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

May 1999

<draft-ietf-ion-nhrp-mib-09.txt>

Maria Greene
Contractor
maria@xedia.com

Joan Cucchiara
IronBridge Networks
joan@ironbridgenetworks.com

James V. Luciani
Bay Networks
luciani@baynetworks.com

Status of this Memo

Copyright Notice

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

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:

- An overall architecture, described in RFC 2571 [1].
- 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 RFC 1155 [2], RFC 1212 [3] and RFC 1215 [4]. The second version, called SMIv2, is described in RFC 2578 [5], RFC 2579 [6] and RFC 2580 [7].
- Message protocols for transferring management information. The first version of the SNMP message protocol is called SNMPv1 and described in 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].
- Protocol operations for accessing management information. The first set of protocol operations and associated PDU formats is described in RFC 1157 [8]. A second set of protocol operations and associated PDU formats is described in RFC 1905 [13].
- 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 nhprClientIndex 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 "9905191200Z"  -- May 19, 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 Procol, NHRP, as defined in RFC 2332 [17]."

        -- revision history

        REVISION     "9905191200Z"  -- May 19, 1999
                                    -- RFC-Editor assigns RFC xxxx
        DESCRIPTION  "Initial version, published as RFC xxxx."

        ::= { mib-2 XXX }           -- to be assigned by IANA

    --*****************************************************************
    -- 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 nhprServerIndex.

        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       {
                        nhrpCacheInternetworkAddrType,
                        nhrpCacheInternetworkAddr,
                        ifIndex,
                        nhrpCacheIndex
                    }
        ::= { nhrpCacheTable 1 }

    NhrpCacheEntry ::= SEQUENCE {
        nhrpCacheInternetworkAddrType    AddressFamilyNumbers,
        nhrpCacheInternetworkAddr        NhrpGenAddr,
        nhrpCacheIndex                   Unsigned32,
        nhrpCachePrefixLength            Integer32,
        nhrpCacheNextHopInternetworkAddr NhrpGenAddr,
        nhrpCacheNbmaAddrType            AddressFamilyNumbers,
        nhrpCacheNbmaAddr                NhrpGenAddr,
        nhrpCacheNbmaSubaddr             NhrpGenAddr,
        nhrpCacheType                    INTEGER,
        nhrpCacheState                   INTEGER,
        nhrpCacheHoldingTimeValid        TruthValue,
        nhrpCacheHoldingTime             Unsigned32,
        nhrpCacheNegotiatedMtu           Integer32,
        nhrpCachePreference              Integer32,
```

```
        nhrpCacheStorageType            StorageType,
        nhrpCacheRowStatus              RowStatus
```

```
    }

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

    nhrpCacheInternetworkAddr 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,
        nhrpClientInternetworkAddrType      AddressFamilyNumbers,
        nhrpClientInternetworkAddr          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 NHSes 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,
        nhrpClientNhsInternetworkAddrType   AddressFamilyNumbers,
        nhrpClientNhsInternetworkAddr       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 }
```

```
    nhrpClientNhsInternetworkAddrType 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
            nhrpClientNhsInternetworkAddr is to be interpreted."
        ::= { nhrpClientNhsEntry 2 }

    nhrpClientNhsInternetworkAddr 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,
        nhrpServerInternetworkAddrType  AddressFamilyNumbers,
        nhrpServerInternetworkAddr      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       {
                        nhrpCacheInternetworkAddrType,
                        nhrpCacheInternetworkAddr,
                        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,
        nhrpServerNhcInternetworkAddrType   AddressFamilyNumbers,
        nhrpServerNhcInternetworkAddr       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
            nhrpServerNhcInternetworkAddr."
        ::= { nhrpServerNhcEntry 2 }

    nhrpServerNhcInternetworkAddrType 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 nhrpServerNhcInternetworkAddr
            is to be interpreted."
        ::= { nhrpServerNhcEntry 3 }

    nhrpServerNhcInternetworkAddr 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 familes
            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,
            nhrpCacheNextHopInternetworkAddr,
            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 {
            nhrpServerInternetworkAddrType,
            nhrpServerInternetworkAddr,
            nhrpServerNbmaAddrType,
            nhrpServerNbmaAddr,
            nhrpServerNbmaSubaddr,
            nhrpServerStorageType,
            nhrpServerRowStatus,
            nhrpServerCacheAuthoritative,
            nhrpServerCacheUniqueness,
            nhrpServerNhcPrefixLength,
            nhrpServerNhcInternetworkAddrType,
            nhrpServerNhcInternetworkAddr,
            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 request made here is for the IANA to place 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.

An example of what the MIB would look like is included in this document.

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, of which an example is given in this document (see IANA Address Family Numbers 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, Cabletron Systems, Inc., BMC Software, Inc., IBM T. J. Watson Research, April 1999

[2] Rose, M., and K. McCloghrie, "Structure and Identification of Management Information for TCP/IP-based Internets", RFC 1155, STD 16, Performance Systems International, Hughes LAN Systems, May 1990

[3] Rose, M., and K. McCloghrie, "Concise MIB Definitions", RFC 1212, STD 16, Performance Systems International, Hughes LAN Systems, March 1991

[4] M. Rose, "A Convention for Defining Traps for use with the SNMP", RFC 1215, Performance Systems International, March 1991

[5] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M., and S. Waldbusser, "Structure of Management Information Version 2 (SMIv2)", RFC 2578, STD 58, Cisco Systems, SNMPinfo, TU Braunschweig, SNMP Research, First Virtual Holdings, International Network Services, April 1999

[6] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M., and S. Waldbusser, "Textual Conventions for SMIv2", RFC 2579, STD 58, Cisco Systems, SNMPinfo, TU Braunschweig, SNMP Research, First Virtual Holdings, International Network Services, April 1999

[7] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M., and S. Waldbusser, "Conformance Statements for SMIv2", RFC 2580, STD 58, Cisco Systems, SNMPinfo, TU Braunschweig, SNMP Research, First Virtual Holdings, International Network Services, April 1999

[8] Case, J., Fedor, M., Schoffstall, M., and J. Davin, "Simple Network Management Protocol", RFC 1157, STD 15, SNMP Research, Performance Systems International, Performance Systems International, MIT Laboratory for Computer Science, May 1990.

[9] Case, J., McCloghrie, K., Rose, M., and S. Waldbusser, "Introduction to Community-based SNMPv2", RFC 1901, SNMP Research, Inc., Cisco Systems, Inc., Dover Beach Consulting, Inc., International Network Services, 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, SNMP Research, Inc., Cisco Systems, Inc., Dover Beach Consulting, Inc., International Network Services, 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, SNMP Research, Inc., Cabletron Systems, Inc., BMC Software, Inc., IBM T. J. Watson Research, 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, IBM T. J. Watson Research, 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, SNMP Research, Inc., Cisco Systems, Inc., Dover Beach Consulting, Inc., International Network Services, January 1996.

[14] Levi, D., Meyer, P., and B. Stewart, "SNMPv3 Applications", RFC 2573, SNMP Research, Inc., Secure Computing Corporation, Cisco Systems, 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, IBM T. J. Watson Research, BMC Software, Inc., Cisco Systems, Inc., 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, SNMP Research, Inc., TIS Labs at Network Associates, Inc., Ericsson, Cisco Systems, April 1999

[17] Luciani, J. V., Katz, D., Piscitello, D., and B. Cole, "NBMA Next Hop Resolution Protocol (NHRP).", RFC 2332, Bay Networks, Cisco Systems, Core Competence, Inc., December 1997

[18] McCloghrie, K., and F. Kastenholz, "The Interfaces Group MIB using SMIv2.", RFC 2233, Cisco Systems, FTP Software., November 1997

[19] Tesink, K., Editor, "Definitions of Managed Objects for ATM Management.", RFC 2515, Bell Communications Research, February 1999

[20] Narten, T., and H. Alvestrand, "Guidelines for Writing an IANA Considerations Section in RFCs.", BCP 26, RFC 2434, IBM, Maxware, October 1998

[21] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, Harvard University, March 1997

[22] Bradner, S., "The Internet Standards Process -- Revision 3", BCP 9, RFC 2026, Harvard University, 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, Com21, Newbridge Networks, 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, Xedia, Bay Networks, April 1998

10. Authors' Addresses

James V. Luciani
Bay Networks
3 Federal Street
Mail Stop: BL3-03
Billerica, MA 01821
Phone: (978) 916-4734
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

11. Full Copyright Statement

12. IANA Address Family Numbers MIB

This appendix defines the initial content of the IANA-ADDRESS-FAMILY-NUMBERS-MIB. This section should be removed from this document prior to its approval, at which time this MIB will be administered by IANA.

The branch for this MIB needs to be determined, and an appropriate number should be added where XXX is currently.

```
  IANA-ADDRESS-FAMILY-NUMBERS-MIB DEFINITIONS ::= BEGIN

  IMPORTS
      MODULE-IDENTITY,
      mib-2                                FROM SNMPv2-SMI
      TEXTUAL-CONVENTION                   FROM SNMPv2-TC;

  ianaAddressFamilyNumbers MODULE-IDENTITY
      LAST-UPDATED "9905191200Z"  -- May 19, 1999
      ORGANIZATION "IANA"
      CONTACT-INFO
          "Postal:    Internet Assigned Numbers Authority
                      USC/Information Sciences Institute
                      4676 Admiralty Way
                      Marina del Rey, CA 90292-6695
                      USA

          Tel:    +1  310-822-1511
          E-Mail: iana@isi.edu"
      DESCRIPTION
          "The MIB module defines the AddressFamilyNumbers
          textual convention."

      -- revision history

      REVISION     "9905191200Z"  -- May 19, 1999
                                  -- RFC-Editor assigns RFC xxxx
      DESCRIPTION  "Initial version, published as RFC xxxx."

      ::= { mib-2 XXX }           -- to be assigned by IANA
```

```
     AddressFamilyNumbers ::= TEXTUAL-CONVENTION
```

```
        STATUS      current
        DESCRIPTION
            "The definition of this textual convention with the
            addition of newly assigned values is published
            periodically by the IANA, in either the Assigned
            Numbers RFC, or some derivative of it specific to
            Internet Network Management number assignments.
            (The latest arrangements can be obtained by
            contacting the IANA.)

            The enumerations are described as:

            other(0),    -- none of the following
            ipV4(1),     -- IP Version 4
            ipV6(2),     -- IP Version 6
            nsap(3),     -- NSAP
            hdlc(4),     -- (8-bit multidrop)
            bbn1822(5),
            all802(6),   -- (includes all 802 media
                         --   plus Ethernet 'canonical format')
            e163(7),
            e164(8),     -- (SMDS, Frame Relay, ATM)
            f69(9),      -- (Telex)
            x121(10),    -- (X.25, Frame Relay)
            ipx(11),     -- IPX (Internet Protocol Exchange)
            appletalk(12),  -- Apple Talk
            decnetIV(13),   -- DEC Net Phase IV
            banyanVines(14),  -- Banyan Vines
            e164withNsap(15),
                         -- (E.164 with NSAP format subaddress)

            reserved(65535)



            Requests for new values should be made to IANA via
            email (iana@isi.edu)."

        SYNTAX  INTEGER {
                    other(0),
                    ipV4(1),
                    ipV6(2),
                    nsap(3),
                    hdlc(4),
                    bbn1822(5),
                    all802(6),
                    e163(7),
                    e164(8),
```

```
                    f69(9),
                    x121(10),
```

```
                    ipx(11),
                    appletalk(12),
                    decnetIV(13),
                    banyanVines(14),
                    e164withNsap(15),
                    reserved(65535)
                }

    END
```