpGenAddr,
    nhrpCacheIndex                      Unsigned32,
    nhrpCachePrefixLength                Integer32,
    nhrpCacheNextHopInternetNetworkAddr NhrpGenAddr,
    nhrpCacheNbmaAddrType                AddressFamilyNumbers,
    nhrpCacheNbmaAddr                    NhrpGenAddr,
    nhrpCacheNbmaSubaddr                  NhrpGenAddr,
    nhrpCacheType                         INTEGER,
    nhrpCacheState                       INTEGER,
    nhrpCacheHoldingTimeValid             TruthValue,
    nhrpCacheHoldingTime                  Unsigned32,
    nhrpCacheNegotiatedMtu                Integer32,
    nhrpCachePreference                   Integer32,
    nhrpCacheStorageType                  StorageType,
    nhrpCacheRowStatus                    RowStatus
}

nhrpCacheInternetNetworkAddrType OBJECT-TYPE
    SYNTAX      AddressFamilyNumbers
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The internetnetwork layer address type of this Next Hop
        Resolution Cache entry. The value of this object indicates
        how to interpret the values of nhrpCacheInternetNetworkAddr
        and nhrpCacheNextHopInternetNetworkAddr."
    ::= { nhrpCacheEntry 1 }

nhrpCacheInternetNetworkAddr OBJECT-TYPE
    SYNTAX      NhrpGenAddr
    MAX-ACCESS  not-accessible
    STATUS      current

```

DESCRIPTION

"The value of the internetwork address of the destination."

::= { nhrpCacheEntry 2 }

nhrpCacheIndex OBJECT-TYPE

SYNTAX Unsigned32 (1..4294967295)

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An identifier for this entry that has local significance within the scope of the General Group. This identifier is used here to uniquely identify this row, and also used in the 'nhrpPurgeTable' for the value of the 'nhrpPurgeCacheIdentifier'."

::= { nhrpCacheEntry 3 }

nhrpCachePrefixLength OBJECT-TYPE

SYNTAX Integer32 (0..255)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of bits that define the internetwork layer prefix associated with the nhrpCacheInternetworkAddr."

::= { nhrpCacheEntry 4 }

nhrpCacheNextHopInternetworkAddr OBJECT-TYPE

SYNTAX NhrpGenAddr

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The value of the internetwork address of the next hop."

::= { nhrpCacheEntry 5 }

nhrpCacheNbmaAddrType OBJECT-TYPE

SYNTAX AddressFamilyNumbers

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The NBMA address type. The value of this object indicates how to interpret the values of nhrpCacheNbmaAddr and nhrpCacheNbmaSubaddr."

::= { nhrpCacheEntry 6 }

nhrpCacheNbmaAddr OBJECT-TYPE

SYNTAX NhrpGenAddr

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The value of the NBMA subnetwork address of the next hop."

::= { nhrpCacheEntry 7 }

nhrpCacheNbmaSubaddr OBJECT-TYPE

SYNTAX NhrpGenAddr

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The value of the NBMA subaddress of the next hop. If there is no subaddress concept for the NBMA address family, this value will be a zero-length OCTET STRING."

::= { nhrpCacheEntry 8 }

nhrpCacheType OBJECT-TYPE

SYNTAX INTEGER {
 other(1),
 register(2),
 resolveAuthoritative(3),
 resoveNonauthoritative(4),
 transit(5),
 administrativelyAdded(6),
 atmarp(7),
 scsp(8)
 }

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"An indication of how this cache entry was created. The values are:

'other(1)' The entry was added by some other means.

'register(2)' In a server, added based on a client registration.

'resolveAuthoritative(3)' In a client, added based on receiving an Authoritative NHRP Resolution Reply.

'resolveNonauthoritative(4)' In a client, added based on receiving a Nonauthoritative NHRP Resolution Reply.

'transit(5)' In a transit server, added by examining a forwarded NHRP packet.

'administrativelyAdded(6)' In a client or server, manually added by the administrator. The StorageType of this entry is reflected in 'nhrpCacheStorageType'.

'atmarp(7)' The entry was added due to an ATMARP.

'scsp(8)' The entry was added due to SCSP.

When the entry is under creation using the nhrpCacheRowStatus column, the only value that can be specified by the administrator is 'administrativelyAdded'. Attempting to set any other value will cause an 'inconsistentValue' error.

The value cannot be modified once the entry is active."
 ::= { nhrpCacheEntry 9 }

```
nhrpCacheState OBJECT-TYPE
    SYNTAX      INTEGER {
                    incomplete(1),
                    ackReply(2),
                    nakReply(3)
                }
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
```

"An indication of the state of this entry. The values are:

'incomplete(1)' The client has sent a NHRP Resolution Request but has not yet received the NHRP Resolution Reply.

'ackReply(2)' For a client or server, this is a
cached valid mapping.

'nakReply(3)' For a client or server, this is a
cached NAK mapping."

::= { nhrpCacheEntry 10 }

nhrpCacheHoldingTimeValid OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"True(1) is returned if the value of
'nhrpCacheType' is not
'administrativelyAdded'. Since the
value of 'nhrpCacheType' was not
configured by a user, the value of
'nhrpCacheHoldingTime' is
considered valid. In other words, the value of
'nhrpCacheHoldingTime' represents
the Holding Time for the cache Entry.

If 'nhrpCacheType has been configured by a
user, (i.e. the value of 'nhrpCacheType' is
'administrativelyAdded') then false(2) will be returned.
This indicates that the value of
'nhrpCacheHoldingTime' is undefined because this row
could possibly be backed up in nonvolatile storage."

::= { nhrpCacheEntry 11 }

nhrpCacheHoldingTime OBJECT-TYPE

SYNTAX Unsigned32(0..65535)

UNITS "seconds"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"If the value of 'nhrpCacheHoldingTimeValid is
true(1) then this object represents the number
of seconds that the cache entry will remain in this
table. When this value reaches 0 (zero) the row should
be deleted.

If the value of 'nhrpCacheHoldingTimeValid is
false(2) then this object is undefined."

::= { nhrpCacheEntry 12 }

nhrpCacheNegotiatedMtu OBJECT-TYPE

SYNTAX Integer32 (0..65535)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The maximum transmission unit (MTU) that was negotiated or registered for this entity. In other words, this is the actual MTU being used."

::= { nhrpCacheEntry 13 }

nhrpCachePreference OBJECT-TYPE

SYNTAX Integer32 (0..255)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"An object which reflects the Preference value of the Client Information Entry (CIE).

Zero or more Client Information Entries (CIEs) may be included in the NHRP Packet. One of the fields in the CIE is the Preference. For a complete description of the CIE, refer to Section 5.2.0.1 of RFC 2332 [17]."

REFERENCE

"Section 5.2.0.1 Mandatory Part Format, RFC 2332 [17]."

::= { nhrpCacheEntry 14 }

nhrpCacheStorageType OBJECT-TYPE

SYNTAX StorageType

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This value only has meaning when the 'nhrpCacheType' has the value of 'administrativelyAdded'.

When the row is created due to being 'administrativelyAdded', this object reflects whether this row is kept in volatile storage and lost upon reboot or if this row is backed up by non-volatile or permanent storage.

If the value of 'nhrpCacheType' has a value which is not 'administrativelyAdded', then the value of this object is 'other(1)'."

DEFVAL { nonVolatile }

::= { nhrpCacheEntry 15 }

nhrpCacheRowStatus OBJECT-TYPE

SYNTAX RowStatus
 MAX-ACCESS read-create
 STATUS current
 DESCRIPTION

"An object that allows entries in this table to be
 created and deleted using the RowStatus convention."
 ::= { nhrpCacheEntry 16 }

--

-- The NHRP Purge Request Table

--

nhrpPurgeReqTable OBJECT-TYPE

SYNTAX SEQUENCE OF NhrpPurgeReqEntry
 MAX-ACCESS not-accessible
 STATUS current
 DESCRIPTION

"This table will track Purge Request Information."
 ::= { nhrpGeneralObjects 3 }

nhrpPurgeReqEntry OBJECT-TYPE

SYNTAX NhrpPurgeReqEntry
 MAX-ACCESS not-accessible
 STATUS current
 DESCRIPTION

"Information regarding a Purge Request."

INDEX { nhrpPurgeIndex }
 ::= { nhrpPurgeReqTable 1 }

NhrpPurgeReqEntry ::= SEQUENCE {

nhrpPurgeIndex	Unsigned32,
nhrpPurgeCacheIdentifier	Unsigned32,
nhrpPurgePrefixLength	Integer32,
nhrpPurgeRequestID	Unsigned32,
nhrpPurgeReplyExpected	TruthValue,
nhrpPurgeRowStatus	RowStatus

}

nhrpPurgeIndex OBJECT-TYPE

SYNTAX Unsigned32 (1..4294967295)
 MAX-ACCESS not-accessible
 STATUS current
 DESCRIPTION

"An index for this entry that has local significance
 within the scope of this table."

::= { nhrpPurgeReqEntry 1 }

nhrpPurgeCacheIdentifier OBJECT-TYPE

SYNTAX Unsigned32 (1..4294967295)
MAX-ACCESS read-create
STATUS current

DESCRIPTION

"This object identifies which row in
'nhrpCacheTable' is being purged. This object
should have the same value as the 'nhrpCacheIndex'
in the 'nhrpCacheTable'."

::= { nhrpPurgeReqEntry 2 }

nhrpPurgePrefixLength OBJECT-TYPE

SYNTAX Integer32 (0..255)
MAX-ACCESS read-only
STATUS current

DESCRIPTION

"In the case of NHRP Purge Requests, this specifies the
equivalence class of addresses which match the first
'Prefix Length' bit positions of the Client Protocol
Address specified in the Client Information Entry (CIE)."

::= { nhrpPurgeReqEntry 3 }

nhrpPurgeRequestID OBJECT-TYPE

SYNTAX Unsigned32
MAX-ACCESS read-create
STATUS current

DESCRIPTION

"The Request ID used in the purge request."

::= { nhrpPurgeReqEntry 4 }

nhrpPurgeReplyExpected OBJECT-TYPE

SYNTAX TruthValue
MAX-ACCESS read-create
STATUS current

DESCRIPTION

"An indication of whether this Purge Request has the
'N' Bit cleared (off)."

::= { nhrpPurgeReqEntry 5 }

nhrpPurgeRowStatus OBJECT-TYPE

SYNTAX RowStatus
MAX-ACCESS read-create
STATUS current

DESCRIPTION

"An object that allows entries in this table to be
created and deleted using the RowStatus convention."

::= { nhrpPurgeReqEntry 6 }


```

--*****
-- NHRP Client Objects
--*****

nhrpClientObjects OBJECT IDENTIFIER ::= { nhrpObjects 2 }

--
-- The NHRP Client Table
--

nhrpClientTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF NhrpClientEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "Information about NHRP clients (NHCs) managed by this
        agent."
    ::= { nhrpClientObjects 1 }

nhrpClientEntry OBJECT-TYPE
    SYNTAX      NhrpClientEntry
    MAX-ACCESS   not-accessible
    STATUS       current
    DESCRIPTION
        "Information about a single NHC."
    INDEX       { nhrpClientIndex }
    ::= { nhrpClientTable 1 }

NhrpClientEntry ::= SEQUENCE {
    nhrpClientIndex                Unsigned32,
    nhrpClientInternetNetworkAddrType AddressFamilyNumbers,
    nhrpClientInternetNetworkAddr   NhrpGenAddr,
    nhrpClientNbmaAddrType          AddressFamilyNumbers,
    nhrpClientNbmaAddr              NhrpGenAddr,
    nhrpClientNbmaSubaddr            NhrpGenAddr,
    nhrpClientInitialRequestTimeout Integer32,
    nhrpClientRegistrationRequestRetries Integer32,
    nhrpClientResolutionRequestRetries Integer32,
    nhrpClientPurgeRequestRetries   Integer32,
    nhrpClientDefaultMtu             Unsigned32,
    nhrpClientHoldTime               Unsigned32,
    nhrpClientRequestID              Unsigned32,
    nhrpClientStorageType            StorageType,
    nhrpClientRowStatus              RowStatus
}

```

```
nhrpClientIndex OBJECT-TYPE
    SYNTAX      Unsigned32 (1..4294967295)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "An identifier for the NHRP client that is unique within
        the scope of this agent. The 'nhrpNextIndex' value
        should be consulted (read), prior to creating a row in
        this table, and the value returned from reading
        'nhrpNextIndex' should be used as this object's value."

    ::= { nhrpClientEntry 1 }

nhrpClientInternetworkAddrType OBJECT-TYPE
    SYNTAX      AddressFamilyNumbers
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "The type of the internetwork layer address of this
        client. This object indicates how the value of
        nhrpClientInternetworkAddr is to be interpreted."
    ::= { nhrpClientEntry 2 }

nhrpClientInternetworkAddr OBJECT-TYPE
    SYNTAX      NhrpGenAddr
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "The value of the internetwork layer address of this
        client."
    ::= { nhrpClientEntry 3 }

nhrpClientNbmaAddrType OBJECT-TYPE
    SYNTAX      AddressFamilyNumbers
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "The type of the NBMA subnetwork address of this client.
        This object indicates how the values of
        nhrpClientNbmaAddr and nhrpClientNbmaSubaddr are to be
        interpreted."
    ::= { nhrpClientEntry 4 }

nhrpClientNbmaAddr OBJECT-TYPE
    SYNTAX      NhrpGenAddr
    MAX-ACCESS  read-create
    STATUS      current
```

DESCRIPTION

"The NBMA subnetwork address of this client."
::= { nhrpClientEntry 5 }

nhrpClientNbmaSubaddr OBJECT-TYPE

SYNTAX NhrpGenAddr

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The NBMA subaddress of this client. For NBMA address families without a subaddress concept, this will be a zero-length OCTET STRING."
::= { nhrpClientEntry 6 }

nhrpClientInitialRequestTimeout OBJECT-TYPE

SYNTAX Integer32 (1..900)

UNITS "seconds"

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The number of seconds that the client will wait before timing out an NHRP initial request. This object only has meaning for the initial timeout period."
DEFVAL { 10 }
::= { nhrpClientEntry 7 }

nhrpClientRegistrationRequestRetries OBJECT-TYPE

SYNTAX Integer32 (0..65535)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The number of times the client will retry the registration request before failure. A value of 0 means don't retry. A value of 65535 means retry forever."
DEFVAL { 3 }
::= { nhrpClientEntry 8 }

nhrpClientResolutionRequestRetries OBJECT-TYPE

SYNTAX Integer32 (0..65535)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The number of times the client will retry the resolution request before failure. A value of 0 means don't retry. A value of 65535 means retry forever."
DEFVAL { 3 }
::= { nhrpClientEntry 9 }

nhrpClientPurgeRequestRetries OBJECT-TYPE

SYNTAX Integer32 (0..65535)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The number of times the client will retry a purge request before failure. A value of 0 means don't retry. A value of 65535 means retry forever."

DEFVAL { 3 }

::= { nhrpClientEntry 10 }

nhrpClientDefaultMtu OBJECT-TYPE

SYNTAX Unsigned32 (0..65535)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The default maximum transmission unit (MTU) of the LIS/LAG which this client should use. This object will be initialized by the agent to the default MTU of the LIS/LAG (which is 9180) unless a different MTU value is specified during creation of this Client."

REFERENCE

"RFC 2225 [25], Classical IP and ARP over ATM, Section 7, DEFAULT VALUE FOR IP MTU OVER ATM AAL5."

DEFVAL { 9180 }

::= { nhrpClientEntry 11 }

nhrpClientHoldTime OBJECT-TYPE

SYNTAX Unsigned32(0..65535)

UNITS "seconds"

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The hold time the client will register."

DEFVAL { 900 }

::= { nhrpClientEntry 12 }

nhrpClientRequestID OBJECT-TYPE

SYNTAX Unsigned32

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The Request ID used to register this client with its server. According to Section 5.2.3 of the NHRP Specification, RFC 2332 [17], the Request ID must be kept in non-volatile storage, so that if an NHC crashes and re-initializes, it will use a different

Request ID during the registration process
when reregistering with the same NHS."

REFERENCE

"Section 5.2.3 NHRP Registration Request, RFC 2332 [17]."

::= { nhrpClientEntry 13 }

nhrpClientStorageType OBJECT-TYPE

SYNTAX StorageType

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This object defines whether this row is kept in volatile storage and lost upon a Client crash or reboot situation, or if this row is backed up by nonvolatile or permanent storage."

DEFVAL { nonVolatile }

::= { nhrpClientEntry 14 }

nhrpClientRowStatus OBJECT-TYPE

SYNTAX RowStatus

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"An object that allows entries in this table to be created and deleted using the RowStatus convention."

::= { nhrpClientEntry 15 }

--

-- The NHRP Client Registration Table

--

nhrpClientRegistrationTable OBJECT-TYPE

SYNTAX SEQUENCE OF NhrpClientRegistrationEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A table of Registration Request Information that needs to be maintained by the NHCs (clients)."

REFERENCE

"Section 5.2.3 NHRP Registration Request, RFC 2332 [17]."

::= { nhrpClientObjects 2 }

nhrpClientRegistrationEntry OBJECT-TYPE

SYNTAX NhrpClientRegistrationEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An NHC needs to maintain registration request information between the NHC and the NHS. An entry in this table represents information for a single registration request."

```
INDEX      { nhrpClientIndex,
              nhrpClientRegIndex
            }
 ::= { nhrpClientRegistrationTable 1 }
```

```
NhrpClientRegistrationEntry ::= SEQUENCE {
    nhrpClientRegIndex      Unsigned32,
    nhrpClientRegUniqueness INTEGER,
    nhrpClientRegState      INTEGER,
    nhrpClientRegRowStatus  RowStatus
}
```

nhrpClientRegIndex OBJECT-TYPE

```
SYNTAX      Unsigned32 (1..4294967295)
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
```

"An identifier for this entry such that it identifies a specific Registration Request from the NHC represented by the nhrpClientIndex."

```
::= { nhrpClientRegistrationEntry 1 }
```

nhrpClientRegUniqueness OBJECT-TYPE

```
SYNTAX      INTEGER {
                requestUnique(1),
                requestNotUnique(2)
            }
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION
```

"The Uniqueness indicator for this Registration Request. If this object has the value of requestUnique(1), then the Uniqueness bit is set in the the NHRP Registration Request represented by this row. The value cannot be changed once the row is created."

```
::= { nhrpClientRegistrationEntry 2 }
```

nhrpClientRegState OBJECT-TYPE

```
SYNTAX      INTEGER {
                other(1),
                registering(2),
                ackRegisterReply(3),
                nakRegisterReply(4)
            }
```

```

    }
MAX-ACCESS      read-only
STATUS          current
DESCRIPTION
    "The registration state of this client. The values are:
      'other(1)'          The state of the registration
                          request is not one of
                          'registering',
                          'ackRegisterReply' or
                          'nakRegisterReply'.

      'registering(2)'     A registration request has
                          been issued and a registration
                          reply is expected.

      'ackRegisterReply(3)' A positive registration reply
                          has been received.

      'nakRegisterReply(4)' The client has received a
                          negative registration
                          reply (NAK)."
```

::= { nhrpClientRegistrationEntry 3 }

nhrpClientRegRowStatus OBJECT-TYPE

```

SYNTAX          RowStatus
MAX-ACCESS      read-create
STATUS          current
DESCRIPTION
    "An object that allows entries in this table to be
     created and deleted using the RowStatus convention."
 ::= { nhrpClientRegistrationEntry 4 }
```

```

--
-- The NHRP Client->Server Table
--
```

nhrpClientNhsTable OBJECT-TYPE

```

SYNTAX          SEQUENCE OF NhrpClientNhsEntry
MAX-ACCESS      not-accessible
STATUS          current
DESCRIPTION
    "A table of NHCs that are available for use by this NHC
     (client). By default, the agent will add an entry to this
     table that corresponds to the client's default router."
 ::= { nhrpClientObjects 3 }
```

```

nhrpClientNhsEntry OBJECT-TYPE
    SYNTAX      NhrpClientNhsEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "An NHS that may be used by an NHC."
    INDEX       { nhrpClientIndex, nhrpClientNhsIndex }
    ::= { nhrpClientNhsTable 1 }

NhrpClientNhsEntry ::= SEQUENCE {
    nhrpClientNhsIndex                Unsigned32,
    nhrpClientNhsInternetNetworkAddrType  AddressFamilyNumbers,
    nhrpClientNhsInternetNetworkAddr      NhrpGenAddr,
    nhrpClientNhsNbmaAddrType             AddressFamilyNumbers,
    nhrpClientNhsNbmaAddr                 NhrpGenAddr,
    nhrpClientNhsNbmaSubaddr              NhrpGenAddr,
    nhrpClientNhsInUse                     TruthValue,
    nhrpClientNhsRowStatus                 RowStatus
}

nhrpClientNhsIndex OBJECT-TYPE
    SYNTAX      Unsigned32 (1..4294967295)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "An identifier for an NHS available to an NHC."
    ::= { nhrpClientNhsEntry 1 }

nhrpClientNhsInternetNetworkAddrType OBJECT-TYPE
    SYNTAX      AddressFamilyNumbers
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "The type of the internetwork layer address of the
        NHRP server represented in this entry. This object
        indicates how the value of
        nhrpClientNhsInternetNetworkAddr is to be interpreted."
    ::= { nhrpClientNhsEntry 2 }

nhrpClientNhsInternetNetworkAddr OBJECT-TYPE
    SYNTAX      NhrpGenAddr
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "The value of the destination internetwork layer
        address of the NHRP server represented by this

```


entry. If this value is not known, this will be
a zero-length OCTET STRING."
::= { nhrpClientNhsEntry 3 }

nhrpClientNhsNbmaAddrType OBJECT-TYPE

SYNTAX AddressFamilyNumbers

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The type of the NBMA subnetwork address of the NHRP
Server represented by this entry. This object indicates
how the values of nhrpClientNhsNbmaAddr and
nhrpClientNhsNbmaSubaddr are to be interpreted."

::= { nhrpClientNhsEntry 4 }

nhrpClientNhsNbmaAddr OBJECT-TYPE

SYNTAX NhrpGenAddr

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The NBMA subnetwork address of the NHS. The type of
the address is indicated by the corresponding value of
nhrpClientNhsNbmaAddrType."

::= { nhrpClientNhsEntry 5 }

nhrpClientNhsNbmaSubaddr OBJECT-TYPE

SYNTAX NhrpGenAddr

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The NBMA subaddress of the NHS. For NMBA address
families that do not have the concept of subaddress,
this will be a zero-length OCTET STRING."

::= { nhrpClientNhsEntry 6 }

nhrpClientNhsInUse OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"An indication of whether this NHS is in use by the NHC."

::= { nhrpClientNhsEntry 7 }

nhrpClientNhsRowStatus OBJECT-TYPE

SYNTAX RowStatus

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"An object that allows entries in this table to be created and deleted using the RowStatus convention."

::= { nhrpClientNhsEntry 8 }

--

-- The NHRP Client StatisticsTable

--

nhrpClientStatTable OBJECT-TYPE

SYNTAX SEQUENCE OF NhrpClientStatEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This table contains statistics collected by NHRP clients."

::= { nhrpClientObjects 4 }

nhrpClientStatEntry OBJECT-TYPE

SYNTAX NhrpClientStatEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"Statistics collected by a NHRP client."

INDEX { nhrpClientIndex }

::= { nhrpClientStatTable 1 }

NhrpClientStatEntry ::= SEQUENCE {

nhrpClientStatTxResolveReq Counter32,

nhrpClientStatRxResolveReplyAck Counter32,

nhrpClientStatRxResolveReplyNakProhibited Counter32,

nhrpClientStatRxResolveReplyNakInsufResources Counter32,

nhrpClientStatRxResolveReplyNakNoBinding Counter32,

nhrpClientStatRxResolveReplyNakNotUnique Counter32,

nhrpClientStatTxRegisterReq Counter32,

nhrpClientStatRxRegisterAck Counter32,

nhrpClientStatRxRegisterNakProhibited Counter32,

nhrpClientStatRxRegisterNakInsufResources Counter32,

nhrpClientStatRxRegisterNakAlreadyReg Counter32,

nhrpClientStatRxPurgeReq Counter32,

nhrpClientStatTxPurgeReq Counter32,

nhrpClientStatRxPurgeReply Counter32,

nhrpClientStatTxPurgeReply Counter32,

nhrpClientStatTxErrorIndication Counter32,

nhrpClientStatRxErrUnrecognizedExtension Counter32,

nhrpClientStatRxErrLoopDetected Counter32,

```

    nhrpClientStatRxErrProtoAddrUnreachable      Counter32,
    nhrpClientStatRxErrProtoError                Counter32,
    nhrpClientStatRxErrSduSizeExceeded           Counter32,
    nhrpClientStatRxErrInvalidExtension           Counter32,
    nhrpClientStatRxErrAuthenticationFailure      Counter32,
    nhrpClientStatRxErrHopCountExceeded           Counter32,
    nhrpClientStatDiscontinuityTime               TimeStamp
}

nhrpClientStatTxResolveReq OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of NHRP Resolution Requests transmitted
        by this client.

        Discontinuities in the value of this counter can occur
        at re-initialization of the management system, at
        NHRP Client re-initialization and at
        other times as indicated by the value of
        nhrpClientStatDiscontinuityTime."
    ::= { nhrpClientStatEntry 1 }

nhrpClientStatRxResolveReplyAck OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of positively acknowledged NHRP Resolution
        Replies received by this client.

        Discontinuities in the value of this counter can occur
        at re-initialization of the management system, at
        NHRP Client re-initialization and at
        other times as indicated by the value of
        nhrpClientStatDiscontinuityTime."
    ::= { nhrpClientStatEntry 2 }

nhrpClientStatRxResolveReplyNakProhibited OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of NAKed NHRP Resolution Replies received
        by this client that contained the code indicating
        'Administratively Prohibited'."

```

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Client re-initialization and at other times as indicated by the value of nhrpClientStatDiscontinuityTime."

::= { nhrpClientStatEntry 3 }

nhrpClientStatRxResolveReplyNakInsufResources OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NAKed NHRP Resolution Replies received by this client that contained the code indicating 'Insufficient Resources'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Client re-initialization and at other times as indicated by the value of nhrpClientStatDiscontinuityTime."

::= { nhrpClientStatEntry 4 }

nhrpClientStatRxResolveReplyNakNoBinding OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NAKed NHRP Resolution Replies received by this client that contained the code indicating 'No Internetworking Layer Address to NBMA Address Binding Exists'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Client re-initialization and at other times as indicated by the value of nhrpClientStatDiscontinuityTime."

::= { nhrpClientStatEntry 5 }

nhrpClientStatRxResolveReplyNakNotUnique OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NAKed NHRP Resolution Replies received by this client that contained the code indicating 'Binding Exists But Is Not Unique'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Client re-initialization and at other times as indicated by the value of nhrpClientStatDiscontinuityTime."

::= { nhrpClientStatEntry 6 }

nhrpClientStatTxRegisterReq OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NHRP Registration Requests transmitted by this client.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Client re-initialization and at other times as indicated by the value of nhrpClientStatDiscontinuityTime."

::= { nhrpClientStatEntry 7 }

nhrpClientStatRxRegisterAck OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of positively acknowledged NHRP Registration Replies received by this client.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Client re-initialization and at other times as indicated by the value of nhrpClientStatDiscontinuityTime."

::= { nhrpClientStatEntry 8 }

nhrpClientStatRxRegisterNakProhibited OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NAKed NHRP Registration Replies received by this client that contained the code indicating 'Administratively Prohibited'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Client re-initialization and at other times as indicated by the value of nhrpClientStatDiscontinuityTime."

::= { nhrpClientStatEntry 9 }

nhrpClientStatRxRegisterNakInsufResources OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NAKed NHRP Registration Replies received by this client that contained the code indicating 'Insufficient Resources'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Client re-initialization and at other times as indicated by the value of nhrpClientStatDiscontinuityTime."

::= { nhrpClientStatEntry 10 }

nhrpClientStatRxRegisterNakAlreadyReg OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NAKed NHRP Registration Replies received by this client that contained the code indicating 'Unique Internetworking Layer Address Already Registered'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Client re-initialization and at other times as indicated by the value of nhrpClientStatDiscontinuityTime."

::= { nhrpClientStatEntry 11 }

nhrpClientStatRxPurgeReq OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NHRP Purge Requests received by this client.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Client re-initialization and at other times as indicated by the value of nhrpClientStatDiscontinuityTime."

::= { nhrpClientStatEntry 12 }

nhrpClientStatTxPurgeReq OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NHRP Purge Requests transmitted by this client.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Client re-initialization and at other times as indicated by the value of nhrpClientStatDiscontinuityTime."

::= { nhrpClientStatEntry 13 }

nhrpClientStatRxPurgeReply OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NHRP Purge Replies received by this client.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Client re-initialization and at other times as indicated by the value of nhrpClientStatDiscontinuityTime."

::= { nhrpClientStatEntry 14 }

nhrpClientStatTxPurgeReply OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NHRP Purge Replies transmitted by this client.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Client re-initialization and at other times as indicated by the value of nhrpClientStatDiscontinuityTime."

::= { nhrpClientStatEntry 15 }

nhrpClientStatTxErrorIndication OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NHRP Error Indication packets transmitted by this client.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Client re-initialization and at other times as indicated by the value of nhrpClientStatDiscontinuityTime."

REFERENCE

"Section 5.2.7 NHRP Error Indication, RFC 2332 [17]."

::= { nhrpClientStatEntry 16 }

nhrpClientStatRxErrUnrecognizedExtension OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NHRP Error Indication packets received by this client with the error code 'Unrecognized Extension'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Client re-initialization and at other times as indicated by the value of nhrpClientStatDiscontinuityTime."

REFERENCE

"Section 5.2.7 NHRP Error Indication, RFC 2332 [17]."

::= { nhrpClientStatEntry 17 }

nhrpClientStatRxErrLoopDetected OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NHRP Error Indication packets received by this client with the error code 'NHRP Loop Detected'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Client re-initialization and at other times as indicated by the value of nhrpClientStatDiscontinuityTime."

REFERENCE

"Section 5.2.7 NHRP Error Indication, RFC 2332 [17]."
 ::= { nhrpClientStatEntry 18 }

nhrpClientStatRxErrProtoAddrUnreachable OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NHRP Error Indication packets received by this client with the error code 'Protocol Address Unreachable'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Client re-initialization and at other times as indicated by the value of nhrpClientStatDiscontinuityTime."

REFERENCE

"Section 5.2.7 NHRP Error Indication, RFC 2332 [17]."
 ::= { nhrpClientStatEntry 19 }

nhrpClientStatRxErrProtoError OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NHRP Error Indication packets received by this client with the error code 'Protocol Error'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Client re-initialization and at other times as indicated by the value of nhrpClientStatDiscontinuityTime."

REFERENCE

"Section 5.2.7 NHRP Error Indication, RFC 2332 [17]."
 ::= { nhrpClientStatEntry 20 }

`nhrpClientStatRxErrSduSizeExceeded OBJECT-TYPE``SYNTAX Counter32``MAX-ACCESS read-only``STATUS current``DESCRIPTION`

"The number of NHRP Error Indication packets received by this client with the error code 'NHRP SDU Size

Exceeded'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Client re-initialization and at other times as indicated by the value of `nhrpClientStatDiscontinuityTime`."

`REFERENCE`

"Section 5.2.7 NHRP Error Indication, RFC 2332 [17]."

::= { `nhrpClientStatEntry` 21 }

`nhrpClientStatRxErrInvalidExtension OBJECT-TYPE``SYNTAX Counter32``MAX-ACCESS read-only``STATUS current``DESCRIPTION`

"The number of NHRP Error Indication packets received by this client with the error code 'Invalid Extension'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Client re-initialization and at other times as indicated by the value of `nhrpClientStatDiscontinuityTime`."

`REFERENCE`

"Section 5.2.7 NHRP Error Indication, RFC 2332 [17]."

::= { `nhrpClientStatEntry` 22 }

`nhrpClientStatRxErrAuthenticationFailure OBJECT-TYPE``SYNTAX Counter32``MAX-ACCESS read-only``STATUS current``DESCRIPTION`

"The number of NHRP Error Indication packets received by this client with the error code 'Authentication Failure'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Client re-initialization and at other times as indicated by the value of nhrpClientStatDiscontinuityTime."

REFERENCE

"Section 5.2.7 NHRP Error Indication, RFC 2332 [17]."

::= { nhrpClientStatEntry 23 }

nhrpClientStatRxErrHopCountExceeded OBJECT-TYPE

SYNTAX Counter32
MAX-ACCESS read-only
STATUS current

DESCRIPTION

"The number of NHRP Error Indication packets received by this client with the error code 'Hop Count Exceeded'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Client re-initialization and at other times as indicated by the value of nhrpClientStatDiscontinuityTime."

REFERENCE

"Section 5.2.7 NHRP Error Indication, RFC 2332 [17]."

::= { nhrpClientStatEntry 24 }

nhrpClientStatDiscontinuityTime OBJECT-TYPE

SYNTAX TimeStamp
MAX-ACCESS read-only
STATUS current

DESCRIPTION

"The value of sysUpTime on the most recent occasion at which any one or more of this Client's counters suffered a discontinuity. If no such discontinuities have occurred since the last re-initialization of the local management subsystem or the NHRP Client re-initialization associated with this entry, then this object contains a zero value."

REFERENCE

"RFC 2233 [18]."

::= { nhrpClientStatEntry 25 }

```

--*****
-- NHRP Server Objects
--*****

nhrpServerObjects OBJECT IDENTIFIER ::= { nhrpObjects 3 }

--
-- The NHRP Next Hop Server Table
--

nhrpServerTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF NhrpServerEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "This table contains information for a set of NHSes
         associated with this agent."
    ::= { nhrpServerObjects 1 }

nhrpServerEntry OBJECT-TYPE
    SYNTAX      NhrpServerEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Information about a single NHS."
    INDEX       { nhrpServerIndex }
    ::= { nhrpServerTable 1 }

NhrpServerEntry ::= SEQUENCE {
    nhrpServerIndex                Unsigned32,
    nhrpServerInternetNetworkAddrType  AddressFamilyNumbers,
    nhrpServerInternetNetworkAddr      NhrpGenAddr,
    nhrpServerNbmaAddrType             AddressFamilyNumbers,
    nhrpServerNbmaAddr                 NhrpGenAddr,
    nhrpServerNbmaSubaddr              NhrpGenAddr,
    nhrpServerStorageType              StorageType,
    nhrpServerRowStatus                RowStatus
}

nhrpServerIndex OBJECT-TYPE
    SYNTAX      Unsigned32 (1..4294967295)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "An identifier for the server that is unique within the
         scope of this agent."
    ::= { nhrpServerEntry 1 }

```

```
nhrpServerInternetworkAddrType OBJECT-TYPE
    SYNTAX      AddressFamilyNumbers
    MAX-ACCESS   read-create
    STATUS       current
    DESCRIPTION
        "The type of the internetwork layer address of this
        server. This object is used to interpret the value of
        nhrpServerInternetworkAddr."
    ::= { nhrpServerEntry 2 }

nhrpServerInternetworkAddr OBJECT-TYPE
    SYNTAX      NhrpGenAddr
    MAX-ACCESS   read-create
    STATUS       current
    DESCRIPTION
        "The value of the internetwork layer address of this
        server."
    ::= { nhrpServerEntry 3 }

nhrpServerNbmaAddrType OBJECT-TYPE
    SYNTAX      AddressFamilyNumbers
    MAX-ACCESS   read-create
    STATUS       current
    DESCRIPTION
        "The type of the NBMA subnetwork address of this server.
        This object is used to interpret the value of
        nhrpServerNbmaAddr."
    ::= { nhrpServerEntry 4 }

nhrpServerNbmaAddr OBJECT-TYPE
    SYNTAX      NhrpGenAddr
    MAX-ACCESS   read-create
    STATUS       current
    DESCRIPTION
        "The value of the NBMA subnetwork address of this
        server."
    ::= { nhrpServerEntry 5 }

nhrpServerNbmaSubaddr OBJECT-TYPE
    SYNTAX      NhrpGenAddr
    MAX-ACCESS   read-create
    STATUS       current
    DESCRIPTION
        "The value of the NBMA subaddress of this server.
        For NBMA address families without a subaddress
        concept, this will be a zero-length OCTET STRING."
    ::= { nhrpServerEntry 6 }
```

nhrpServerStorageType OBJECT-TYPE

SYNTAX StorageType

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This object defines whether this row is kept in volatile storage and lost upon a Server crash or reboot situation, or if this row is backed up by nonvolatile or permanent storage."

DEFVAL { nonVolatile }

::= { nhrpServerEntry 7 }

nhrpServerRowStatus OBJECT-TYPE

SYNTAX RowStatus

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"An object that allows entries in this table to be created and deleted using the RowStatus convention."

::= { nhrpServerEntry 8 }

--

-- The Server Cache Table

--

nhrpServerCacheTable OBJECT-TYPE

SYNTAX SEQUENCE OF NhrpServerCacheEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This table extends the nhrpCacheTable for NHSes. If the nhrpCacheTable has a row added due to an NHS or based on information regarding an NHS then a row is also added in this table.

The rows in this table will be created when rows in the nhrpCacheTable are created. However, there may be rows created in the nhrpCacheTable which do not have corresponding rows in this table. For example, if the nhrpCacheTable has a row added due to a Next Hop Client which is co-resident on the same device as the NHS, a row will not be added to this table."

::= { nhrpServerObjects 2 }

nhrpServerCacheEntry OBJECT-TYPE

SYNTAX NhrpServerCacheEntry

MAX-ACCESS not-accessible

STATUS current

```

DESCRIPTION
    "Additional information kept by a NHS for a relevant
    Next Hop Resolution Cache entry."
INDEX      {
            nhrpCacheInternetNetworkAddrType,
            nhrpCacheInternetNetworkAddr,
            ifIndex,
            nhrpCacheIndex
            }
 ::= { nhrpServerCacheTable 1 }

NhrpServerCacheEntry ::= SEQUENCE {
    nhrpServerCacheAuthoritative TruthValue,
    nhrpServerCacheUniqueness    TruthValue
}

nhrpServerCacheAuthoritative OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "An indication of whether this cache entry is
        authoritative, which means the entry was added because
        of a direct registration request with this server or
        by Server Cache Synchronization Protocol (SCSP) from
        an authoritative source."
    ::= { nhrpServerCacheEntry 1 }

nhrpServerCacheUniqueness OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "The Uniqueness indicator for this cache
        entry used in duplicate address detection. This value
        cannot be changed after the entry is active."
    ::= { nhrpServerCacheEntry 2 }

--
-- The NHRP Server->Client Table
--

nhrpServerNhcTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF NhrpServerNhcEntry
    MAX-ACCESS  not-accessible
    STATUS      current

```

DESCRIPTION

"A table of NHCs that are available for use by this NHS (Server)."

REFERENCE

"Section 4 Configuration (Next Hop Servers),
RFC 2332 [17]."

::= { nhrpServerObjects 3 }

nhrpServerNhcEntry OBJECT-TYPE

SYNTAX NhrpServerNhcEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An NHC that may be used by an NHS."

INDEX { nhrpServerIndex, nhrpServerNhcIndex }

::= { nhrpServerNhcTable 1 }

NhrpServerNhcEntry ::= SEQUENCE {

nhrpServerNhcIndex	Unsigned32,
nhrpServerNhcPrefixLength	Integer32,
nhrpServerNhcInternetNetworkAddrType	AddressFamilyNumbers,
nhrpServerNhcInternetNetworkAddr	NhrpGenAddr,
nhrpServerNhcNbmaAddrType	AddressFamilyNumbers,
nhrpServerNhcNbmaAddr	NhrpGenAddr,
nhrpServerNhcNbmaSubaddr	NhrpGenAddr,
nhrpServerNhcInUse	TruthValue,
nhrpServerNhcRowStatus	RowStatus

}

nhrpServerNhcIndex OBJECT-TYPE

SYNTAX Unsigned32 (1..4294967295)

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An identifier for an NHC available to an NHS."

::= { nhrpServerNhcEntry 1 }

nhrpServerNhcPrefixLength OBJECT-TYPE

SYNTAX Integer32 (0..255)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The number of bits that define the internetwork layer prefix associated with the nhrpServerNhcInternetNetworkAddr."

::= { nhrpServerNhcEntry 2 }

nhrpServerNhcInternetNetworkAddrType OBJECT-TYPE

SYNTAX AddressFamilyNumbers

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The type of the internetwork layer address of the NHRP Client represented in this entry. This object indicates how the value of nhrpServerNhcInternetNetworkAddr is to be interpreted."

::= { nhrpServerNhcEntry 3 }

nhrpServerNhcInternetNetworkAddr OBJECT-TYPE

SYNTAX NhrpGenAddr

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The value of the internetwork layer address of the NHRP Client represented by this entry. If this value is not known, this will be a zero-length OCTET STRING."

::= { nhrpServerNhcEntry 4 }

nhrpServerNhcNbmaAddrType OBJECT-TYPE

SYNTAX AddressFamilyNumbers

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The type of the NBMA subnetwork address of the NHRP Client represented by this entry. This object indicates how the values of nhrpServerNhcNbmaAddr and nhrpServerNhcNbmaSubaddr are to be interpreted."

::= { nhrpServerNhcEntry 5 }

nhrpServerNhcNbmaAddr OBJECT-TYPE

SYNTAX NhrpGenAddr

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The NBMA subnetwork address of the NHC. The type of the address is indicated by the corresponding value of nhrpServerNbmaAddrType."

::= { nhrpServerNhcEntry 6 }

nhrpServerNhcNbmaSubaddr OBJECT-TYPE

SYNTAX NhrpGenAddr

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The NBMA subaddress of the NHC. For NMBA address families that do not have the concept of subaddress, this will be a zero-length OCTET STRING."

::= { nhrpServerNhcEntry 7 }

nhrpServerNhcInUse OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"An indication of whether this NHC is in use by the NHS."

::= { nhrpServerNhcEntry 8 }

nhrpServerNhcRowStatus OBJECT-TYPE

SYNTAX RowStatus

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"An object that allows entries in this table to be created and deleted using the RowStatus convention."

::= { nhrpServerNhcEntry 9 }

--

-- The Next Hop Server Statistics Table

--

nhrpServerStatTable OBJECT-TYPE

SYNTAX SEQUENCE OF NhrpServerStatEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"Statistics collected by Next Hop Servers."

::= { nhrpServerObjects 4 }

nhrpServerStatEntry OBJECT-TYPE

SYNTAX NhrpServerStatEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"Statistics for a particular NHS. The statistics are broken into received (Rx), transmitted (Tx) and forwarded (Fw). Forwarded (Fw) would be done by a transit NHS."

INDEX { nhrpServerIndex }

::= { nhrpServerStatTable 1 }

```

NhrpServerStatEntry ::= SEQUENCE {
    nhrpServerStatRxResolveReq          Counter32,
    nhrpServerStatTxResolveReplyAck     Counter32,
    nhrpServerStatTxResolveReplyNakProhibited Counter32,
    nhrpServerStatTxResolveReplyNakInsufResources Counter32,
    nhrpServerStatTxResolveReplyNakNoBinding Counter32,
    nhrpServerStatTxResolveReplyNakNotUnique Counter32,

    nhrpServerStatRxRegisterReq        Counter32,
    nhrpServerStatTxRegisterAck         Counter32,
    nhrpServerStatTxRegisterNakProhibited Counter32,
    nhrpServerStatTxRegisterNakInsufResources Counter32,
    nhrpServerStatTxRegisterNakAlreadyReg Counter32,

    nhrpServerStatRxPurgeReq           Counter32,
    nhrpServerStatTxPurgeReq           Counter32,
    nhrpServerStatRxPurgeReply         Counter32,
    nhrpServerStatTxPurgeReply         Counter32,

    -- Error Indications
    nhrpServerStatRxErrUnrecognizedExtension Counter32,
    nhrpServerStatRxErrLoopDetected         Counter32,
    nhrpServerStatRxErrProtoAddrUnreachable Counter32,
    nhrpServerStatRxErrProtoError           Counter32,
    nhrpServerStatRxErrSduSizeExceeded      Counter32,
    nhrpServerStatRxErrInvalidExtension     Counter32,
    nhrpServerStatRxErrInvalidResReplyReceived Counter32,
    nhrpServerStatRxErrAuthenticationFailure Counter32,
    nhrpServerStatRxErrHopCountExceeded     Counter32,

    nhrpServerStatTxErrUnrecognizedExtension Counter32,
    nhrpServerStatTxErrLoopDetected         Counter32,
    nhrpServerStatTxErrProtoAddrUnreachable Counter32,
    nhrpServerStatTxErrProtoError           Counter32,
    nhrpServerStatTxErrSduSizeExceeded      Counter32,
    nhrpServerStatTxErrInvalidExtension     Counter32,
    nhrpServerStatTxErrAuthenticationFailure Counter32,
    nhrpServerStatTxErrHopCountExceeded     Counter32,

    -- Transit NHS statistics
    nhrpServerStatFwResolveReq           Counter32,
    nhrpServerStatFwResolveReply         Counter32,
    nhrpServerStatFwRegisterReq          Counter32,
    nhrpServerStatFwRegisterReply        Counter32,
    nhrpServerStatFwPurgeReq             Counter32,
    nhrpServerStatFwPurgeReply           Counter32,
    nhrpServerStatFwErrorIndication       Counter32,
    nhrpServerStatDiscontinuityTime      TimeStamp

```

}

nhrpServerStatRxResolveReq OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NHRP Resolution Requests received by this server.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of nhrpServerStatDiscontinuityTime."

::= { nhrpServerStatEntry 1 }

nhrpServerStatTxResolveReplyAck OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of positively acknowledged NHRP Resolution Replies transmitted by this server.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of nhrpServerStatDiscontinuityTime."

::= { nhrpServerStatEntry 2 }

nhrpServerStatTxResolveReplyNakProhibited OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NAKed NHRP Resolution Replies transmitted by this server with the code 'Administratively Prohibited'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of nhrpServerStatDiscontinuityTime."

::= { nhrpServerStatEntry 3 }

`nhrpServerStatTxResolveReplyNakInsufResources OBJECT-TYPE``SYNTAX Counter32``MAX-ACCESS read-only``STATUS current``DESCRIPTION`

"The number of NAKed NHRP Resolution Replies transmitted by this server with the code 'Insufficient Resources'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of `nhrpServerStatDiscontinuityTime`."

::= { `nhrpServerStatEntry` 4 }

`nhrpServerStatTxResolveReplyNakNoBinding OBJECT-TYPE``SYNTAX Counter32``MAX-ACCESS read-only``STATUS current``DESCRIPTION`

"The number of NAKed NHRP Resolution Replies transmitted by this server with the code 'No Internetworking Layer Address to NBMA Address Binding Exists'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of `nhrpServerStatDiscontinuityTime`."

::= { `nhrpServerStatEntry` 5 }

`nhrpServerStatTxResolveReplyNakNotUnique OBJECT-TYPE``SYNTAX Counter32``MAX-ACCESS read-only``STATUS current``DESCRIPTION`

"The number of NAKed NHRP Resolution Replies transmitted by this server with the code 'Binding Exists But Is Not Unique'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of `nhrpServerStatDiscontinuityTime`."

::= { `nhrpServerStatEntry` 6 }

`nhrpServerStatRxRegisterReq OBJECT-TYPE``SYNTAX Counter32``MAX-ACCESS read-only``STATUS current``DESCRIPTION`

"The number of NHRP Registration Requests received by this server.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of `nhrpServerStatDiscontinuityTime`."

::= { nhrpServerStatEntry 7 }

`nhrpServerStatTxRegisterAck OBJECT-TYPE``SYNTAX Counter32``MAX-ACCESS read-only``STATUS current``DESCRIPTION`

"The number of positively acknowledged NHRP Registration Replies transmitted by this server.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of `nhrpServerStatDiscontinuityTime`."

::= { nhrpServerStatEntry 8 }

`nhrpServerStatTxRegisterNakProhibited OBJECT-TYPE``SYNTAX Counter32``MAX-ACCESS read-only``STATUS current``DESCRIPTION`

"The number of NAKed NHRP Registration Replies transmitted by this server with the code 'Administratively Prohibited'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of `nhrpServerStatDiscontinuityTime`."

::= { nhrpServerStatEntry 9 }

nhrpServerStatTxRegisterNakInsufResources OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NAKed NHRP Registration Replies transmitted by this server with the code 'Insufficient Resources'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of nhrpServerStatDiscontinuityTime."

::= { nhrpServerStatEntry 10 }

nhrpServerStatTxRegisterNakAlreadyReg OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NAKed NHRP Registration Replies transmitted by this server with the code 'Unique Internetworking Layer Address Already Registered'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of nhrpServerStatDiscontinuityTime."

::= { nhrpServerStatEntry 11 }

nhrpServerStatRxPurgeReq OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NHRP Purge Requests received by this server.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of nhrpServerStatDiscontinuityTime."

::= { nhrpServerStatEntry 12 }

nhrpServerStatTxPurgeReq OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NHRP Purge Requests transmitted by this server.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of nhrpServerStatDiscontinuityTime."

::= { nhrpServerStatEntry 13 }

nhrpServerStatRxPurgeReply OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NHRP Purge Replies received by this server.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of nhrpServerStatDiscontinuityTime."

::= { nhrpServerStatEntry 14 }

nhrpServerStatTxPurgeReply OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NHRP Purge Replies transmitted by this server.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of nhrpServerStatDiscontinuityTime."

::= { nhrpServerStatEntry 15 }

nhrpServerStatRxErrUnrecognizedExtension OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current
DESCRIPTION
"The number of NHRP Error Indication packets received
by this server with the error code

'Unrecognized Extension'.

Discontinuities in the value of this counter can occur
at re-initialization of the management system, at
NHRP Server re-initialization and at
other times as indicated by the value of
nhrpServerStatDiscontinuityTime."

REFERENCE
"Section 5.2.7 NHRP Error Indication, RFC 2332 [17]."
::= { nhrpServerStatEntry 16 }

nhrpServerStatRxErrLoopDetected OBJECT-TYPE

SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of NHRP Error Indication packets received
by this server with the error code 'NHRP Loop Detected'.

Discontinuities in the value of this counter can occur
at re-initialization of the management system, at
NHRP Server re-initialization and at
other times as indicated by the value of
nhrpServerStatDiscontinuityTime."

REFERENCE
"Section 5.2.7 NHRP Error Indication, RFC 2332 [17]."
::= { nhrpServerStatEntry 17 }

nhrpServerStatRxErrProtoAddrUnreachable OBJECT-TYPE

SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of NHRP Error Indication packets received
by this server with the error code 'Protocol Address
Unreachable'.

Discontinuities in the value of this counter can occur
at re-initialization of the management system, at
NHRP Server re-initialization and at
other times as indicated by the value of
nhrpServerStatDiscontinuityTime."

REFERENCE

"Section 5.2.7 NHRP Error Indication, RFC 2332 [17]."
::= { nhrpServerStatEntry 18 }

nhrpServerStatRxErrProtoError OBJECT-TYPE

SYNTAX Counter32
MAX-ACCESS read-only
STATUS current

DESCRIPTION

"The number of NHRP Error Indication packets received by this server with the error code 'Protocol Error'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of nhrpServerStatDiscontinuityTime."

REFERENCE

"Section 5.2.7 NHRP Error Indication, RFC 2332 [17]."
::= { nhrpServerStatEntry 19 }

nhrpServerStatRxErrSduSizeExceeded OBJECT-TYPE

SYNTAX Counter32
MAX-ACCESS read-only
STATUS current

DESCRIPTION

"The number of NHRP Error Indication packets received by this server with the error code 'NHRP SDU Size Exceeded'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of nhrpServerStatDiscontinuityTime."

REFERENCE

"Section 5.2.7 NHRP Error Indication, RFC 2332 [17]."
::= { nhrpServerStatEntry 20 }

nhrpServerStatRxErrInvalidExtension OBJECT-TYPE

SYNTAX Counter32
MAX-ACCESS read-only
STATUS current

DESCRIPTION

"The number of NHRP Error Indication packets received by this server with the error code 'Invalid Extension'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of nhrpServerStatDiscontinuityTime."

REFERENCE

"Section 5.2.7 NHRP Error Indication, RFC 2332 [17]."

::= { nhrpServerStatEntry 21 }

nhrpServerStatRxErrInvalidResReplyReceived OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NHRP Error Indication packets received by this server with the error code 'Invalid Resolution Reply Received'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of nhrpServerStatDiscontinuityTime."

REFERENCE

"Section 5.2.7 NHRP Error Indication, RFC 2332 [17]."

::= { nhrpServerStatEntry 22 }

nhrpServerStatRxErrAuthenticationFailure OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NHRP Error Indication packets received by this server with the error code 'Authentication Failure'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of nhrpServerStatDiscontinuityTime."

REFERENCE

"Section 5.2.7 NHRP Error Indication, RFC 2332 [17]."

::= { nhrpServerStatEntry 23 }

`nhrpServerStatRxErrHopCountExceeded OBJECT-TYPE``SYNTAX Counter32``MAX-ACCESS read-only``STATUS current``DESCRIPTION`

"The number of NHRP Error Indication packets received by this server with the error code 'Hop Count Exceeded'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of `nhrpServerStatDiscontinuityTime`."

`REFERENCE`

"Section 5.2.7 NHRP Error Indication, RFC 2332 [17]."

::= { nhrpServerStatEntry 24 }

`nhrpServerStatTxErrUnrecognizedExtension OBJECT-TYPE``SYNTAX Counter32``MAX-ACCESS read-only``STATUS current``DESCRIPTION`

"The number of NHRP Error Indication packets transmitted by this server with the error code 'Unrecognized Extension'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of `nhrpServerStatDiscontinuityTime`."

`REFERENCE`

"Section 5.2.7 NHRP Error Indication, RFC 2332 [17]."

::= { nhrpServerStatEntry 25 }

`nhrpServerStatTxErrLoopDetected OBJECT-TYPE``SYNTAX Counter32``MAX-ACCESS read-only``STATUS current``DESCRIPTION`

"The number of NHRP Error Indication packets transmitted by this server with the error code 'NHRP Loop Detected'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of nhrpServerStatDiscontinuityTime."

REFERENCE

"Section 5.2.7 NHRP Error Indication, RFC 2332 [17]."

::= { nhrpServerStatEntry 26 }

nhrpServerStatTxErrProtoAddrUnreachable OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NHRP Error Indication packets transmitted by this server with the error code 'Protocol Address Unreachable'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of nhrpServerStatDiscontinuityTime."

REFERENCE

"Section 5.2.7 NHRP Error Indication, RFC 2332 [17]."

::= { nhrpServerStatEntry 27 }

nhrpServerStatTxErrProtoError OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NHRP Error Indication packets transmitted by this server with the error code 'Protocol Error'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of nhrpServerStatDiscontinuityTime."

REFERENCE

"Section 5.2.7 NHRP Error Indication, RFC 2332 [17]."

::= { nhrpServerStatEntry 28 }

nhrpServerStatTxErrSduSizeExceeded OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NHRP Error Indication packets transmitted by this server with the error code 'NHRP SDU Size Exceeded'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of nhrpServerStatDiscontinuityTime."

REFERENCE

"Section 5.2.7 NHRP Error Indication, RFC 2332 [17]."

::= { nhrpServerStatEntry 29 }

nhrpServerStatTxErrInvalidExtension OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NHRP Error Indication packets transmitted by this server with the error code

'Invalid Extension'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of nhrpServerStatDiscontinuityTime."

REFERENCE

"Section 5.2.7 NHRP Error Indication, RFC 2332 [17]."

::= { nhrpServerStatEntry 30 }

nhrpServerStatTxErrAuthenticationFailure OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NHRP Error Indication packets transmitted by this server with the error code 'Authentication Failure'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of nhrpServerStatDiscontinuityTime."

REFERENCE

"Section 5.2.7 NHRP Error Indication, RFC 2332 [17]."

::= { nhrpServerStatEntry 31 }

nhrpServerStatTxErrHopCountExceeded OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NHRP Error Indication packets transmitted by this server with the error code 'Hop Count Exceeded'.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of nhrpServerStatDiscontinuityTime."

REFERENCE

"Section 5.2.7 NHRP Error Indication, RFC 2332 [17]."

::= { nhrpServerStatEntry 32 }

nhrpServerStatFwResolveReq OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NHRP Resolution Requests forwarded by this server acting as a transit NHS.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of nhrpServerStatDiscontinuityTime."

::= { nhrpServerStatEntry 33 }

nhrpServerStatFwResolveReply OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NHRP Resolution Replies forwarded by this server acting as a transit NHS.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of nhrpServerStatDiscontinuityTime."

::= { nhrpServerStatEntry 34 }

nhrpServerStatFwRegisterReq OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NHRP Registration Requests forwarded by this server acting as a transit NHS.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of nhrpServerStatDiscontinuityTime."

::= { nhrpServerStatEntry 35 }

nhrpServerStatFwRegisterReply OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NHRP Registration Replies forwarded by this server acting as a transit NHS.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of nhrpServerStatDiscontinuityTime."

::= { nhrpServerStatEntry 36 }

nhrpServerStatFwPurgeReq OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NHRP Purge Requests forwarded by this server acting as a transit NHS.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of nhrpServerStatDiscontinuityTime."

::= { nhrpServerStatEntry 37 }

nhrpServerStatFwPurgeReply OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NHRP Purge Replies forwarded by this server acting as a transit NHS.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of nhrpServerStatDiscontinuityTime."

::= { nhrpServerStatEntry 38 }

nhrpServerStatFwErrorIndication OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of NHRP Error Indication packets forwarded by this server acting as a transit NHS.

Discontinuities in the value of this counter can occur at re-initialization of the management system, at NHRP Server re-initialization and at other times as indicated by the value of nhrpServerStatDiscontinuityTime."

::= { nhrpServerStatEntry 39 }

nhrpServerStatDiscontinuityTime OBJECT-TYPE

SYNTAX TimeStamp

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of sysUpTime on the most recent occasion at which any one or more of this Server's counters suffered a discontinuity. If no such discontinuities have occurred since the last re-initialization of the

local management subsystem or the NHRP Server
re-initialization associated with this entry, then
this object contains a zero value."

REFERENCE

"RFC 2233 [18]."

::= { nhrpServerStatEntry 40 }

```
--*****
-- Module Compliance Statement
--*****
```

nhrpConformance OBJECT IDENTIFIER ::= { nhrpMIB 2 }

nhrpCompliances
OBJECT IDENTIFIER ::= { nhrpConformance 1 }

nhrpGroups
OBJECT IDENTIFIER ::= { nhrpConformance 2 }

nhrpModuleCompliance MODULE-COMPLIANCE
STATUS current
DESCRIPTION
"The compliance statement for the NHRP MIB."
MODULE -- this module
MANDATORY-GROUPS { nhrpGeneralGroup }

GROUP nhrpClientGroup
DESCRIPTION
"This group must be supported only by stations that
are NHRP clients."

GROUP nhrpServerGroup
DESCRIPTION
"This group must be supported only by stations that
are NHRP servers."

::= { nhrpCompliances 1 }

nhrpGeneralGroup OBJECT-GROUP
OBJECTS {

nhrpNextIndex,
nhrpCachePrefixLength,
nhrpCacheNextHopInternetNetworkAddr,
nhrpCacheNbmaAddrType,
nhrpCacheNbmaAddr,
nhrpCacheNbmaSubaddr,
nhrpCacheType,
nhrpCacheState,

```

    nhrpCacheHoldingTimeValid,
    nhrpCacheHoldingTime,
    nhrpCacheNegotiatedMtu,
    nhrpCachePreference,
    nhrpCacheStorageType,
    nhrpCacheRowStatus,
    nhrpPurgeCacheIdentifier,
    nhrpPurgePrefixLength,
    nhrpPurgeRequestID,
    nhrpPurgeReplyExpected,
    nhrpPurgeRowStatus
}
STATUS      current
DESCRIPTION
    "Objects that apply to both NHRP clients and NHRP
    servers."
 ::= { nhrpGroups 1 }

```

nhrpClientGroup OBJECT-GROUP

```

OBJECTS {
    nhrpClientInternetworkAddrType,
    nhrpClientInternetworkAddr,
    nhrpClientNbmaAddrType,
    nhrpClientNbmaAddr,
    nhrpClientNbmaSubaddr,
    nhrpClientInitialRequestTimeout,
    nhrpClientRegistrationRequestRetries,
    nhrpClientResolutionRequestRetries,
    nhrpClientPurgeRequestRetries,
    nhrpClientDefaultMtu,
    nhrpClientHoldTime,
    nhrpClientRequestID,
    nhrpClientStorageType,
    nhrpClientRowStatus,
    nhrpClientRegUniqueness,
    nhrpClientRegState,
    nhrpClientRegRowStatus,
    nhrpClientNhsInternetworkAddrType,
    nhrpClientNhsInternetworkAddr,
    nhrpClientNhsNbmaAddrType,
    nhrpClientNhsNbmaAddr,
    nhrpClientNhsNbmaSubaddr,

    nhrpClientNhsInUse,
    nhrpClientNhsRowStatus,
    nhrpClientStatTxResolveReq,
    nhrpClientStatRxResolveReplyAck,
    nhrpClientStatRxResolveReplyNakProhibited,

```

```

    nhrpClientStatRxResolveReplyNakInsufResources,
    nhrpClientStatRxResolveReplyNakNoBinding,
    nhrpClientStatRxResolveReplyNakNotUnique,
    nhrpClientStatTxRegisterReq,
    nhrpClientStatRxRegisterAck,
    nhrpClientStatRxRegisterNakProhibited,
    nhrpClientStatRxRegisterNakInsufResources,
    nhrpClientStatRxRegisterNakAlreadyReg,
    nhrpClientStatRxPurgeReq,
    nhrpClientStatTxPurgeReq,
    nhrpClientStatRxPurgeReply,
    nhrpClientStatTxPurgeReply,
    nhrpClientStatTxErrorIndication,
    nhrpClientStatRxErrUnrecognizedExtension,
    nhrpClientStatRxErrLoopDetected,
    nhrpClientStatRxErrProtoAddrUnreachable,
    nhrpClientStatRxErrProtoError,
    nhrpClientStatRxErrSduSizeExceeded,
    nhrpClientStatRxErrInvalidExtension,
    nhrpClientStatRxErrAuthenticationFailure,
    nhrpClientStatRxErrHopCountExceeded,
    nhrpClientStatDiscontinuityTime
}
STATUS      current
DESCRIPTION
    "Objects that apply only to NHRP clients."
 ::= { nhrpGroups 2 }

```

nhrpServerGroup OBJECT-GROUP

```

OBJECTS {
    nhrpServerInternetNetworkAddrType,
    nhrpServerInternetNetworkAddr,
    nhrpServerNbmaAddrType,
    nhrpServerNbmaAddr,
    nhrpServerNbmaSubaddr,
    nhrpServerStorageType,
    nhrpServerRowStatus,
    nhrpServerCacheAuthoritative,
    nhrpServerCacheUniqueness,
    nhrpServerNhcPrefixLength,
    nhrpServerNhcInternetNetworkAddrType,
    nhrpServerNhcInternetNetworkAddr,
    nhrpServerNhcNbmaAddrType,
    nhrpServerNhcNbmaAddr,
    nhrpServerNhcNbmaSubaddr,
    nhrpServerNhcInUse,
    nhrpServerNhcRowStatus,
    nhrpServerStatRxResolveReq,

```

```

    nhrpServerStatTxResolveReplyAck,
    nhrpServerStatTxResolveReplyNakProhibited,
    nhrpServerStatTxResolveReplyNakInsufResources,
    nhrpServerStatTxResolveReplyNakNoBinding,
    nhrpServerStatTxResolveReplyNakNotUnique,
    nhrpServerStatRxRegisterReq,
    nhrpServerStatTxRegisterAck,
    nhrpServerStatTxRegisterNakProhibited,
    nhrpServerStatTxRegisterNakInsufResources,
    nhrpServerStatTxRegisterNakAlreadyReg,
    nhrpServerStatRxPurgeReq,
    nhrpServerStatTxPurgeReq,
    nhrpServerStatRxPurgeReply,
    nhrpServerStatTxPurgeReply,
    nhrpServerStatRxErrUnrecognizedExtension,
    nhrpServerStatRxErrLoopDetected,
    nhrpServerStatRxErrProtoAddrUnreachable,
    nhrpServerStatRxErrProtoError,
    nhrpServerStatRxErrSduSizeExceeded,
    nhrpServerStatRxErrInvalidExtension,
    nhrpServerStatRxErrInvalidResReplyReceived,
    nhrpServerStatRxErrAuthenticationFailure,
    nhrpServerStatRxErrHopCountExceeded,
    nhrpServerStatTxErrUnrecognizedExtension,
    nhrpServerStatTxErrLoopDetected,
    nhrpServerStatTxErrProtoAddrUnreachable,
    nhrpServerStatTxErrProtoError,
    nhrpServerStatTxErrSduSizeExceeded,
    nhrpServerStatTxErrInvalidExtension,
    nhrpServerStatTxErrAuthenticationFailure,
    nhrpServerStatTxErrHopCountExceeded,
    nhrpServerStatFwResolveReq,
    nhrpServerStatFwResolveReply,
    nhrpServerStatFwRegisterReq,
    nhrpServerStatFwRegisterReply,
    nhrpServerStatFwPurgeReq,
    nhrpServerStatFwPurgeReply,
    nhrpServerStatFwErrorIndication,
    nhrpServerStatDiscontinuityTime
}
STATUS      current
DESCRIPTION
    "Objects that apply only to NHRP servers."
 ::= { nhrpGroups 3 }

```

END

5. IANA Considerations

The Internet Assigned Numbers Authority (IANA) has been and continues to be responsible for maintaining the ADDRESS FAMILY NUMBERS (<http://www.isi.edu/in-notes/iana/assignments/address-family-numbers>) name space assignments. The IANA has placed this list in a MIB module, such that it may be imported into other MIBs. The motivation for doing this is to allow MIBs to not have to change when a new assignment is made to the ADDRESS FAMILY NUMBERS. This is very similar to the motivation behind the IANAifType-MIB.

Any additions or changes to the list of ADDRESS FAMILY NUMBERS registered via IANA will be done as they have in the past and this document does not propose any changes to the ADDRESS FAMILY NUMBERS other than to place them into a MIB, which can be found via anonymous FTP at: <ftp://ftp.isi.edu/mib/ianaaddressfamilynumbers.mib>.

6. Security

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.

The NHRP Protocol, RFC 2332 [17], Section 5.2.4.4 discusses security. There is an authentication option which should be utilized to authenticate the source and also provide data integrity to the NHRP payload. This MIB does not contain any managed objects which configure or expose security information such as that needed for NHRP authentication or data integrity.

The following items were deemed to jeopardize security and thus, were NOT added to this MIB. Items denoted as (configurable) are those which would need values. Items denoted as (read-only) are those which would provide information. Although the NHRP Protocol [17], requires or has this information, exposing it in a MIB would jeopardize the entire NBMA domain where NHRP was being used. Therefore, these items have been omitted from the MIB.

1. (configurable) enable/disable security
2. (configurable) SPI (security parameter index).
Depending upon the implementation, there may be multiple SPIs, and these would be configurable also. For example, if the implementation switched to a different SPI after a given time.
3. (configurable) algorithm.
The HMAC-MD5-128 is the default hash algorithm.
4. (configurable) lifetime value in seconds.
5. (read-only) key.
6. (read-only) list of users who have access to the above information.

7. 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.

8. Acknowledgments

This document is a product of the IETF's Internetworking Over NBMA Networks (ion) Working Group.

The authors would like to thank Avri Doria (Bytex) for the first draft of the NHRP MIB and Keith McCloghrie (cisco) and David Horton (CITR) for their feedback and suggestions. Also, we would like to thank Naganand Doraswamy (Bay Networks) for assistance with the "Security Considerations" section.

9. References

- [1] Harrington, D., Presuhn, R. and B. Wijnen, "An Architecture for Describing SNMP Management Frameworks", RFC 2571, April 1999.
- [2] Rose, M. and K. McCloghrie, "Structure and Identification of Management Information for TCP/IP-based Internets", STD 16, RFC 1155, May 1990.
- [3] Rose, M. and K. McCloghrie, "Concise MIB Definitions", STD 16, RFC 1212, March 1991.
- [4] Rose, M., "A Convention for Defining Traps for use with the SNMP", RFC 1215, March 1991.
- [5] 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.
- [6] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M. and S. Waldbusser, "Textual Conventions for SMIv2", STD 58, RFC 2579, April 1999.
- [7] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M. and S. Waldbusser, "Conformance Statements for SMIv2", STD 58, RFC 2580, April 1999.
- [8] Case, J., Fedor, M., Schoffstall, M. and J. Davin, "Simple Network Management Protocol", STD 15, RFC 1157, May 1990.
- [9] Case, J., McCloghrie, K., Rose, M. and S. Waldbusser, "Introduction to Community-based SNMPv2", RFC 1901, January 1996.
- [10] Case, J., McCloghrie, K., Rose, M. and S. Waldbusser, "Transport Mappings for Version 2 of the Simple Network Management Protocol (SNMPv2)", RFC 1906, January 1996.
- [11] Case, J., Harrington D., Presuhn R. and B. Wijnen, "Message Processing and Dispatching for the Simple Network Management Protocol (SNMP)", RFC 2572, April 1999.
- [12] Blumenthal, U. and B. Wijnen, "User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3)", RFC 2574, April 1999.

- [13] Case, J., McCloghrie, K., Rose, M. and S. Waldbusser, "Protocol Operations for Version 2 of the Simple Network Management Protocol (SNMPv2)", RFC 1905, January 1996.
- [14] Levi, D., Meyer, P. and B. Stewart, "SNMPv3 Applications", RFC 2573, April 1999.
- [15] Wijnen, B., Presuhn, R. and K. McCloghrie, "View-based Access Control Model (VACM) for the Simple Network Management Protocol (SNMP)", RFC 2575, April 1999.
- [16] Case, J., Mundy, R., Partain, D. and B. Stewart, "Introduction to Version 3 of the Internet-standard Network Management Framework", RFC 2570, April 1999.
- [17] Luciani, J. V., Katz, D., Piscitello, D. and B. Cole, "NBMA Next Hop Resolution Protocol (NHRP)", RFC 2332, December 1997.
- [18] McCloghrie, K. and F. Kastenholz, "The Interfaces Group MIB using SMIV2", RFC 2233, November 1997.
- [19] Tesink, K., Editor, "Definitions of Managed Objects for ATM Management", RFC 2515, February 1999.
- [20] Narten, T. and H. Alvestrand, "Guidelines for Writing an IANA Considerations Section in RFCs", BCP 26, RFC 2434, October 1998.
- [21] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.
- [22] Bradner, S., "The Internet Standards Process -- Revision 3", BCP 9, RFC 2026, October 1996.
- [23] Cucchiara, J., editor, "Multiprotocol Over ATM Version 1.0 MIB", af-mpoa-0092.000, ATM Forum, July 1998.
- [24] Fredette, A., editor, "Multiprotocol Over ATM Version 1.0", af-mpoa-0087.000, ATM Forum, May 1997.
- [25] Laubach, M., and J. Halpern, "Classical IP and ARP over ATM", RFC 2225, April 1998.
- [26] Greene, M., J. Luciani, K. White and T. Kuo, "Definitions of Managed Objects for Classical IP and ARP Over ATM Using SMIV2", RFC 2320, April 1998.

10. Authors' Addresses

James V. Luciani
Bay Networks
3 Federal Street
Mail Stop: BL3-03
Billerica, MA 01821

Phone: (978) 288-4734
EMail: luciani@baynetworks.com

Maria Greene
Contractor
Xedia, Corp.
119 Russell Dr.
Littleton, MA 01460

EMail: maria@xedia.com

Joan Cucchiara
IronBridge Networks
55 Hayden Ave.
Lexington, MA 02421

Phone: (781) 372-8236
EMail: joan@ironbridgenetworks.com

12. Full Copyright Statement

Copyright (C) The Internet Society (1999). 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.

Acknowledgement

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

