 Definition of Managed Objects for the Neighborhood Discovery Protocol
                    draft-cole-manet-nhdp-mib-01

Status of This Memo

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Abstract

   This memo defines a portion of the Management Information Base (MIB)

for use with network management protocols in the Internet community.
In particular, it describes objects for configuring aspects of the
Neighborhood Discovery Protocol (NHDP) process on a router. The NHDP
MIB also reports state information, performance information and
notifications. This additional state and performance information is
useful to management stations troubleshooting neighbor discovery
problems.

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 objects for configuring aspects of the
   Neighborhood Discovery Protocol (NHDP) [I-D:ietf-manet-nhdp] process
   on a router. The NHDP MIB also reports state information,
   performance information and notifications. This additional state and
   performance information is useful to management stations
   troubleshooting neighbor discovery problems.

2. The Internet-Standard Management Framework

   For a detailed overview of the documents that describe the current
   Internet-Standard Management Framework, please refer to section 7 of
   RFC 3410 [RFC3410].

   Managed objects are accessed via a virtual information store, termed
   the Management Information Base or MIB. MIB objects are generally
   accessed through the Simple Network Management Protocol (SNMP).
   Objects in the MIB are defined using the mechanisms defined in the
   Structure of Management Information (SMI). This memo specifies a MIB
   module that is compliant to the SMIv2, which is described in STD 58,
   RFC 2578 [RFC2578], STD 58, RFC 2579 [RFC2579] and STD 58, RFC 2580
   [RFC2580].

3. Conventions

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

4. Overview

   The NHDP protocol allows routers in a Mobile Ad-Hoc Network (MANET)
   setting to discover and track one-hop and two-hop neighbor sets.
   This information is useful for routers running various routing and
   multicast flooding protocols developed within the IETF MANET Working
   Group.

4.1. Terms

   The following definitions apply throughout this document:

   o Configuration Objects - switches, tables, objects which are
      initialized to default settings or set through the management
      interface defined by this MIB.

o Tunable Configuration Objects - objects whose values affect timing
   or attempt bounds on the NHDP protocol.

o State Objects - automatically generated values which define the
   current operating state of the NHDP protocol process in the
   router.

o Performance Objects - automatically generated values which help an
   administrator or automated tool to assess the performance of the
   NHDP protocol process on the router and the overall discovery
   performance within the NHDP domain.

4.2. Organization

This document is organized as ...

5. Structure of the MIB Module

This section presents the structure of the NHDP MIB module. The MIB
is arranged into the following structure:

o nhdpNotifications - objects defining NHDP MIB notifications.

o nhdpObjects - defining objects within this MIB. The objects are
   arranged into the following groups:

o

   * General Information Group - defining objects of a general
      nature, e.g., version numbers.

   * Configuration Group - defining objects related to the
      configuration of the NHDP instance on the device.

   * State Group - defining objects which reflect the current state
      of the NHDP running on the device.

   * Performance Group - defining objects which are useful to a
      management station when characterizing the performance of the
      NHDP on the device and in the MANET.

o nhdpConformance - defining the minimal and maximal conformance
   requirements for implementations of this MIB.

5.1. Textual Conventions

   This section is TBD.

5.2. The General Information Group

   This section provides general information about the capabilities of
   the device running the NHDP. This group is currently empty and will
   be removed in future drafts if no objects are identified.

5.3. The Configuration Group

   The device is configured with a set of controls. These will serve as
   the object descriptions once they are discussed and refined. The
   list of configuration controls for the NHDP-MIB (found in [ietf-
   manet-nhdp]), are discussed in the following subsections.

5.3.1. Interface Parameters

   The Interface Parameters include:

5.3.1.1. Message Intervals

   o HELLO_INTERVAL - is the maximum time between the transmission of
      two successive HELLO messages on this MANET interface. If using
      periodic transmission of HELLO messages, these SHOULD be at a
      separation of HELLO_INTERVAL, possibly modified by jitter as
      specified in [XXX].

   o HELLO_MIN_INTERVAL - is the minimum interval between transmission
      of two successive HELLO messages, on this MANET interface. (This
      minimum interval MAY be modified by jitter, as defined in [XXX].)

   o REFRESH_INTERVAL - is the maximum interval between advertisements
      in a HELLO message of each 1-hop neighbor address and its status.
      In all intervals of length REFRESH_INTERVAL, a node MUST include
      all 1-hop neighbor information which it is specified as sending in
      at least one HELLO message on this MANET interface.

   The following constraints apply to these interface parameters:

   o HELLO_INTERVAL > 0

   o HELLO_MIN_INTERVAL >= 0

   o HELLO_INTERVAL >= HELLO_MIN_INTERVAL

o REFRESH_INTERVAL >= HELLO_INTERVAL

o If INTERVAL_TIME message TLVs as defined in [XXX] are included in
   HELLO messages, then HELLO_INTERVAL MUST be representable as
   described in [XXX].

o If REFRESH_INTERVAL > HELLO_INTERVAL, then a node may distribute
   its neighbor advertisements between HELLO messages in any manner,
   subject to the constraints above.

o For a node to employ this protocol in a purely responsive manner
   on a MANET interface, REFRESH_INTERVAL and HELLO_INTERVAL SHOULD
   both be set to a value such that a responsive HELLO message is
   always expected in a shorter period than this.

The following default values are recommended:

o HELLO_INTERVAL = 2 seconds

o HELLO_MIN_INTERVAL = HELLO_INTERVAL/4

o REFRESH_INTERVAL = HELLO_INTERVAL

5.3.1.2. Information Validity Times

Parameters related to the Information Validity Times include:

o L_HOLD_TIME - is the period of advertisement, on this MANET
   interface, of former 1-hop neighbor addresses as lost in HELLO
   messages, allowing recipients of these HELLO messages to
   accelerate removal of information from their Link Sets.
   L_HOLD_TIME can be set to zero if accelerated information removal
   is not required.

o H_HOLD_TIME - is used as the value in the VALIDITY_TIME message
   TLV included in all HELLO messages on this MANET interface.

The following constraints apply to these interface parameters:

o L_HOLD_TIME >= 0

o H_HOLD_TIME >= REFRESH_INTERVAL

o If HELLO messages can be lost then both SHOULD be significantly
   greater than REFRESH_INTERVAL.

o H_HOLD_TIME MUST be representable as described in [XXX].

o H_HOLD_TIME = 3 x REFRESH_INTERVAL

o L_HOLD_TIME = H_HOLD_TIME

o N_HOLD_TIME = L_HOLD_TIME

o I_HOLD_TIME = N_HOLD_TIME

5.3.1.3. Link Quality

Parameters related to the Link Quality include:

o HYST_ACCEPT - is the link quality threshold at or above which a
   link becomes usable, if it was not already so.

o HYST_REJECT - is the link quality threshold below which a link
   becomes unusable, if it was not already so.

o INITIAL_QUALITY - is the initial quality of a newly identified
   link.

o INITIAL_PENDING - if true, then a newly identified link is
   considered pending, and is not usable until the link quality has
   reached or exceeded the HYST_ACCEPT threshold.

The following constraints apply to these interface parameters:

o 0 < = HYST_REJECT < = HYST_ACCEPT < = 1

o 0 < = INITIAL_QUALITY < = 1.

o If link quality is not updated, then INITIAL_QUALITY >=
   HYST_ACCEPT.

o If INITIAL_QUALITY => HYST_ACCEPT, then INITIAL_PENDING == false.

o If INITIAL_QUALITY < HYST_REJECT, then INITIAL_PENDING == true.

Link quality is a mechanism whereby a node MAY take considerations
other than message exchange into account for determining when a link
is and is not a candidate for being considered as HEARD or SYMMETRIC.
Link quality is used only locally by a node, and nodes may fully
inter-operate whether they are using the same, different or no link
quality methods.

NHDP can be operated when the local node does not implement Link
Quality. In order for a node to not employ link quality, the node
MUST define:

   o INITIAL_PENDING = false

   o INITIAL_QUALITY >= HYST_REJECT (there is no reason not to define
      INITIAL_QUALITY = 1).

   If link quality is changed, then parameter values will depend on the
   link quality process. If link quality is not changed, then:

   o HYST_ACCEPT = 1

   o HYST_REJECT = 0

   o INITIAL_QUALITY = 1

   o INITIAL_PENDING = false

5.3.1.4. Jitter

   If jitter, as defined in [XXX], is used then these parameters are as
   follows:

   o HP_MAXJITTER - represents the value of MAXJITTER used in [XXX] for
      periodically generated HELLO messages on this MANET interface.

   o HT_MAXJITTER - represents the value of MAXJITTER used in [XXX] for
      externally triggered HELLO messages on this MANET interface.

   For constraints on these interface parameters see [XXX].

   The following default values are recommended:

   o HP_MAXJITTER = HELLO_INTERVAL/4

   o HT_MAXJITTER = HP_MAXJITTER

   o C = 1/1024 second

5.3.2. Node Parameters

   The following Node Parameters apply:

5.3.2.1. Information Validity Time

   o N_HOLD_TIME - is used as the period during which former 1-hop
      neighbor addresses are advertised as lost in HELLO messages,
      allowing recipients of these HELLO messages to accelerate removal
      of information from their 2-Hop Sets. N_HOLD_TIME can be set to
      zero if accelerated information removal is not required.

o I_HOLD_TIME - is the period for which a recently used local
   interface address is recorded.

The following constraints applies to these node parameters:

o N_HOLD_TIME >= 0

o I_HOLD_TIME >= 0

5.3.3. Parameter Change Constraints

These parameters may be made dynamic:

o HELLO_INTERVAL

o REFRESH_INTERVAL

o HYST_ACCEPT and HYST_REJECT

o L_HOLD_TIME

o N_HOLD_TIME

o HP_MAXJITTER

o HT_MAXJITTER

5.4. The State Group

The State Subtree reports current state information, including
neighbor tables. These are separately discussed below.

(Note: these will serve as the object descriptions once they are
discussed and refined.)

The Local Information Base (LIB), contains the addresses of the
interfaces (MANET and non-MANET) of this node. The contents of this
Information Base are not changed by signaling. The LIB contains two
tables:

o The "Local Interface Set", which consists of Local Interface
   Tuples, each of which records the addresses of an interface (MANET
   or non- MANET) of the node.

o The "Removed Interface Address Set", which consists of Removed
   Interface Address Tuples, each of which records a recently used
   address of an interface (MANET or non-MANET) of the node. A
   node's Removed Interface Address Set records addresses which were

recently local interface addresses. If a node's interface
addresses are immutable then this set is always empty and MAY be
omitted.

The Interface Information Based (IIB), recording information
regarding links to this MANET interface and symmetric 2-hop neighbors
which can be reached through such links. The IIB contains two
tables:

o A "Link Set", which records information about current and recently
   lost links between this interface and MANET interfaces of 1-hop
   neighbors. The Link Set consists of Link Tuples, each of which
   contains information about a single link. Recently lost links are
   recorded so that they can be advertised in HELLO messages,
   accelerating their removal from relevant 1-hop neighbors' Link
   Sets. Link quality information, if used and available, is
   recorded in Link Tuples and may indicate that links are treated as
   lost.

o A "Two-Hop Set", which records the existence of bidirectional
   links between symmetric 1-hop neighbors of this MANET interface
   and other nodes (symmetric 2-hop neighbors). The 2-Hop Set
   consists of 2-Hop Tuples, each of which records an interface
   address of a symmetric 2-hop neighbor, and all interface addresses
   of the corresponding symmetric 1-hop neighbor. The 2-Hop Set is
   updated by the signaling of this protocol, but is not itself
   reported in that signaling.

The Node Information Base (NIB), records information regarding
current and recently lost 1-hop neighbors of this node. The NIB
contains two tables:

o The "Neighbor Set", and

o The "Lost Neighbor Set".

5.5. The Performance Group

Reports values relevant to system performance. These will serve as
the object descriptions once they are discussed and refined.

5.6. The Notifications

The Notifications Subtree contains the list of notifications
supported within the NHDP MIB and their intended purpose or utility.
This group is currently empty, pending further discussion.

6. Relationship to Other MIB Modules

[TODO]: The text of this section specifies the relationship of the
MIB modules contained in this document to other standards,
particularly to standards containing other MIB modules. Definitions
imported from other MIB modules and other MIB modules that SHOULD be
implemented in conjunction with the MIB module contained within this
document are identified in this section.

6.1. Relationship to the SNMPv2-MIB

The 'system' group in the SNMPv2-MIB [RFC3418] is defined as being
mandatory for all systems, and the objects apply to the entity as a
whole. The 'system' group provides identification of the management
entity and certain other system-wide data. The NHDP-MIB does not
duplicate those objects.

6.2. Relationship to the IF-MIB

[TODO] This section is included as an example; If the MIB module is
not an adjunct of the Interface MIB, then this section should be
removed.

6.3. MIB modules required for IMPORTS

[TODO]: Citations are not permitted within a MIB module, but any
module mentioned in an IMPORTS clause or document mentioned in a
REFERENCE clause is a Normative reference, and must be cited
someplace within the narrative sections. If there are imported items
in the MIB module, such as Textual Conventions, that are not already
cited, they can be cited in text here. Since relationships to other
MIB modules should be described in the narrative text, this section
is typically used to cite modules from which Textual Conventions are
imported.

The following NHDP MIB module IMPORTS objects from SNMPv2-SMI
[RFC2578], SNMPv2-TC [RFC2579], SNMPv2-CONF [RFC2580], and IF-MIB
[RFC2863]

7. Definitions

 NHDP-MIB DEFINITIONS ::= BEGIN

 -- This MIB is currently in a very initial stage.
 -- Not all proposed objects have been identified yet
 -- in the current draft. The MIB have not been
 -- formally checked by any MIB checkers yet.

```
 IMPORTS
      MODULE-IDENTITY, OBJECT-TYPE, Counter32,
      Gauge32, Integer32, Unsigned32
                  FROM SNMPv2-SMI  --[RFC2578]
      TEXTUAL-CONVENTION, StorageType, TimeStamp,
      TruthValue, RowStatus
                  FROM SNMPv2-TC  --[RFC2579]
      MODULE-COMPLIANCE, OBJECT-GROUP
                  FROM SNMPv2-CONF  --[STD58]
      InetAddressType, InetAddress
                  FROM INET-ADDRESS-MIB  --[RFC3291]
      InterfaceIndexOrZero
                  FROM IF-MIB  --[RFC2863]


 nhdpMIB MODULE-IDENTITY
         LAST-UPDATED "200902151500Z"  -- February 15, 2009
         ORGANIZATION "IETF MANET working group"
         CONTACT-INFO
         "WG E-Mail: manet@ietf.org

          WG Chairs: ian.chakeres@gmail.com
                     jmacker@nrl.navy.mil


          Editors:   Robert G. Cole
                     Johns Hopkins University
                     Applied Physics Lab and
                     Department of Computer Science
                     11000 Johns Hopkins Road
                     Room 02-257
                     Laurel, MD 22014
                     USA
                     +1 443 778-6951
                     robert.cole@jhuapl.edu
                     http://www.cs.jhu.edu/~rgcole/

                     Ian D Chakeres
                     CenGen
                     9250 Bendix Road North
                     Columbia, Maryland  21045
                     USA
                     ian.chakeres@gmail.com
                     http://www.ianchak.com/"


         DESCRIPTION
```

                "This NHDP MIB module is applicable to devices
                 implementing the Neighborhood Discovery Protocol
                 defined in [XXX].

                 Copyright (C) The IETF Trust (2009). This version
                 of this MIB module is part of RFC xxxx; see the RFC
                 itself for full legal notices."

           -- revision
           REVISION   "200811031500Z"   -- February 15, 2009
           DESCRIPTION
             "The second version of this MIB module,
              published as draft-cole-manet-nhdp-mib-01.txt.   Major
              update adding objects for configuration and state."
           REVISION   "200804251500Z"   -- April 25, 2008
           DESCRIPTION
             "The original version of this MIB module,
              published as RFCXXXX."
           -- RFC-Editor assigns XXXX
           ::= { manet XX }   -- to be assigned by IANA

   --
   -- Top-Level Components of this MIB
   --
   nhdpNotifications OBJECT IDENTIFIER ::= { nhdpMIB 0 }
   nhdpObjects   OBJECT IDENTIFIER ::= { nhdpMIB 1 }
   nhdpConformance   OBJECT IDENTIFIER ::= { nhdpMIB 2 }

   --
   -- Textual Conventions
   --

   NeighborIfIndex ::= TEXTUAL-CONVENTION
        STATUS   current
        DESCRIPTION
            "A locally arbitrary unique identifier associated with an
            NHDP neighbor interface.

            All objects of type NeighborIfIndex are assigned by the agent
            out of a common number space. In other words, NeighborIfIndex
            values assigned to entries in one table must not overlap with
            NeighborIfIndex values assigned to entries in another
            table.

            The NeighborIfIndex defines a discovered interface of a 1-hop
            or 2-hop neighbor of the local node. The agent identifies a
            unique neighbor interface through the reciept of an address

        list advertised through an NHDP HELLO message.

        The value for each discovered neighbor interface must remain
        constant at least from one re-initialization of the entity's
        network management system to the next re-initialization, except
        that if an application is deleted and re-created.

        The specific value is meaningful only within a given SNMP
        entity. An NeighborIfIndex value must not be re-used until the
        next agent restart."
    SYNTAX   Unsigned32 (1..2147483647)

 NeighborNodeId ::= TEXTUAL-CONVENTION
    STATUS   current
    DESCRIPTION
        "A locally arbitrary unique identifier associated with an
        NHDP discovered peer node.

        All objects of type NeighborNodeId are assigned by the agent
        out of a common number space.

        The NeighborNodeId defines a discovered NHDP peer of
        the local node. The agent identifies a
        unique neighbor through the reciept of an address
        list advertised through an NHDP HELLO message and the
        associated .....

        The value for each discovered neighbor ID must remain
        constant at least from one re-initialization of the entity's
        network management system to the next re-initialization, except
        that if an application is deleted and re-created.

        The specific value is meaningful only within a given SNMP
        entity. An NeighborNodeId value must not be re-used until the
        next agent restart."
    SYNTAX   Unsigned32 (1..2147483647)

 --
 -- nhdpObjects
 --

 --   General Objects Group - ...
 --   Configuration Objects Group - ...
 --   State Objects Group - ...
 --   Performance Objects Group - ...

```
 --
 -- nhdpGeneralObjGrp
 --

 --    Note: These objects apply globally to the router's
 --    NHDP process.

 nhdpGeneralObjGrp  OBJECT IDENTIFIER ::= { nhdpObjects 1 }

   --(proposed object list here.)




 --
 -- nhdpConfigurationObjGrp
 --

 -- Contains the NHDP objects which configure specific options
 -- which determine the overall performance and operation of the
 -- discovery protocol.

 nhdpConfigurationObjGrp OBJECT IDENTIFIER ::= { nhdpObjects 2 }


    nhdpInterfaceTable  OBJECT-TYPE
       SYNTAX      SEQUENCE OF NhdpInterfaceEntry
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION
          "The NHDP Interface Table describes the
           configuration of the interfaces of this NHDP device.
           The ifIndex is from the interfaces group
           defined in the Interfaces Group MIB.

           The object 'nhdpIfStatus' provides the functionality
           expected by the NHDP in the Local Interface Base (LIB)
           Local Interface Set Table.  Hence, the Local Interface
           Set Table will not be defined below."
       REFERENCE
          "RFC 2863 - The Interfaces Group MIB, McCloghrie,
           K., and F. Kastenholtz, June 2000."
    ::= { nhdpConfigurationObjGrp 1 }
```

```
nhdpInterfaceEntry OBJECT-TYPE
   SYNTAX      NhdpInterfaceEntry
   MAX-ACCESS  not-accessible
   STATUS      current
   DESCRIPTION
      "The NHDP interface entry describes one NHDP
       local interface configuration as indexed by
       its ifIndex as defined in the Standard MIB II
       Interface Table (RFC2863)."
   INDEX { nhdpIfIndex }
::= { nhdpInterfaceTable 1 }

NhdpInterfaceEntry ::=
   SEQUENCE {
      nhdpIfIndex
         InterfaceIndex,
      nhdpIfStatus
         TruthValue,
      nhdpHelloInterval
         Unsighned32,
      nhdpHelloMinInterval
         Unsigned32,
      nhdpRefreshInterval
         Unsigned32,
      nhdpLHoldTime
         Unsigned32,
      nhdpHHoldTime
         Unsigned32,
      nhdpHystAcceptQuality
         Unsigned32,
      nhdpHystRejectQuality
         Unsigned32,
      nhdpInitialQuality
         Unsigned32,
      nhdpInitialPending
         Unsigned32,
      nhdpHpMaxJitter
         Unsigned32,
      nhdpHtMaxJitter
         Unsigned32,
      nhdpHHoldTime
         Unsigned32,
      nhdpIHoldTime
         Unsigned32,
      nhdpIfRowStatus
         RowStatus
         }
```

```
      nhdpIfIndex  OBJECT-TYPE
         SYNTAX      InterfaceIndex
         MAX-ACCESS  not-accessible
         STATUS      current
         DESCRIPTION
            "The ifIndex for this NHDP device interface."
         ::= { nhdpInterfaceEntry 1 }

      nhdpIfStatus  OBJECT-TYPE
         SYNTAX      TruthValue
         UNITS       ""
         MAX-ACCESS  read-write
         STATUS      current
         DESCRIPTION
            "The nhpdIfStatus indicates the current status of
             this NHDP device's interface with respect to
             supporting the NHDP protocol. A value of true(1) indicates
             that the interface is currently running the NHDP
             protocol.  A value of false(2) indicates that the interface
             is currently not running the NHDP protocol."
         DEFVAL { TBD }
         REFERENCE
            ""
      ::= { nhdpInterfaceEntry 2 }

      -- Interface Parameters - Message Intervals

      nhdpHelloInterval  OBJECT-TYPE
         SYNTAX      Unsigned32 (0..255)
         UNITS       "seconds"
         MAX-ACCESS  read-write
         STATUS      current
         DESCRIPTION
            "The nhpdHelloInterval ..."
         DEFVAL { 2 }
         REFERENCE
            "The NHDP version 5 draft.
             Section 5 on Protocol Parameters and
             Constraints."
      ::= { nhdpInterfaceEntry 3 }

      nhdpHelloMinInterval  OBJECT-TYPE
         SYNTAX      Unsigned32 (0..255)
         UNITS       "seconds"
         MAX-ACCESS  read-write
         STATUS      current
         DESCRIPTION
            "The nhpdHelloMinInterval ...
```

            The default value for this object is
            equal to the nhdpHelloInterval"
        DEFVAL { nhdpHelloInterval }
        REFERENCE
            "The NHDP version 5 draft.
            Section 5 on Protocol Parameters and
            Constraints."
    ::= { nhdpInterfaceEntry 4 }

    nhdpRefreshInterval OBJECT-TYPE
        SYNTAX   Unsigned32 (0..255)
        UNITS   "seconds"
        MAX-ACCESS read-write
        STATUS   current
        DESCRIPTION
            "The nhpdRefreshInterval ...
             The default bvalue for the nhdpRefreshInterval
             is equal fo the nhdpHelloInterval."
        DEFVAL { nhdpHelloInterval }
        REFERENCE
            "The NHDP version 5 draft.
            Section 5 on Protocol Parameters and
            Constraints."
    ::= { nhdpInterfaceEntry 5 }

    -- Interface Parameters - Information Validity times

    nhdpLHoldTime OBJECT-TYPE
        SYNTAX   Unsigned32 (0..255)
        UNITS   "seconds"
        MAX-ACCESS read-write
        STATUS   current
        DESCRIPTION
            "The L_HOLD_TIME is used to define the time
             for which a recently used and replaced
             originator address is used to recognize
             the node's own messages.

             The following constraint applies to this
             parameter: olsrv2OHoldTime >= 0"
        DEFVAL { TBD }
        REFERENCE
            "The NHDP version 5 draft.
            Section 5 on Protocol Parameters and
            Constraints."
    ::= { nhdpInterfaceEntry 6 }

    nhdpHHoldTime OBJECT-TYPE

```
        SYNTAX       Unsigned32 (0..255)
        UNITS        "seconds"
        MAX-ACCESS   read-write
        STATUS       current
        DESCRIPTION
           "The H_HOLD_TIME is used to define the time
            for which a recently used and replaced
            originator address is used to recognize
            the node's own messages.

            The following constraint applies to this
            parameter: olsrv2OHoldTime >= 0"
        DEFVAL { TBD }
        REFERENCE
           "The NHDP version 5 draft.
            Section 5 on Protocol Parameters and
            Constraints."
     ::= { nhdpInterfaceEntry 7 }


     -- Interface Parameters - Link Quality
     -- (is optional and settings define operation)

     nhdpHystAcceptQuality  OBJECT-TYPE
        SYNTAX       Unsigned32 (0..255)
        UNITS        ""
        MAX-ACCESS   read-write
        STATUS       current
        DESCRIPTION
           "The nhdpHystAcceptQuality is the
            link quality threshold at or above
            which a link becomes usable,
            if it was not already so.

            The following constraint    "
        DEFVAL { TBD }
        REFERENCE
           "The NHDP version 5 draft.
            Section 5 on Protocol Parameters and
            Constraints."
     ::= { nhdpInterfaceEntry 8 }

     nhdpHystRejectQuality  OBJECT-TYPE
        SYNTAX       Unsigned32 (0..255)
        UNITS        ""
        MAX-ACCESS   read-write
        STATUS       current
        DESCRIPTION
           "The nhdpHystRejectQuality is the
```

               link quality threshold below which
               a link becomes unusable, if it
               was not already so.

               The following constraint   "
          DEFVAL { TBD }
          REFERENCE
             "The NHDP version 5 draft.
              Section 5 on Protocol Parameters and
              Constraints."
       ::= { nhdpInterfaceEntry 9 }

       nhdpInitialQuality OBJECT-TYPE
          SYNTAX   Unsigned32 (0..255)
          UNITS   ""
          MAX-ACCESS read-write
          STATUS   current
          DESCRIPTION
             "The nhdpInitialQuality is the
              initial quality of a newly
              identified link.

              The following constraint   "
          DEFVAL { TBD }
          REFERENCE
             "The NHDP version 5 draft.
              Section 5 on Protocol Parameters and
              Constraints."
       ::= { nhdpInterfaceEntry 10 }

       -- Note: Probably wnat to move this following object
       -- `nhdpInitialPending' to the State Objects Group.

       nhdpInitialPending OBJECT-TYPE
          SYNTAX   Unsigned32 (0..255)
          UNITS   ""
          MAX-ACCESS read-only
          STATUS   current
          DESCRIPTION
             "The nhdpInitialPending is defined as
              follows:

              If true, then a newly identified link
              is considered pending, and is not
              usable until the link quality has
              reached or exceeded the
              nhdpHystAccept threshold.

                    The following constraint   "
          DEFVAL { TBD }
          REFERENCE
              "The NHDP version 5 draft.
               Section 5 on Protocol Parameters and
               Constraints."
       ::= { nhdpInterfaceEntry 11 }

       -- Interface Parameters - Jitter

       nhdpHpMaxJitter OBJECT-TYPE
          SYNTAX   Unsigned32 (0..255)
          UNITS   ""
          MAX-ACCESS read-write
          STATUS   current
          DESCRIPTION
              "The nhdpHpMaxJitter represents the
               value of MAXJITTER used in [4] for
               periodically generated HELLO messages
               on this MANET interface.

               The following constraint   "
          DEFVAL { nhpdHelloInterval/4 }
          REFERENCE
              "The NHDP version 5 draft.
               Section 5 on Protocol Parameters and
               Constraints."
       ::= { nhdpInterfaceEntry 12 }

       nhdpHtMaxJitter OBJECT-TYPE
          SYNTAX   Unsigned32 (0..255)
          UNITS   ""
          MAX-ACCESS read-write
          STATUS   current
          DESCRIPTION
              "The nhdpHtMaxJitter represents the
               value of MAXJITTER used in [4] for
               externally triggered HELLO messages
               on this MANET interface.

               The following constraint   "
          DEFVAL { nhdpHpMaxJitter }
          REFERENCE
              "The NHDP version 5 draft.
               Section 5 on Protocol Parameters and
               Constraints."
       ::= { nhdpInterfaceEntry 13 }

-- Node Parameters - Information Validity Time

    nhdpHHoldTime OBJECT-TYPE
        SYNTAX   Unsigned32 (0..255)
        UNITS   "seconds"
        MAX-ACCESS read-write
        STATUS   current
        DESCRIPTION
           "The nhdpHHoldTime is used as the period
            during which former 1-hop neighbor
            addresses are advertised as lost in
            HELLO messages, allowing recipients of
            these HELLO messages to accelerate removal
            of information from their 2-Hop Sets.
            N_HOLD_TIME can be set to zero if
            accelerated information removal is not
            required.

            The following constraint
            nhdpHHoldTime >= 0"
        DEFVAL { 2 }
        REFERENCE
           "The NHDP version 5 draft.
            Section 5 on Protocol Parameters and
            Constraints."
    ::= { nhdpInterfaceEntry 14 }

    nhdpIHoldTime OBJECT-TYPE
        SYNTAX   Unsigned32 (0..255)
        UNITS   "seconds"
        MAX-ACCESS read-write
        STATUS   current
        DESCRIPTION
           "The nhdpIHoldTime is the period
            for which a recently used local
            interface address is recorded.

            The following constraint
            nhdpIHoldTime >= 0 "
        DEFVAL { nhdpHelloInterval }
        REFERENCE
           "The NHDP version 5 draft.
            Section 5 on Protocol Parameters and
            Constraints."
    ::= { nhdpInterfaceEntry 15 }

    nhdpIfRowStatus OBJECT-TYPE
        SYNTAX   RowStatus

          MAX-ACCESS not-accessible
          STATUS   current
          DESCRIPTION
             "This
             "
          REFERENCE
             "The NHDP draft."
      ::= { nhdpInterfaceEntry 16 }

   --
   -- nhdpStateObjGrp
   --

   -- Contains information describing the current state of the NHDP
   -- process.

   nhdpStateObjGrp   OBJECT IDENTIFIER ::= { nhdpObjects 3 }

      -- Before building the NHDP Information Bases, we define
      -- two new constructs for indexing into the following
      -- tables and indexing into other tables in other MIBs.
      -- The NeighborIfIndex defines a unique (to the local node)
      -- index referencing a discovered interface on another
      -- node within the NHDP MANET. The NeighborNodeId defines a
      -- unique (to the local node) index referencing a discovered
      -- node within the NHDP MANET.

      -- Note: This table is indexed by an IpAddr associated with
      -- NeighborIfIndex. Multiple addresses can be associated
      -- with a given NeighborIfIndex. Each NeighborIfIndex is
      -- associated with a NeighborNodeId. Throughout this MIB,
      -- the NeighborIfIndex and the NeighborNodeId are used
      -- to define the set of IpAddrs related to the interface
      -- in discussion.

      nhdpDiscIfSetTable OBJECT-TYPE
         SYNTAX   SEQUENCE OF NhdpDiscIfSetEntry
          MAX-ACCESS   not-accessible
          STATUS   current
          DESCRIPTION
             " A node's set of discovered interfaces on

                 neighboring nodes.
              "
          REFERENCE
             "The NHDP draft."
       ::= { nhdpStateObjGrp 1 }

       nhdpDiscIfSetEntry OBJECT-TYPE
          SYNTAX   NhdpDiscIfSetEntry
          MAX-ACCESS   not-accessible
          STATUS   current
          DESCRIPTION
             "The entries include the nhdpDiscNodeId of
              the discovered node, the nhdpDiscIfIndex
              of the discovered interface and the
              current set of addresses associated
              with this neighbor interface. The
              nhdpDiscIfIndex has to uniquely identify
              the remote interface address sets. It
              need not be unique across the MANET.
              It must be unique within this node.

              Note: need to describe how to age out
              the entries in this table?
              "
          REFERENCE
             "This NHDP-MIB draft."
          INDEX { nhdpDiscIfSetIpAddr }
       ::= { nhdpDiscIfSetTable 1 }

       NhdpDiscIfSetEntry ::=
          SEQUENCE {
             nhdpDiscIfSetNodeId
               NeighborNodeId,
             nhdpDiscIfSetIndex
               NeighborIfIndex,
             nhdpDiscIfSetAddrType
               InetAddressType,
             nhdpDiscIfSetIpAddr
               InetAddress,
             nhdpDiscIfSetAddrPrefix
               InetAddrPrefix
           }

       nhdpDiscIfSetNodeId OBJECT-TYPE
          SYNTAX   NeighborNodeId
          MAX-ACCESS   read-only
          STATUS   current
          DESCRIPTION

```
         "The NHDP node ID (locally created)
          of a neigboring node.  Used for cross
          indexing into other NHDP tables and other
          MIBs.
          "
      REFERENCE
         "This NHDP-MIB draft."
   ::= { nhdpDiscIfSetEntry 1 }

   nhdpDiscIfSetIndex  OBJECT-TYPE
      SYNTAX       NeighborIfIndex
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "The NHDP interface index (locally created)
          of a neigbor's interface.  Used for cross
          indexing into other NHDP tables and other
          MIBs.
          "
      REFERENCE
         "This NHDP-MIB draft."
   ::= { nhdpDiscIfSetEntry 2 }

   nhdpDiscIfSetAddrType  OBJECT-TYPE
      SYNTAX       InetAddressType
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "The type of the ...
          in the InetAddress MIB [RFC 4001]."
      REFERENCE
         "The NHDP draft."
   ::= { nhdpDiscIfSetEntry 3 }

   nhdpDiscIfSetIpAddr  OBJECT-TYPE
      SYNTAX       InetAddress
      MAX-ACCESS   read-only
      STATUS       current
      DESCRIPTION
         "The nhdpDiscIfSetIpAddr is a
          recently used address of a neighbor
          of this node.
          "
      REFERENCE
         "The NHDP draft."
   ::= { nhdpDiscIfSetEntry 4 }

   nhdpDiscIfSetAddrPrefixLen  OBJECT-TYPE
```

         SYNTAX   InetAddressPrefixLength
         MAX-ACCESS   read-only
         STATUS   current
         DESCRIPTION
            "Indicates the number of leading one bits that form the
             mask to be logical-ANDed with the destination address
             before being compared to the value in the
             nhdpDiscIfSetAddr field. If the resulting
             address block is contained in a block in this
             table, then a match should be returned.
             "
         REFERENCE
            "The NHDP draft."
      ::= { nhdpDiscIfSetEntry 5 }

      -- An NHDP node's Local Information Base (LIB)

         -- Local IF Set Table
         -- Entry (foreach IF): (IfAddrList,
         --   PrefixMask,
         --   Manet_indication)
         --
         -- Note: This table is redundant with information in
         -- the nhdpIfTable above. Hence it is not present here.

         -- Removed Addr Set Table
         -- Entry (foreach Addr): (IfAddrRemoved,
         --   ExpirationTime)

       nhdpLibRemovedAddrSetTable OBJECT-TYPE
         SYNTAX   SEQUENCE OF NhdpLibRemovedAddrSetEntry
         MAX-ACCESS   not-accessible
         STATUS   current
         DESCRIPTION
            " A node's Removed Addr Set Table ...
             "
         REFERENCE
            "The NHDP draft."
      ::= { nhdpStateObjGrp 2 }

      nhdpLibRemovedAddrSetEntry OBJECT-TYPE
         SYNTAX   NhdpRemovedAddrSetEntry

```
         MAX-ACCESS  not-accessible
         STATUS      current
         DESCRIPTION
            "The entries include the
             removed addresses and their expiration
             time from this table.

             The association between these addrs and
             the node's Interface is found in the
             Standard MIB II's IP addr table
             (RFC1213).
            "
         REFERENCE
            "The NHDP draft."
         INDEX { nhdpLibRemovedAddrSetAddr }
       ::= { nhdpLibRemovedAddrSetTable 1 }

      NhdpLibRemovedAddrSetEntry ::=
         SEQUENCE {
            nhdpLibRemovedAddrSetAddrType
              InetAddressType,
            nhdpLibRemovedAddrSetAddr
              InetAddress,
            nhdpLibRemovedAddrSetAddrPrefix
              InetAddrPrefix,
            nhdpLibRemovedAddrSetIfIndex
              IfIndex,
            nhdpLibRemovedAddrSetIrTime
              Unsigned32
           }

      nhdpLibRemovedAddrSetAddrType  OBJECT-TYPE
         SYNTAX      InetAddressType
         MAX-ACCESS  read-only
         STATUS      current
         DESCRIPTION
            "The type of the ...
             in the InetAddress MIB [RFC 4001]."
         REFERENCE
            "The NHDP draft."
      ::= { nhdpLibRemovedAddrSetEntry 1 }

      nhdpLibRemovedAddrSetAddr  OBJECT-TYPE
         SYNTAX      InetAddress
         MAX-ACCESS  read-only
         STATUS      current
         DESCRIPTION
            "The nhdpLibRemovedAddrSetAddr is a
```

```
              recently used address of an interface of
              this node."
          REFERENCE
             "The NHDP draft."
       ::= { nhdpLibRemovedAddrSetEntry 2 }


      nhdpLibRemovedAddrSetAddrPrefixLen  OBJECT-TYPE
         SYNTAX       InetAddressPrefixLength
         MAX-ACCESS  read-only
         STATUS       current
         DESCRIPTION
            "Indicates the number of leading one bits that form the
             mask to be logical-ANDed with the address
             to determine the network address to which
             this interface is attached.
             "
         REFERENCE
            "The NHDP draft."
       ::= { nhdpLibRemovedAddrSetEntry 3 }


      -- Note: need to identify a time type for the
      -- nhdpRemoveAddrSetIrTime.

        nhdpLibRemovedAddrSetIfIndex  OBJECT-TYPE
           SYNTAX       IfIndex
           MAX-ACCESS  read-only
           STATUS       current
           DESCRIPTION
              "Specifies the local IfIndex from which this
               Ip addr was re4cently removed.
              "
           REFERENCE
              "The NHDP draft."
        ::= { nhdpLibRemovedAddrSetEntry 4 }


        nhdpLibRemovedAddrSetIrTime  OBJECT-TYPE
           SYNTAX       Unsigned32
           MAX-ACCESS  read-only
           STATUS       current
           DESCRIPTION
              "Specifies when this Tuple expires and MUST be removed
               from this table.
              "
           REFERENCE
              "The NHDP draft."
        ::= { nhdpLibRemovedAddrSetEntry 5 }
```

     -- Interface Information Base (IIB)

     --
     -- NHDP Interface Information Base (IIB)
     --

     --   IIB Link Set
     --   Entry (foreach 1-H neighbor): (NeighborAddrList,
     --   HeardTime,
     --   SymTime,
     --   Quality,
     --   Pending,
     --   Lost,
     --   ExpireTime)

     nhdpIibLinkSetTable OBJECT-TYPE
        SYNTAX   SEQUENCE OF NhdpIibLinkSetEntry
        MAX-ACCESS   not-accessible
        STATUS   current
        DESCRIPTION
           " A node's Link Set records links from
             other nodes which are, or recently
             were, 1-hop neighbors. It consists
             of Link Tuples, each representing a
             single link:

             (L_neighbor_iface_addr_list, L_HEARD_time,
              L_SYM_time, L_quality, L_pending,
              L_lost, L_time).
           "
        REFERENCE
           "The NHDP draft."
     ::= { nhdpStateObjGrp 3 }

      nhdpIibLinkSetEntry OBJECT-TYPE
         SYNTAX   NhdpIibLinkSetEntry
         MAX-ACCESS   not-accessible
         STATUS   current
         DESCRIPTION
            "The entries include ...
            "
         REFERENCE
            "This NHDP-MIB draft."
         INDEX { nhdpIibLinkSet1HopIfIndex }
      ::= { nhdpIibLinkSetTable 1 }

      NhdpIibLinkSetEntry ::=
         SEQUENCE {

```
        nhdpIibLinkSet1HopIfIndex
          NeighborIfIndex,
        nhdpIibLinkSetIfIndex
          IfIndex,
        nhdpIibLinkSetLHeardTime
          Unsigned32,
        nhdpIibLinkSetLSymTime
          Unsigned32,
        nhdpIibLinkSetLQuality
          Unsigned32,
        nhdpIibLinkSetLPending
          TruthValue
      }

nhdpIibLinkSet1HopIfIndex  OBJECT-TYPE
   SYNTAX      NeighborIfIndex
   MAX-ACCESS  read-only
   STATUS      current
   DESCRIPTION
      "The nhdpIibLinkSet1HopIfIndex is
       the value of the NeighborIfIndex (from
       table 'xxx' above).  This object
       is repeated here to support table
       walks to view the set of neighbors
       of this node.
      "
   REFERENCE
      "The NHDP draft."
::= { nhdpIibLinkSetEntry 1 }

nhdpIibLinkSetIfIndex  OBJECT-TYPE
   SYNTAX      IfIndex
   MAX-ACCESS  read-only
   STATUS      current
   DESCRIPTION
      "The nhdpIibLinkSetIfIndex is
       is the local node's interface
       index associated with the symmetric
       link to this entries neighbor
       interface.

       The IP addr set associated with this
       neighbor's interface is found in the
       'nhdpDiscIfSetTable' above.
      "
   REFERENCE
      "The NHDP draft."
::= { nhdpIibLinkSetEntry 2 }
```

```
     nhdpIibLinkSetLHeardTime  OBJECT-TYPE
        SYNTAX       Unsigned32
        MAX-ACCESS   read-only
        STATUS       current
        DESCRIPTION
           "The nhdpIibLinkSetLHeardTime is
            the time until which the MANET
            interface of the 1-hop neighbor
            would be considered heard if not
            considering link quality.
            "
        REFERENCE
           "The NHDP draft."
     ::= { nhdpIibLinkSetEntry 3 }

     nhdpIibLinkSetLSymTime  OBJECT-TYPE
        SYNTAX       Unsigned32
        MAX-ACCESS   read-only
        STATUS       current
        DESCRIPTION
           "The nhdpIibLinkSetLSymTime is the
            time until which the link to the
            1-hop neighbor would be considered
            symmetric if not considering link
            quality.
            "
        REFERENCE
           "The NHDP draft."
     ::= { nhdpIibLinkSetEntry 4 }

     nhdpIibLinkSetLQuality  OBJECT-TYPE
        SYNTAX       Unsigned32
        MAX-ACCESS   read-only
        STATUS       current
        DESCRIPTION
           "The nhdpIibLinkSetLQuality is a
            dimensionless number between 0
            (inclusive) and 1 (inclusive)
            describing the quality of a link;
            a greater value of L_quality
            indicating a higher quality link.
            "
        REFERENCE
           "The NHDP draft."
     ::= { nhdpIibLinkSetEntry 5 }

     nhdpIibLinkSetLPending  OBJECT-TYPE
        SYNTAX       TruthValue
```

```
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
         "The nhdpIibLinkSetLPending is a
          boolean flag, describing if a
          link is considered pending (i.e.,
          a candidate, but not yet
          established, link).
         "
      REFERENCE
         "The NHDP draft."
   ::= { nhdpIibLinkSetEntry 6 }

   nhdpIibLinkSetLLost  OBJECT-TYPE
      SYNTAX      TruthValue
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
         "The nhdpIibLinkSetLLost is a
          boolean flag, describing if a
          link is considered lost due
          to link quality.
         "
      REFERENCE
         "The NHDP draft."
   ::= { nhdpIibLinkSetEntry 7 }

   -- Note: need to locate a time type for this object
   nhdpIibLinkSetLTime  OBJECT-TYPE
      SYNTAX      Unsigned32
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
         "The nhdpIibLinkSetLTime specifies
          when this Tuple expires and MUST
          be removed.
         "
      REFERENCE
         "The NHDP draft."
   ::= { nhdpIibLinkSetEntry 8 }




   --
   --     IIB 2-Hop Set
   --          Entry (foreach IF on a 2-H neighbor):
```

```
   --                                  (1NeighIfAddrList,
   --                                   2NeighIfAddr,
   --                                   ExpireTime)

   nhdpIib2HopSetTable OBJECT-TYPE
      SYNTAX       SEQUENCE OF NhdpIib2HopSetEntry
      MAX-ACCESS   not-accessible
      STATUS       current
      DESCRIPTION
         " A node's 2-Hop Set records symmetric
           2-hop neighbors, and the symmetric links
           to symmetric 1-hop neighbors through
           which the symmetric 2-hop neighbors
           can be reached.  It consists of 2-Hop
           Tuples, each representing a single
           interface address of a symmetric
           2-hop neighbor, and a single MANET
           interface of a symmetric 1-hop
           neighbor, i.e.,

          (N2_neighbor_iface_addr_list,
           N2_2hop_iface_addr, N2_time).
         "
      REFERENCE
         "The NHDP draft."
   ::= { nhdpStateObjGrp 4 }

   nhdpIib2HopSetEntry  OBJECT-TYPE
      SYNTAX       NhdpIib2HopSetEntry
      MAX-ACCESS   not-accessible
      STATUS       current
      DESCRIPTION
         "The entries include the 2 hop neighbor addrs,
          which act as the table index, and associated
          1 hop symmetric link addr set, designated through
          the nhdpDiscIfIndex, and ...
         "
      REFERENCE
         "This NHDP-MIB draft."
      INDEX { nhdpIib2HopSetIpAddr }
   ::= { nhdpIib2HopSetTable 1 }

   NhdpIib2HopSetEntry ::=
      SEQUENCE {
         nhdpIib2HopSetAddrType
            InetAddressType,
         nhdpIib2HopSetAddress
            InetAddress,
```

```
            nhdpIib2HopSet1HopIfIndex
              NeighborIfIndex,
            nhdpIib2HopSetN2Time
              Unsigned32
          }


    nhdpIib2HopSetAddrType  OBJECT-TYPE
       SYNTAX      InetAddressType
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION
          "The type of the ...
           in the InetAddress MIB [RFC 4001]."
       REFERENCE
          "The NHDP draft."
    ::= { nhdpIib2HopSetEntry 1 }

    nhdpIib2HopSetIpAddr  OBJECT-TYPE
       SYNTAX      InetAddress
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION
          "The nhdpIib2HopSetIpAddr is an
           address of an interface of a symmetric
           2-hop neighbor which has a symmetric
           link (using any MANET interface) to
           the indicated symmetric 1-hop neighbor.
          "
       REFERENCE
          "The NHDP draft."
    ::= { nhdpIib2HopSetEntry 2 }

    nhdpIib2HopSet1HopIfIndex  OBJECT-TYPE
       SYNTAX      NeighborIfIndex
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION
          "The nhdpIib2HopSet1HopIfIndex is
           NeighborIfIndex of the one hop
           neighbor which communicated the ipAddress
           of the 2 hop neighbor in this row entry.
          "
       REFERENCE
          "The NHDP draft."
    ::= { nhdpIib2HopSetEntry 3 }

    -- Note: need to get a time type for this object.
```

```
nhdpIib2HopSetN2Time  OBJECT-TYPE
   SYNTAX      Unsigned32
   MAX-ACCESS  read-only
   STATUS      current
   DESCRIPTION
      "The nhdpIib2HopSetN2Time specifies
       when this column entry expires and
       MUST be removed.
      "
   REFERENCE
      "The NHDP draft."
::= { nhdpIibLinkSetEntry 4 }




--
-- Node Information Base (NIB)
--
-- Each node maintains a Node Information Base
-- that records information about addresses of
-- current and recently symmetric 1-hop neighbors.
--
-- All addresses MUST have an associated prefix
-- length.  Prefix lengths are indicated in HELLO
-- messages as specified in [1]; if an address
-- has no specified prefix length, then its prefix
-- length is equal to the address length.  Two
-- addresses are considered equal if and only
-- if their associated prefix lengths are also equal.




--      NIB Neighbor Set
--          Entry (foreach 1-H Neighbor):
--              (AllIfAddrListOfIhNeighbor,
--               SymmetricIndicator)
--      The NIB Neighbor Set Table is small because
--      most of the corresponding information is found
--      in the nhdpDiscoveredIfTable above.

nhdpNibNeighborSetTable OBJECT-TYPE
   SYNTAX      SEQUENCE OF NhdpNibNeighborSetEntry
   MAX-ACCESS  not-accessible
   STATUS      current
   DESCRIPTION
      " A node's Neighbor Set records all
        interface addresses of each 1-hop
```

```
      neighbor.  It consists of Neighbor
      Tuples, each representing a single
      1-hop neighbor:

      (N_neighbor_iface_addr_list,
       N_symmetric)
   "
REFERENCE
   "The NHDP draft."
::= { nhdpStateObjGrp 5 }

nhdpNibNeighborSetEntry  OBJECT-TYPE
   SYNTAX      NhdpNibNeighborSetEntry
   MAX-ACCESS  not-accessible
   STATUS      current
   DESCRIPTION
      "The entries include ...
      "
   REFERENCE
      "This NHDP-MIB draft."
   INDEX { nhdpNibNeighborSetNodeId }
::= { nhdpNibNeighborSetTable 1 }

 NhdpNibNeighborSetEntry ::=
    SEQUENCE {
      nhdpNibNeighborSetNodeId
        NeighborNodeId,
      nhdpNibNeighborSetNSymmetric
        TruthValue
      }

nhdpNibNeighborSetNodeId  OBJECT-TYPE
   SYNTAX      NeighborNodeId
   MAX-ACCESS  read-only
   STATUS      current
   DESCRIPTION
      "The nhdpNibNeighborSetNodeId is
       the NeighborNodeId of a one hop
       neighbor to this node.  It must also
       exist in the 'nhdpDiscSetTable'
       allowing the manager to determine
       the set of Ip addr's associated
       with the NeighborNodeId in this row.
      "
   REFERENCE
      "The NHDP draft."
::= { nhdpNibNeighborSetEntry 1 }
```

```
     nhdpNibNeighborSetNSymmetric  OBJECT-TYPE
        SYNTAX       TruthValue
        MAX-ACCESS   read-only
        STATUS       current
        DESCRIPTION
           "The nhdpNibNeighborNSymmetric is
            a boolean flag, describing if this
            is a symmetric 1-hop neighbor.
           "
        REFERENCE
           "The NHDP draft."
     ::= { nhdpNibNeighborSetEntry 2 }



     --     Lost Neighbor Set
     --          Entry ( foreach IF foreach 1-H Neighbor): (IfAddr,
     --                                               ExpireTime)

     nhdpNibLostNeighborSetTable OBJECT-TYPE
        SYNTAX       SEQUENCE OF NhdpNibLostNeighborSetEntry
        MAX-ACCESS   not-accessible
        STATUS       current
        DESCRIPTION
           " A node's Lost Neighbor Set records all
             interface addresses of each 1-hop
             neighbor recently advertised as lost.
             It consists of Neighbor
             Tuples, each representing a single
             1-hop neighbor:

             (NL_neighbor_iface_addr_list,
              NL_time)
           "
        REFERENCE
           "The NHDP draft."
     ::= { nhdpStateObjGrp 6 }

     nhdpNibLostNeighborSetEntry  OBJECT-TYPE
        SYNTAX       NhdpNibLostNeighborSetEntry
        MAX-ACCESS   not-accessible
        STATUS       current
        DESCRIPTION
           "The entries include ...
           "
        REFERENCE
           "This NHDP-MIB draft."
        INDEX { nhdpNibLostNeighborSetNodeId }
```

```
      ::= { nhdpNibLostNeighborSetTable 1 }

    NhdpNibNeighborSetEntry ::=
       SEQUENCE {
          nhdpNibLostNeighborSetNodeId
            NeighorNodeId,
          nhdpNibLostNeighborSetNLTime
            Unsigned32
          }

   nhdpNibLostNeighborSetNodeId  OBJECT-TYPE
      SYNTAX      NeighborNodeId
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
         "The nhdpNibLostNeighborSetNodeId is
          the NeighborNodeId of a one hop
          neighbor to this node which was
          recently lost.  It must also
          exist in the 'nhdpDiscSetTable'
          allowing the manager to determine
          the set of Ip addr's associated
          with the NeighborNodeId in this row.
          "
      REFERENCE
         "The NHDP draft."
   ::= { nhdpNibLostNeighborSetEntry 1 }


   -- Note: need to fime time type for this object
   nhdpNibLostNeighborSetNLTime  OBJECT-TYPE
      SYNTAX      Unsigned32
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
         "The nhdpNibLostNeighborSetNLTime
          specifies when this Tuple expires
          and MUST be removed.
          "
      REFERENCE
         "The NHDP draft."
   ::= { nhdpNibLostNeighborSetEntry 2 }




  --
```

   -- nhdpPerformanceObjGrp
   --

   -- Contains objects which help to characterize the performance of
   -- the NHDP process, typically counters.

   nhdpPerformanceObjGrp OBJECT IDENTIFIER ::= { nhdpObjects 4 }

     -- Note: Insert proposed objects here.
     --
     -- For each NHDP IF - Hello messg sent and rec,
     --   Do we want rec's per DiscoveredIfs?
     -- For each NHDP IF - TLVs sent and rec (e.g.,
     --   VALIDITY_TIME,
     --   INTERVAL_TIME,
     --   address block,
     --   LINK_STATUS,
     --   OTHER_NEIGHB
     -- For each 'link' - number link quality transitions from
     --   up to down

   --
   -- nhdpNotifications
   --

     -- Note: What are the valuable notification information for the
     -- NHDP-MIB?

   --
   -- nhdpConformance information
   --

   -- Note: To be determined.

   nhdpCompliances   OBJECT IDENTIFIER ::= { nhdpConformance 1 }
   nhdpGroups   OBJECT IDENTIFIER ::= { nhdpConformance 2 }

   -- Compliance Statements
   nhdpGeneralCompliance MODULE-COMPLIANCE
     STATUS current

```
   DESCRIPTION
      "A general compliance which allows ...."
   MODULE -- this module

   MANDATORY-GROUPS { nhdpGeneralGroup }

   ::= { nhdpCompliances 1 }

 --
 -- NHDP MIB Group Compliance
 --

 --
 -- Groups
 --

 END
```

8. Security Considerations

[TODO] Each specification that defines one or more MIB modules MUST
contain a section that discusses security considerations relevant to
those modules. This section MUST be patterned after the latest
approved template (available at
http://www.ops.ietf.org/mib-security.html). Remember that the
objective is not to blindly copy text from the template, but rather
to think and evaluate the risks/vulnerabilities and then state/
document the result of this evaluation.

[TODO] if you have any read-write and/or read-create objects, please
include the following boilerplate paragraph.

There are a number of management objects defined in this MIB module
with 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. These are the tables and objects and their
sensitivity/vulnerability:

o [TODO] writable MIB objects that could be especially disruptive if
   abused MUST be explicitly listed by name and the associated
   security risks MUST be spelled out; RFC 2669 has a very good
   example.

o [TODO] list the writable tables and objects and state why they are
   sensitive.

[TODO] else if there are no read-write objects in your MIB module,
use the following boilerplate paragraph.

There are no management objects defined in this MIB module that have
a MAX-ACCESS clause of read-write and/or read-create. So, if this
MIB module is implemented correctly, then there is no risk that an
intruder can alter or create any management objects of this MIB
module via direct SNMP SET operations.

[TODO] if you have any sensitive readable objects, please include the
following boilerplate paragraph.

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

o [TODO] you must explicitly list by name any readable objects that
   are sensitive or vulnerable and the associated security risks MUST
   be spelled out (for instance, if they might reveal customer
   information or violate personal privacy laws such as those of the
   European Union if exposed to unauthorized parties)

o [TODO] list the tables and objects and state why they are
   sensitive.

[TODO] discuss what security the protocol used to carry the
information should have. The following three boilerplate paragraphs
should not be changed without very good reason. Changes will almost
certainly require justification during IESG review.

SNMP versions prior to SNMPv3 did not include adequate security.
Even if the network itself is secure (for example by using IPSec),
even then, there is no control as to who on the secure network is
allowed to access and GET/SET (read/change/create/delete) the objects
in this MIB module.

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

Further, deployment of SNMP versions prior to SNMPv3 is NOT
RECOMMENDED. Instead, it is RECOMMENDED to deploy SNMPv3 and to
enable cryptographic security. It is then a customer/operator

responsibility to ensure that the SNMP entity giving access to an
instance of this MIB module is properly configured to give access to
the objects only to those principals (users) that have legitimate
rights to indeed GET or SET (change/create/delete) them.

9. IANA Considerations

[TODO] In order to comply with IESG policy as set forth in
http://www.ietf.org/ID-Checklist.html, every Internet-Draft that is
submitted to the IESG for publication MUST contain an IANA
Considerations section. The requirements for this section vary
depending what actions are required of the IANA. see RFC4181 section
3.5 for more information on writing an IANA clause for a MIB module
document.

[TODO] select an option and provide the necessary details.

Option #1:

     The MIB module in this document uses the following IANA-assigned
     OBJECT IDENTIFIER values recorded in the SMI Numbers registry:

     Descriptor   OBJECT IDENTIFIER value
     ----------   -----------------------

     sampleMIB { mib-2 XXX }

Option #2:

Editor's Note (to be removed prior to publication): the IANA is
requested to assign a value for "XXX" under the 'mib-2' subtree and
to record the assignment in the SMI Numbers registry. When the
assignment has been made, the RFC Editor is asked to replace "XXX"
(here and in the MIB module) with the assigned value and to remove
this note.

Note well: prior to official assignment by the IANA, a draft document
MUST use placeholders (such as "XXX" above) rather than actual
numbers. See RFC4181 Section 4.5 for an example of how this is done
in a draft MIB module.

Option #3:

This memo includes no request to IANA.

10. Contributors

   This MIB document uses the template authored by D. Harrington which
   is based on contributions from the MIB Doctors, especially Juergen
   Schoenwaelder, Dave Perkins, C.M.Heard and Randy Presuhn.

11. Acknowledgements

   [TODO]This acknowledgement can be removed from your MIB module
   document.

12. References

12.1. Normative References

   [RFC2863] McCloghrie, K. and F. Kastenholz, "The Interfaces Group
              MIB", RFC 2863, June 2000.

   [RFC3418] Presuhn, R., "Management Information Base (MIB) for the
              Simple Network Management Protocol (SNMP)", STD 62,
              RFC 3418, December 2002.

   [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate
              Requirement Levels", BCP 14, RFC 2119, March 1997.

   [RFC2578] McCloghrie, K., Ed., Perkins, D., Ed., and J.
              Schoenwaelder, Ed., "Structure of Management Information
              Version 2 (SMIv2)", STD 58, RFC 2578, April 1999.

   [RFC2579] McCloghrie, K., Ed., Perkins, D., Ed., and J.
              Schoenwaelder, Ed., "Textual Conventions for SMIv2",
              STD 58, RFC 2579, April 1999.

   [RFC2580] McCloghrie, K., Perkins, D., and J. Schoenwaelder,
              "Conformance Statements for SMIv2", STD 58, RFC 2580,
              April 1999.

12.2. Informative References

   [RFC3410] Case, J., Mundy, R., Partain, D., and B. Stewart,
              "Introduction and Applicability Statements for Internet-
              Standard Management Framework", RFC 3410, December 2002.

Appendix A. Change Log

   Here we list the changes made to the various drafts of this MIB.

   We list here the changes made on the draft-cole-manet-nhdp-mib-00

draft to generate the draft-cole-manet-nhdp-mib-01 draft.

1. Defined the NeighborIfIndex and the NeighborNodeId textual
    conventions. These identify a remote neighbor IfIndex and a
    remote neighbor node and are used as indexes into NHDP state
    tables. These constructs were necessary in order to associate
    address lists with specific remote interfaces as required by the
    NHDP protocol specification.

2. Developed the nhdpInterfaceTable as part of the configuration
    group.

3. Developed the nhdpDiscIfSetTable as a means to associate address
    lists with remotely discovered neighbor interfaces.

4. Added tables defining the node's NHDP Local Information Base
    (LIB) as specified in the NHPD protocol specification.

5. Added tables defining the node's NHDP Interface information Base
    (IIB) as specified in the NHPD protocol specification.

6. Added tables defining the node's NHDP Node Information Base (NIB)
    as specified in the NHPD protocol specification.

7. Aligned the NHDP-MIB and the OLSRv2-MIB configuration tables and
    indexing.

Appendix B. Open Issues

This section contains the set of open issues related to the
development and design of the NHDP-MIB. This section will not be
present in the final version of the MIB and will be removed once all
the open issues have been resolved.

1.   How to handle dynamic parameters within NHDP? Should we expose
     setting, min and max values?

2.   Need to address how to handle Link Quality settings and
     parameters for a) optional operation and b) changing nature of
     link quality.

3.   What performance objects are of interest and utility?

4.   What notifications are of interest and utility?

5.   Identify all objects requiring non-volatile storage in their
     DESCRIPTION clauses.

    6.   Incorporate parameter relationship conditions into their
          DESCRIPTION clauses.

    7.   Also, specify specific SNMP response to the snmp set request,
          i.e., 'generic error', 'bad value', etc.

    8.   Fill in all of the DEFVAL within the configuration group
          objects.

    9.   Run through the MIB checker.

    10.   Clean up all of the 'Note:' statements within the body of the
          MIB.

    11.   Work on the Security Section. This MIB does have settable
          objects, but not sensitive objects (true?).

    12.   Work on the relationship to other MIBs, IF-MIB, NHDP-MIB.

    13.   Cleanup all the [TODOs] from the MIB template.

Appendix C.

    ****
    * Note to the RFC Editor (to be removed prior to publication) *
    *   *
    * 1) The reference to RFCXXXX within the DESCRIPTION clauses *
    * of the MIB module point to this draft and are to be   *
    * assigned by the RFC Editor.   *
    *   *
    * 2) The reference to RFCXXX2 throughout this document point *
    * to the current draft-cole-manet-nhdp-xx.txt.   This   *
    * need to be replaced with the XXX RFC number.   *
    *   *
    ****

Authors' Addresses

    Robert G. Cole
    Johns Hopkins University
    11100 Johns Hopkins Road, Room 257
    Laurel, Maryland 21073
    USA

    Phone: +1 443 778 6951
    EMail: robert.cole@jhuapl.edu
    URI: http://www.cs.jhu.edu/~rgcole/

    Ian D Chakeres
    CenGen
    9250 Bendix Road North
    Columbia, Maryland 560093
    USA

    EMail: ian.chakeres@gmail.com
    URI: http://www.ianchak.com/