Definition of Managed Objects for the Neighborhood Discovery Protocol

Abstract

This document replaces RFC 6779; it contains revisions and extensions to the original document. It 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 parameters of the Neighborhood Discovery Protocol (NHDP) process on a router. The extensions described in this document add objects and values to support the NHDP optimization specified in RFC 7466. The MIB module defined in this document, denoted NHDP-MIB, also reports state, performance information, and notifications about NHDP. This additional state and performance information is useful to troubleshoot problems and performance issues during neighbor discovery.

Status of This Memo

This is an Internet Standards Track document.

This document is a product of the Internet Engineering Task Force (IETF). It represents the consensus of the IETF community. It has received public review and has been approved for publication by the Internet Engineering Steering Group (IESG). Further information on Internet Standards is available in Section 2 of RFC 7841.

Information about the current status of this document, any errata, and how to provide feedback on it may be obtained at http://www.rfc-editor.org/info/rfc7939.
RFC 7939  The NHDP-MIB  August 2016

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1. Introduction

This document 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 parameters of the Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP) [RFC6130] process on a router. The MIB module defined in this document, denoted NHDP-MIB, also reports state, performance information, and notifications about NHDP. This additional state and performance information is useful to troubleshoot problems and performance issues during neighbor discovery.

1.1. Differences from RFC 6779

This document obsoletes [RFC6779], replacing that document as the specification of the MIB module for [RFC6130]. This revision to [RFC6779] is necessitated by the update to [RFC6130] specified in [RFC7466].

The MIB module for [RFC6130], specified in this document, captures the new information and states for each symmetric 2-hop neighbor, recorded in the Neighbor Information Base of a router and to be reflected in the appropriate tables, introduced by [RFC7466], specifically:

- Addition of objects nhdpIib2HopSetN2Lost and nhdpIfPerfCounterDiscontinuityTime.
- Addition of extra value (notconsidered) to nhdp2HopNbrState.
- Revised full compliance state.

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", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

4. Overview

[RFC6130] allows a router to discover and track topological information of routers up to two hops away by virtue of exchanging HELLO messages. 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:

- Notification Objects - triggers and associated notification messages allowing for asynchronous tracking of predefined events on the managed router.

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

- State Objects - automatically generated values that define the current operating state of the NHDP instance in the router.

- Performance Objects - automatically generated values that help to assess the performance of the NHDP instance on the router and the overall discovery performance within the MANET.

4.2. Notation

The same notations as defined in [RFC6130] are used throughout this document.

5. Structure of the MIB Module

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

- nhdpNotifications - objects defining NHDP-MIB notifications.
nhdpObjects - defining objects within this MIB module. The objects are arranged into the following groups:

* Configuration Group - defining objects related to the configuration of the NHDP instance on the router.
* State Group - defining objects that reflect the current state of the NHDP instance running on the router.
* Performance Group - defining objects that are useful to a management station when characterizing the performance of NHDP on the router and in the MANET.

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

5.1. Notifications

This section describes the use of notifications and mechanisms to enhance the ability to manage NHDP routing domains.

5.1.1. Introduction

Notifications can be emitted by a router running an instance of this specification as a reaction to a specific event. This allows an observer of these events to efficiently determine the source of problems or significant changes of configuration or topology, instead of polling a possibly large number of routers.

5.1.2. Notification Generation

When an exception event occurs, the application notifies the local agent, which sends a notification to the appropriate SNMP management stations. The message includes the notification type and may include a list of notification-specific variables. Section 7 contains the notification definitions, which includes the variable lists. At least one IP address of the router that originates the notification is included in the variable list so that the source of the notification may be determined.

5.1.3. Limiting Frequency of Notifications

To limit the frequency of notifications, the following additional mechanisms are suggested, similar to those in [RFC4750].

Herberg, et al. Standards Track [Page 5]
5.1.3.1. Ignoring Initial Activity

The majority of critical events occur when NHDP is first enabled on a router, at which time, the symmetric neighbors and 2-hop neighbors of the router are discovered. During this initial period, a potential flood of notifications is unnecessary since the events are expected. To avoid unnecessary notifications, a router SHOULD NOT originate expected notifications until a predefined and administratively configured time interval has elapsed. It is RECOMMENDED that this time interval be at least 3 times nhdpHelloInterval so that symmetric neighbors are discovered. The suppression window for notifications is started when the nhdpIfStatus transitions from its default value of ‘false(2)’ to ‘true(1)’.

5.1.3.2. Throttling Notifications

The mechanism for throttling the notifications is the same as in [RFC4750] (i.e., the number of transmitted notifications per time is bounded).

Appropriate values for the window time and upper bound are to be administratively configured and depend on the deployment of the MANET. If NHDP is deployed on a lossy, wireless medium, sending too many notifications in a short time interval may lead to collisions and dropped packets. In particular, in dense deployments of routers running NHDP (i.e., where each router has many neighbors), a change of the local topology may trigger many notifications at the same time. [RFC4750] recommends "7 traps with a window time of 10 seconds" as the upper bound. As NHDP is expected to be deployed in more lossy channels than OSPF, it is RECOMMENDED to choose a lower threshold for the number of notifications per time than that. Specifically, it is RECOMMENDED that the threshold value for the objects reflecting the change be set to a value of ‘10’ and the DEFAULT values for these objects within the Notifications Group be set to this value. Further, a time window for the change objects is defined within this MIB module. If the number of occurrences exceeds the change threshold within the previous change window, then it is RECOMMENDED that the notification be sent. Furthermore, it is RECOMMENDED that the value for this window be set to at least 5 times the nhdpHelloInterval.

The following objects are used to define the thresholds and time windows for specific notifications defined in the NHDP-MIB module: nhdpNbrStateChangeThreshold, nhdp2HopNbrStateChangeThreshold, and nhdp2HopNbrStateChangeWindow.
5.1.3.3. One Notification per Event

Similar to the mechanism in [RFC4750], only one notification is sent per event.

5.2. The Configuration Group

The router running NHDP is configured with a set of controls. The authoritative list of configuration controls within the NHDP-MIB module are found within the MIB module itself. Generally, an attempt was made in developing the NHDP-MIB module to support all configuration objects defined in [RFC6130]. For all of the configuration parameters, the same constraints and default values of these parameters as defined in [RFC6130] are followed. Refer to [RFC5148] for guidance on setting jitter-related parameters, e.g., nhdpMaxJitter.

5.3. The State Group

The State Group reports current state information of a router running NHDP. The NHDP-MIB State Group tables were designed to contain the complete set of state information defined within the information bases specified in Sections 6, 7, and 8 of [RFC6130].

Two constructs, i.e., TEXTUAL-CONVENTIONs, are defined to support the tables in the State Group. NHDP stores and indexes information through sets of (dynamically defined) addresses, i.e., address sets. Within SMIV2, it is not possible to index tables with variably defined address sets. Hence, these TEXTUAL-CONVENTIONs are defined to provide a local mapping between NHDP-managed address sets and SMIV2 table indexing. These constructs are the NeighborIfIndex and NeighborRouterIndex. These are locally (to the router) defined, unique identifiers of virtual neighbors and neighbor interfaces. Due to the nature of NHDP, the local router may have identified distinct address sets but is not able to associate these as a single interface. Hence, two or more NeighborIfIndexes pointing to multiple distinct address sets may, in fact, be related to a common neighbor interface. This ambiguity may also hold with respect to the assignment of the NeighborRouterIndex. The local MIB agent is responsible for managing, aggregating, and retiring the defined indexes and for updating MIB tables using these indexes as the local router learns more about its neighbors’ topologies. These constructs are used to define indexes to the appropriate State Group tables and to correlate table entries to address sets, virtual neighbor interfaces, and virtual neighbors within the MANET.
5.4. The Performance Group

The Performance Group reports values relevant to system performance. Unstable neighbors or 2-hop neighbors and frequent changes of sets can have a negative influence on the performance of NHDP. This MIB module defines several objects that can be polled in order to, e.g., calculate histories or monitor frequencies of changes. This may help an observer determining unusual topology changes or other changes that affect stability and reliability of the MANET.

5.5. Tables and Indexing

The NHDP-MIB module contains a number of tables that record data related to:

- the local router,
- a local MANET interface on the router,
- other routers that are one hop removed from the local router,
- interfaces on other routers that are one hop removed from the local router, and
- other routers that are two hops removed from the local router.

The NHDP-MIB module’s tables are indexed via the following constructs:

- nhdpIfIndex - the IfIndex of the local router on which NHDP is configured.
- nhdpDiscIfIndex - a locally managed index representing a known interface on a neighboring router.
- nhdpDiscRouterIndex - a locally managed index representing an ID of a known neighboring router.

These tables and their indexing are:

- nhdpInterfaceTable - describes the configuration of the interfaces of this router. This table has INDEX { nhdpIfIndex }.
- nhdpLibLocalIfSetTable - records all network addresses that are defined as local interface network addresses on this router. This table has INDEX { nhdpLibLocalIfSetIndex }.
o  nhdpLibRemovedIfAddrSetTable - records network addresses that were
recently used as local interface network addresses on this router
but have been removed. This table has INDEX
{ nhdpLibRemovedIfAddrSetIndex }.

o  nhdpInterfaceStateTable - records state information related to
specific interfaces of this router. This table has INDEX
{ nhdpIfIndex }.

o  nhdpDiscIfSetTable - includes the nhdpDiscRouterIndex of the
discovered router, the nhdpDiscIfIndex of the discovered
interface, and the current set of addresses associated with this
neighbor interface. This table has INDEX { nhdpDiscIfSetIndex }.

o  nhdpIibLinkSetTable - for each local interface, records all links
belonging to other routers that are, or recently were, 1-hop
neighbors to this router. This table has INDEX { nhdpIfIndex,
nhdpDiscIfIndex }.

o  nhdpIib2HopSetTable - for each local interface, records network
addresses (one at a time) of symmetric 2-hop neighbors and the
symmetric links to symmetric 1-hop neighbors of this router
through which these symmetric 2-hop neighbors can be reached.
This table has INDEX { nhdpIfIndex, nhdpDiscIfIndex,
nhdpIib2HopSetIpAddressType, nhdpIib2HopSetIpAddress }.

o  nhdpNibNeighborSetTable - records all network addresses of each
1-hop neighbor to this router. This table has INDEX
{ nhdpDiscRouterIndex }.

o  nhdpNibLostNeighborSetTable - records network addresses of other
routers that were recently symmetric 1-hop neighbors to this
router but are now advertised as lost. This table has INDEX
{ nhdpDiscRouterIndex }.

o  nhdpInterfacePerfTable - records performance objects that are
measured for each local NHDP interface on this router. This table
has INDEX { nhdpIfIndex }.

o  nhdpDiscIfSetPerfTable - records performance objects that are
measured for each discovered interface of a neighbor of this
router. This table has INDEX { nhdpDiscIfIndex }.

o  nhdpDiscNeighborSetPerfTable - records performance objects that
are measured for discovered neighbors of this router. This table
has INDEX { nhdpDiscRouterIndex }.
6. Relationship to Other MIB Modules

This section specifies the relationship of the MIB module contained in this document to other standards, particularly to standards containing other MIB modules. MIB modules and specific definitions imported from 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 module [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 module does not duplicate those objects.

6.2. Relationship to Routing Protocol MIB Modules Relying on the NHDP-MIB Module

[RFC6130] allows routing protocols to rely on the neighborhood information that is discovered by means of HELLO message exchange. In order to allow for troubleshooting, fault isolation, and management of such routing protocols through a routing protocol MIB module, it may be desired to align the State Group tables of the NHDP-MIB module and the routing protocol MIB module. This is accomplished through the definition of two TEXTUAL-CONVENTIONS in the NHDP-MIB module: the NeighborIfIndex and the NeighborRouterIndex. These object types are used to develop indexes into common NHDP-MIB module and routing protocol State Group tables. These objects are locally significant but should be locally common to the NHDP-MIB module and the routing protocol MIB module implemented on a common networked router. This will allow for improved cross-referencing of information across the two MIB modules.

6.3. Relationship to the If-MIB

The nhdpInterfaceTable in this MIB module describes the configuration of the interfaces of this router that are intended to use MANET control protocols. As such, this table ‘sparse augments’ the ifTable [RFC2863] specifically when NHDP is to be configured to operate over this interface. The interface is identified by the ifIndex from the Interfaces Group defined in the Interfaces Group MIB module [RFC2863].
A conceptual row in the nhdpInterfaceTable exists if and only if either the row has been administratively created or there is an interface on the managed device that supports and runs NHDP. This implies that for each entry in the nhdpInterfaceTable, there is a corresponding entry in the Interface Table where nhdpIfIndex and ifIndex are equal. If that corresponding entry in the Interface Table is deleted, then the entry in nhdpInterfaceTable is automatically deleted, NHDP is disabled on this interface, and all configuration and state information related to this interface is to be removed from memory.

6.4. MIB Modules Required for IMPORTS

The following NHDP-MIB module IMPORTS objects from SNMPv2-SMI [RFC2578], SNMPv2-TC [RFC2579], SNMPv2-CONF [RFC2580], IF-MIB [RFC2863], SNMP-FRAMEWORK-MIB [RFC3411], INET-ADDRESS-MIB [RFC4001], and FLOAT-TC-MIB [RFC6340].

7. Definitions

This section contains the MIB module defined by the specification.

NHDP-MIB DEFINITIONS ::= BEGIN

-- This MIB module defines objects for the management of
-- NHDP (RFC 6130) - Mobile Ad Hoc Network (MANET)
-- Neighborhood Discovery Protocol (NHDP),
-- Clausen, T., Dearlove, C., and J. Dean, January 2011.

IMPORTS

MODULE-IDENTITY, OBJECT-TYPE, NOTIFICATION-TYPE,
Counter32, Counter64, Integer32, Unsigned32, mib-2,
TimeTicks
FROM SNMPv2-SMI -- RFC 2578

TEXTUAL-CONVENTION, TruthValue, TimeStamp,
RowStatus
FROM SNMPv2-TC -- RFC 2579

MODULE-COMPLIANCE, OBJECT-GROUP, NOTIFICATION-GROUP
FROM SNMPv2-CONF -- STD 58

SnmpAdminString
FROM SNMP-FRAMEWORK-MIB -- RFC 3411
InetAddressType, InetAddress, InetAddressPrefixLength
   FROM INET-ADDRESS-MIB -- RFC 4001

InterfaceIndex
   FROM IF-MIB -- RFC 2863

Float32TC
   FROM FLOAT-TC-MIB -- RFC 6340

nhdpMIB MODULE-IDENTITY
   LAST-UPDATED "201607120000Z" -- 12 July 2016
   ORGANIZATION "IETF MANET Working Group"
   CONTACT-INFO
   "WG Email: manet@ietf.org
    WG web page: https://datatracker.ietf.org/wg/manet"

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DESCRIPTION
"This NHDP-MIB module is applicable to routers implementing the Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP) defined in RFC 6130.

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-- revision
REVISION "201607120000Z" -- 12 July 2016
DESCRIPTION
"Updated version of this MIB module, including updates made to NHDP by RFC 7466, published as RFC 7939."
REVISION "201210221000Z" -- 22 October 2012
DESCRIPTION
"Initial version of this MIB module, published as RFC 6779."
::= { mib-2 213 }

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

--
-- TEXTUAL-CONVENTIONS
--
-- Two new TEXTUAL-CONVENTIONS have been defined in
-- this MIB module for indexing into the following
-- tables and indexing into other tables in other MIB modules.
-- This was necessary because NHDP manages and
-- indexes based upon dynamic address tuples, i.e.,
-- address sets, while SMI requires statically
-- defined indexes for accessing its table rows.
-- The NeighborIfIndex defines a unique (to the local router)
-- index referencing a discovered virtual interface on another
-- neighbor within the MANET. The NeighborRouterIndex defines a
-- unique (to the local router) index referencing a discovered
-- virtual neighbor within the MANET.

-- Due to the nature of NHDP,
-- different indexes may be related to common neighbor
-- interfaces or common neighbor routers, but the information
-- obtained through NHDP has not allowed the local router
-- to relate these virtual objects (i.e., interfaces or routers)
-- at this point in time. As more topology information
-- is gathered by the local router, it may associate
-- virtual interfaces or routers and collapse these
-- indexes appropriately.

-- Multiple addresses can be associated with a
-- given NeighborIfIndex. Each NeighborIfIndex is
-- associated with a NeighborRouterIndex. Throughout
-- the nhdpStateObjGroup, the
-- NeighborIfIndex and the NeighborRouterIndex are used
-- to define the set of IP Addresses related to a virtual
-- neighbor interface or virtual neighbor under discussion.

NeighborIfIndex ::= TEXTUAL-CONVENTION
DISPLAY-HINT "d"
STATUS       current
DESCRIPTION
"An arbitrary, locally unique identifier associated with a
virtual interface of a discovered NHDP neighbor.
Due to the nature of NHDP, the local router
may not know if two distinct addresses belong to the
same interface of a neighbor or to two different
interfaces. As the local router gains more
knowledge of its neighbors, its local view may change, and
this table will be updated to reflect the local router’s
current understanding, associating address sets to neighbor
interfaces. The local router identifies a virtual neighbor
interface through the receipt of address lists advertised
through an NHDP HELLO message.

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

The value for each discovered virtual neighbor
interface may not remain constant from
one re-initialization of the entity’s network management
agent to the next re-initialization. If the
local router gains information associating two virtual
interfaces on a neighbor as a common interface,
then the agent MUST aggregate the two address sets to a single index chosen from the set of aggregated indexes, and it MUST update all tables in this MIB module that are indexed by indexes of type NeighborIfIndex. It MAY then reuse freed index values following the next agent restart.

The specific value is meaningful only within a given SNMP entity.

SYNTAX          Unsigned32 (1..2147483647)

NeighborRouterIndex ::= TEXTUAL-CONVENTION
  DISPLAY-HINT "d"
  STATUS        current
  DESCRIPTION
    "An arbitrary, locally unique identifier associated with a virtual discovered neighbor (one or two hop). Due to the nature of NHDP, the local router may identify multiple virtual neighbors that, in fact, are one and the same. Neighbors that are two hops away with more than one advertised address will exhibit this behavior. As the local router’s knowledge of its neighbors’ topology increases, the local router will be able to associate multiple virtual neighbor indexes into a single virtual neighbor index chosen from the set of aggregated indexes; it MUST update all tables in this MIB module indexed by these indexes, and it MAY reuse the freed indexes following the next agent re-initialization.

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

The NeighborRouterIndex defines a discovered NHDP peer virtual neighbor of the local router. The value for each discovered virtual neighbor index MUST remain constant at least from one re-initialization of the entity’s network management agent to the next re-initialization, except if an application is deleted and re-created.

The specific value is meaningful only within a given SNMP entity. A NeighborRouterIndex value MUST NOT be reused until the next agent restart."

SYNTAX          Unsigned32 (1..2147483647)
nhdpObjects

1) Configuration Objects Group
2) State Objects Group
3) Performance Objects Group

nhdpObjects

nhdpObjects

Contains the NHDP objects that configure specific options
that determine the overall performance and operation of
NHDP.

nhdpConfigurationObjGrp

OBJECT IDENTIFIER ::= { nhdpObjects 1 }

nhdpInterfaceTable

OBJECT-TYPE
SYNTAX SEQUENCE OF NhdpInterfaceEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"The nhdpInterfaceTable describes the
collection of the interfaces of this router
that are intended to use MANET control protocols.
As such, this table ‘sparse augments’ the ifTable
specifically when NHDP is to be configured to
operate over this interface. The interface is
identified by the ifIndex from the Interfaces
Group defined in the Interfaces Group MIB module.
A conceptual row in this table exists if and only
if the row has been administratively created
or there is an interface on the managed device
that supports and runs NHDP.

A row can be administratively created by setting
rowStatus to ‘createAndGo’ or ‘createAndWait’.
During the row creation, objects having associated
DEFVAL clauses are automatically defined by
the agent if not explicitly administratively defined.

For each entry in the nhdpInterfaceTable, there is a
corresponding entry in the Interface Table where
nhdpIfIndex and ifIndex are equal. If that corresponding
entry in the Interface Table is deleted, then the entry in
the nhdpInterfaceTable is automatically deleted,
NHDP is disabled on this interface, and all configuration and state information related to this interface is to be removed from memory.

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 nhdpInterfaceEntry describes one NHDP local interface configuration as indexed by its ifIndex as defined in the Standard MIB II Interface Table (RFC 2863).

The objects in this table are persistent, and when written, the device SHOULD save the change to nonvolatile storage. For further information on the storage behavior for these objects, refer to the description for the nhdpIfRowStatus object."

INDEX { nhdpIfIndex }
::= { nhdpInterfaceTable 1 }

NhdpInterfaceEntry ::= SEQUENCE {
    nhdpIfIndex     InterfaceIndex,
    nhdpIfName      SnmpAdminString,
    nhdpIfStatus    TruthValue,
    nhdpHelloInterval  Unsigned32,
    nhdpHelloMinInterval  Unsigned32,
    nhdpRefreshInterval  Unsigned32,
    nhdpLHoldTime    Unsigned32,
    nhdpHHoldTime    Unsigned32,
    nhdpHystAcceptQuality  Float32TC,
nhdpHystRejectQuality
  Float32TC,
nhdpInitialQuality
  Float32TC,
nhdpInitialPending
  TruthValue,
nhdpHpMaxJitter
  Unsigned32,
nhdpHtMaxJitter
  Unsigned32,
nhdpIfRowStatus
  RowStatus
)

nhdpIfIndex  OBJECT-TYPE
SYNTAX      InterfaceIndex
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
  "This value MUST correspond to an ifIndex referring
to a valid entry in the Interfaces Table."
REFERENCE
  "RFC 2863 - The Interfaces Group MIB, McCloghrie, K.,
and F. Kastenholtz, June 2000"
::= { nhdpInterfaceEntry 1 }

nhdpIfName  OBJECT-TYPE
SYNTAX      SnmpAdminString
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
  "The textual name of the interface. The value of this
object SHOULD be the name of the interface as assigned by
the local device. This can be a text-name, such as 'le0'
or a simple port number, such as '1',
depending on the interface-naming syntax of the device.

If there is no local name or this object is otherwise not
applicable, then this object contains a zero-length string."
::= { nhdpInterfaceEntry 2 }

nhdpIfStatus  OBJECT-TYPE
SYNTAX      TruthValue
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION

"nhdpIfStatus indicates whether this interface is currently running NHDP. A value of ‘true(1)’ indicates that NHDP is running on this interface. A value of ‘false(2)’ indicates that NHDP is not currently running on this interface. This corresponds to the I_manet parameter in the Local Interface Set of NHDP."

DEFVAL { false }
 ::= { nhdpInterfaceEntry 3 }

--
-- Interface Parameters - Message Intervals
--

nhdpHelloInterval  OBJECT-TYPE
SYNTAX      Unsigned32
UNITS       "milliseconds"
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION

"nhdpHelloInterval corresponds to HELLO_INTERVAL of NHDP and represents the maximum time between the transmission of two successive HELLO messages on this MANET interface.

Guidance for setting this object may be found in Section 5 of the NHDP specification (RFC 6130), which indicates that:
  o nhdpHelloInterval > 0
  o nhdpHelloInterval >= nhdpHelloMinInterval"

REFERENCE

"Section 5 on Protocol Parameters and Constraints of RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"

DEFVAL ( 2000 )
 ::= { nhdpInterfaceEntry 4 }

nhdpHelloMinInterval  OBJECT-TYPE
SYNTAX      Unsigned32
UNITS       "milliseconds"
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION

"nhdpHelloMinInterval corresponds to HELLO_MIN_INTERVAL of NHDP and represents the minimum interval between transmission of two successive HELLO messages on this MANET interface.

Guidance for setting this object may be found in Section 5 of the NHDP specification (RFC 6130), which indicates that:

- nhdpHelloMinInterval <= nhdpHelloInterval"

REFERENCE

"Section 5 on Protocol Parameters and Constraints of RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"

DEFVAL { 500 }
::= { nhdpInterfaceEntry 5 }

nhdpRefreshInterval OBJECT-TYPE
SYNTAX Unsigned32
UNITS "milliseconds"
MAX-ACCESS read-create
STATUS current
DESCRIPTION

"nhdpRefreshInterval corresponds to REFRESH_INTERVAL of NHDP and represents the maximum interval between advertisements of each 1-hop neighbor network address and its status. Each advertisement is in a HELLO message on this MANET interface.

Guidance for setting this object may be found in Section 5 of the NHDP specification (RFC 6130), which indicates that:

- nhdpRefreshInterval >= nhdpHelloInterval"

REFERENCE

"Section 5 on Protocol Parameters and Constraints of RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"

DEFVAL { 2000 }
::= { nhdpInterfaceEntry 6 }

--

-- Interface Parameters - Information Validity times
--
nhdpLHoldTime  OBJECT-TYPE
SYNTAX       Unsigned32
UNITS        "milliseconds"
MAX-ACCESS   read-create
STATUS       current
DESCRIPTION  "nhdpLHoldTime corresponds to
L_HOLD_TIME of NHDP and represents the period
of advertisement, on this MANET interface, of
former 1-hop neighbor network addresses as lost
in HELLO messages, allowing recipients of these
HELLO messages to accelerate removal of this
information from their Link Sets.

Guidance for setting this object may be found
in Section 5 of the NHDP specification (RFC 6130),
which indicates that it should be assigned a
value significantly greater than the refresh
interval held by nhdpRefreshInterval."
REFERENCE
"Section 5 on Protocol Parameters and
Constraints of RFC 6130 — Mobile Ad Hoc Network
(MANET) Neighborhood Discovery Protocol (NHDP),
Clausen, T., Dearlove, C., and J. Dean, April 2011"
DEFVAL { 6000 }
 ::= { nhdpInterfaceEntry 7 }

nhdpHHoldTime  OBJECT-TYPE
SYNTAX       Unsigned32
UNITS        "milliseconds"
MAX-ACCESS   read-create
STATUS       current
DESCRIPTION  "nhdpHHoldTime corresponds to
H_HOLD_TIME of NHDP and is used as the value
in the VALIDITY_TIME Message TLV included in all
HELLO messages on this MANET interface. It is then
used by each router receiving such a HELLO message
to indicate the validity of the information taken
from that HELLO message and recorded in the receiving
router’s Information Bases.

Guidance for setting this object may be found
in Section 5 of the NHDP specification (RFC 6130),
which indicates that it should be assigned a
value significantly greater than the refresh interval
held by nhdpRefreshInterval and must be representable
as described in RFC 5497."
**nhdpHystAcceptQuality**  OBJECT-TYPE
SYNTAX      Float32TC
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION
"nhdpHystAcceptQuality corresponds to
HYST_ACCEPT of NHDP and represents the link
quality threshold at or above which a link becomes
usable, if it was not already so.

Guidance for setting this object may be found
in Section 5 of the NHDP specification (RFC 6130),
which indicates that:
  o 0 <= nhdpHystRejectQuality
    <= nhdpHystAcceptQuality <= 1.0

The default value for this object is 1.0. According to
RFC 6340:
Since these textual conventions are defined in terms
of the OCTET STRING type, the SMI’s mechanisms for
formally setting range constraints are not available.
MIB designers using these textual conventions will need
to use DESCRIPTION clauses to spell out any applicable
range constraints beyond those implied by the underlying
IEEE types.
Therefore, this object does not have a DEFVAL clause."

REFERENCE
"Section 5 on Protocol Parameters and
Constraints of RFC 6130 - Mobile Ad Hoc Network
(MANET) Neighborhood Discovery Protocol (NHDP),
Clausen, T., Dearlove, C., and J. Dean, April 2011"
::= { nhdpInterfaceEntry 9 }

nhdpHystRejectQuality OBJECT-TYPE
SYNTAX Float32TC
MAX-ACCESS read-create
STATUS current
DESCRIPTION "nhdpHystRejectQuality corresponds to HYST_REJECT of NHDP and represents the link quality threshold below which a link becomes unusable, if it was not already so.

Guidance for setting this object may be found in Section 5 of the NHDP specification (RFC 6130), which indicates that:
  o 0 <= nhdpHystRejectQuality <= nhdpHystAcceptQuality <= 1.0

The default value for this object is 0.0. According to RFC 6340:
Since these textual conventions are defined in terms of the OCTET STRING type, the SMI’s mechanisms for formally setting range constraints are not available. MIB designers using these textual conventions will need to use DESCRIPTION clauses to spell out any applicable range constraints beyond those implied by the underlying IEEE types.
Therefore, this object does not have a DEFVAL clause."
REFERENCE
"Section 5 on Protocol Parameters and Constraints of RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"
-- DEFVAL { 0.0 } see DESCRIPTION
::= { nhdpInterfaceEntry 10 }

nhdpInitialQuality OBJECT-TYPE
SYNTAX Float32TC
MAX-ACCESS read-create
STATUS current
DESCRIPTION "nhdpInitialQuality corresponds to INITIAL_QUALITY of NHDP and represents the initial quality of a newly identified link.

Guidance for setting this object may be found in Section 5 of the NHDP specification (RFC 6130),"
which indicates that:
  o 0 <= nhdpInitialQuality <= 1.0

The default value for this object is 1.0. According to RFC 6340:

Since these textual conventions are defined in terms of the OCTET STRING type, the SMI’s mechanisms for formally setting range constraints are not available. MIB designers using these textual conventions will need to use DESCRIPTION clauses to spell out any applicable range constraints beyond those implied by the underlying IEEE types.

Therefore, this object does not have a DEFVAL clause.

REFERENCE
"Section 5 on Protocol Parameters and Constraints of RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"

DEFVAL { 1.0 } see DESCRIPTION
:= { nhdpInterfaceEntry 11 }

nhdpInitialPending OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"nhdpInitialPending corresponds to INITIAL_PENDING of NHDP. If the value of this object is ‘true(1)’, then a newly identified link is considered pending and is not usable until the link quality has reached or exceeded the nhdpHystAcceptQuality threshold.

Guidance for setting this object may be found in Section 5 of the NHDP specification (RFC 6130), which indicates that:
  o If nhdpInitialQuality >= nhdpHystAcceptQuality, then nhdpInitialPending := false(2).
  o If nhdpInitialQuality < nhdpHystRejectQuality, then nhdpInitialPending := true(1)."

REFERENCE
"Section 5 on Protocol Parameters and Constraints of RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"

DEFVAL { false }
:= { nhdpInterfaceEntry 12 }
nhdpHpMaxJitter  OBJECT-TYPE
SYNTAX        Unsigned32
UNITS         "milliseconds"
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION

"nhdpHpMaxJitter corresponds to
HP_MAXJITTER of NHDP and represents the
value of MAXJITTER used in RFC 5148 for
periodically generated HELLO messages on
this MANET interface.

Guidance for setting this object may be found
in Section 5 of RFC 5148, which indicates that:
  o nhdpHpMaxJitter <= nhdpHelloInterval / 2
  o nhdpHpMaxJitter should not be greater
    than nhdpHelloInterval / 4
  o If nhdpMinHelloInterval > 0, then
    nhdpHpMaxJitter <= nhdpHelloMinInterval; and
    nhdpHpMaxJitter should not be greater than
    nhdpHelloMinInterval / 2"

REFERENCE

"Section 5 of RFC 5148 - Jitter Considerations in
Mobile Ad Hoc Networks (MANETs),
Clausen, T., Dearlove, C., and B. Adamson, February 2008"
DEFVAL { 500 }
 ::= { nhdpInterfaceEntry 13 }

nhdpHtMaxJitter  OBJECT-TYPE
SYNTAX        Unsigned32
UNITS         "milliseconds"
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION

"nhdpHtMaxJitter corresponds to
HT_MAXJITTER of NHDP and represents the
value of MAXJITTER used in RFC 5148 for
externally triggered HELLO messages on this
MANET interface.

Guidance for setting this object may be found
in Section 5 of RFC 5148, which indicates that:
  o nhdpHtMaxJitter <= nhdpHelloInterval / 2
o nhdpHtMaxJitter should not be greater than nhdpHelloInterval / 4
o If nhdpMinHelloInterval > 0, then
  nhdpHtMaxJitter <= nhdpHelloMinInterval; and
  nhdpHtMaxJitter should not be greater than
  nhdpHelloMinInterval / 2"

REFERENCE

"Section 5 of RFC 5148 - Jitter Considerations in
Mobile Ad Hoc Networks (MANETs),
Clausen, T., Dearlove, C., and B. Adamson, February 2008"

DEFVAL { 500 }
 ::= { nhdpInterfaceEntry 14 }

nhdpIfRowStatus OBJECT-TYPE
SYNTAX      RowStatus
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION
  "This object permits management of the table
   by facilitating actions such as row creation,
   construction, and destruction. The value of
   this object has no effect on whether other
   objects in this conceptual row can be
   modified.

   An entry may not exist in the 'active(1)' state unless all
   objects in the entry have a defined appropriate value. For
   objects with DEFVAL clauses, the management station
   does not need to specify the value of this object in order
   for the row to transit to the 'active(1)' state; the default
   value for this object is used. For objects that do not
   have DEFVAL clauses, the value of this object prior
   to this row transitioning to the 'active(1)' state MUST be
   administratively specified.

   When this object transitions to 'active(1)', all objects
   in this row SHOULD be written to nonvolatile (stable)
   storage. Read-create objects in this row MAY be modified.
   When an object in a row with nhdpIfRowStatus of 'active(1)'
   is changed, then the updated value MUST be reflected in NHDP,
   and this new object value MUST be written to nonvolatile
   storage.

   If the value of this object is not equal to 'active(1)',
   all associated entries in the nhdpLibLocalIfSetTable,
   nhdpInterfaceStateTable, nhdpLibLinkSetTable, and
   nhdpInterfacePerfTable MUST be deleted."
**nhdpNHoldTime**

**OBJECT-TYPE**

**SYNTAX** Unsigned32

**UNITS** "milliseconds"

**MAX-ACCESS** read-write

**STATUS** current

**DESCRIPTION**

"nhdpNHoldTime corresponds to N_HOLD_TIME of NHDP and is used as the period during which former 1-hop neighbor network addresses are advertised as lost in HELLO messages, allowing recipients of these HELLO messages to accelerate removal of this information from their 2-Hop Sets.

This object is persistent, and when written, the entity SHOULD save the change to nonvolatile storage."

**REFERENCE**

"Section 5 on Protocol Parameters and Constraints of RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"

**DEFVAL** { 6000 }

::= { nhdpConfigurationObjGrp 2 }
This object is persistent, and when written, the entity SHOULD save the change to nonvolatile storage.

REFERENCE

"Section 5 on Protocol Parameters and Constraints of RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"

DEFVAL { 6000 }
::= { nhdpConfigurationObjGrp 3 }

-- A router’s Local Information Base (LIB)
--
-- Local Interface Set Table
--

nhdpLibLocalIfSetTable OBJECT-TYPE
SYNTAX      SEQUENCE OF NhdpLibLocalIfSetEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"A router’s Local Interface Set records all network addresses that are defined as local MANET interface network addresses. As such, this table ‘sparse augments’ the nhdpInterfaceTable when network addresses are being defined for the interfaces existing within the nhdpInterfaceTable. The local interface is defined by the nhdpIfIndex.

The Local Interface Set consists of Local Interface Address Tuples per MANET interface and their prefix lengths (in order to determine the network addresses related to the interface).

A conceptual row in this table exists if and only if one has been administratively created. This can be done by setting rowStatus to ‘createAndGo’ or ‘createAndWait’.

Further guidance on the addition or removal of local addresses and network addresses is found in Section 9 of RFC 6130."

REFERENCE

"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"

::= { nhdpConfigurationObjGrp 4 }
nhdpLibLocalIfSetEntry OBJECT-TYPE
SYNTAX NhdpLibLocalIfSetEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"A router’s Local Interface Set consists of Local Interface Tuples for each network
interface.

The objects in this table are persistent, and when written, the device SHOULD save the change to
nonvolatile storage. For further information on the storage behavior for these objects, refer
to the description for the nhdpLibLocalIfSetRowStatus object."

REFERENCE
"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood
Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"
INDEX { nhdpLibLocalIfSetIndex }
 ::= { nhdpLibLocalIfSetTable 1 }

NhdpLibLocalIfSetEntry ::= 
SEQUENCE {
   nhdpLibLocalIfSetIndex
      Integer32,
   nhdpLibLocalIfSetIfIndex
      InterfaceIndex,
   nhdpLibLocalIfSetIpAddrType
      InetAddressType,
   nhdpLibLocalIfSetIpAddr
      InetAddress,
   nhdpLibLocalIfSetIpAddrPrefixLen
      InetAddressPrefixLength,
   nhdpLibLocalIfSetRowStatus
      RowStatus
}

nhdpLibLocalIfSetIndex OBJECT-TYPE
SYNTAX Integer32 (0..65535)
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"The index for this table. Necessary because multiple addresses may be associated
with a given nhdpIfIndex."
::= { nhdpLibLocalIfSetEntry 1 }

nhdpLibLocalIfSetIfIndex  OBJECT-TYPE
SYNTAX     InterfaceIndex
MAX-ACCESS read-only
STATUS     current
DESCRIPTION "Specifies the local nhdpIfIndex for which this
IP address was added."
REFERENCE  "RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood
Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"
::= { nhdpLibLocalIfSetEntry 2 }

nhdpLibLocalIfSetIpAddrType OBJECT-TYPE
SYNTAX     InetAddressType
MAX-ACCESS read-create
STATUS     current
DESCRIPTION "The type of the nhdpLibLocalIfSetIpAddr
in the InetAddress MIB (RFC 4001).

Only the values 'ipv4(1)' and 'ipv6(2)' are supported."
REFERENCE  "RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood
Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"
::= { nhdpLibLocalIfSetEntry 3 }

nhdpLibLocalIfSetIpAddr  OBJECT-TYPE
SYNTAX     InetAddress (SIZE(4|16))
MAX-ACCESS read-create
STATUS     current
DESCRIPTION "nhdpLibLocalIfSetIpAddr is an
address of an interface of
this router.

This object is interpreted according to
the setting of nhdpLibLocalIfSetIpAddrType."
nhdpLibLocalIfSetIpAddrPrefixLen  OBJECT-TYPE
SYNTAX      InetAddressPrefixLength
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION
  "Indicates the number of leading one bits that form the mask. The mask is logically ANDed to the
  nhdpLibLocalIfSetIpAddr to determine the address prefix. A row match is true if the address used as an
  index falls within the network address range defined by the address prefix."
REFERENCE
  "RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove,
  C., and J. Dean, April 2011"
::= { nhdpLibLocalIfSetEntry 4 }

nhdpLibLocalIfSetRowStatus  OBJECT-TYPE
SYNTAX      RowStatus
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION
  "This object permits management of the table by facilitating actions such as row creation, construction,
  and destruction. The value of this object has no effect on whether other objects in this conceptual row can be
  modified.

  An entry may not exist in the ‘active(1)’ state unless all read-create objects in the entry have a defined
  appropriate value. As no objects in this table have DEFVAL clauses, the management station MUST specify
  the values of all read-create objects prior to this row transitioning to the ‘active(1)’ state.

  When this object transitions to ‘active(1)’, all objects in this row SHOULD be written to nonvolatile (stable)
  storage. Read-create objects in this row MAY be modified. When an object in a row with nhdpIfRowStatus of
  ‘active(1)’ is changed, then the updated value MUST be reflected in NHDP,"
and this new object value MUST be written to nonvolatile storage."
REFERENCE
"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood
Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"
DEFVAL { notReady }
::= { nhdpLibLocalIfSetEntry 6 }

---

**NhdpLibRemovedIfAddrSetTable**

OBJECT-TYPE
SYNTAX SEQUENCE OF NhdpLibRemovedIfAddrSetEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"A router’s Removed Interface Address Set records network addresses that were recently used as local interface network addresses. If a router’s interface network addresses are immutable, then the Removed Interface Address Set is always empty and may be omitted. It consists of Removed Interface Address Tuples, one per network address."
REFERENCE
"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"
::= { nhdpConfigurationObjGrp 5 }

**NhdpLibRemovedIfAddrSetEntry**

OBJECT-TYPE
SYNTAX NhdpLibRemovedIfAddrSetEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"A router’s Removed Interface Address Set consists of Removed Interface Address Tuples, one per network address:

(IR_local_iface_addr, IR_time)

The association between these addresses and the router’s Interface is found in RFC 4293 (ipAddressTable)"
NhdpLibRemovedIfAddrSetEntry ::= SEQUENCE {
  nhdpLibRemovedIfAddrSetIndex             Integer32,
  nhdpLibRemovedIfAddrSetIpAddrType       InetAddressType,
  nhdpLibRemovedIfAddrSetIpAddr           InetAddress,
  nhdpLibRemovedIfAddrSetIpAddrPrefixLen  InetAddressPrefixLength,
  nhdpLibRemovedIfAddrSetIfIndex          InterfaceIndex,
  nhdpLibRemovedIfAddrSetIRTime           TimeStamp
}

NhdpLibRemovedIfAddrSetIndex  OBJECT-TYPE
SYNTAX                    Integer32 (0..65535)
MAX-ACCESS                 not-accessible
STATUS                     current
DESCRIPTION                "The index for this table. Necessary because multiple addresses may be associated with a given nhdpIfIndex."

NhdpLibRemovedIfAddrSetIpAddrType  OBJECT-TYPE
SYNTAX                     InetAddressType
MAX-ACCESS                 read-only
STATUS                     current
DESCRIPTION                "The type of the nhdpLibRemovedIfAddrSetIpAddr in the InetAddress MIB (RFC 4001)."
Only the values 'ipv4(1)' and 'ipv6(2)' are supported.

REFERENCE

"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"

::= { nhdpLibRemovedIfAddrSetEntry 2 }

nhdpLibRemovedIfAddrSetIpAddr OBJECT-TYPE
SYNTAX InetAddress (SIZE(4|16))
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"nhdpLibRemovedIfAddrSetIpAddr is a recently used address of an interface of this router."

REFERENCE

"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"

::= { nhdpLibRemovedIfAddrSetEntry 3 }

nhdpLibRemovedIfAddrSetIpAddrPrefixLen OBJECT-TYPE
SYNTAX InetAddressPrefixLength
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Indicates the number of leading one bits that form the mask. The mask is logically ANDed to the nhdpLibRemovedIfAddrSetIpAddr to determine the address prefix. A row match is true if the address used as an index falls within the network address range defined by the address prefix."

REFERENCE

"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"

::= { nhdpLibRemovedIfAddrSetEntry 4 }

nhdpLibRemovedIfAddrSetIfIndex OBJECT-TYPE
SYNTAX InterfaceIndex
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Specifies the local IfIndex from which this IP address was recently removed."
nhdpLibRemovedIfAddrSetIRTime  OBJECT-TYPE
SYNTAX      TimeStamp
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
"nhdpLibRemovedIfAddrSetIRTime specifies the value of sysUpTime when this entry should expire and be removed from the nhdpLibRemovedIfAddrSetTable."

REFERENCE
"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"
::= { nhdpLibRemovedIfAddrSetEntry 5 }

nhdpStateObjGrp

-- Contains information describing the current state of the NHDP process on this router.

nhdpInterfaceStateTable  OBJECT-TYPE
SYNTAX      SEQUENCE OF NhdpInterfaceStateEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"nhdpInterfaceStateTable lists state information related to specific interfaces of this router. The value of nhdpIfIndex is an ifIndex from the Interfaces Group defined in the Interfaces Group MIB."
The objects in this table are persistent, and when written, the entity SHOULD save the change to nonvolatile storage.

REFERENCE
"RFC 2863 - The Interfaces Group MIB, McCloghrie, K., and F. Kastenholtz, June 2000"

::= { nhdpStateObjGrp 2 }

NhdpInterfaceStateEntry OBJECT-TYPE
SYNTAX NhdpInterfaceStateEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"NhdpInterfaceStateEntry describes one NHDP local interface state as indexed by its nhdpIfIndex."
INDEX { nhdpIfIndex }
::= { nhdpInterfaceStateTable 1 }

NhdpInterfaceStateEntry ::=SEQUENCE {
    nhdpIfStateUpTime
       TimeStamp
}

NhdpIfStateUpTime OBJECT-TYPE
SYNTAX TimeStamp
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The value of the sysUpTime when NHDP was last initialized on this MANET interface."
::= { nhdpInterfaceStateEntry 1 }

--
-- This table allows for the mapping between discovered remote interfaces and routers and their addresses.
--

NhdpDiscIfSetTable OBJECT-TYPE
SYNTAX SEQUENCE OF NhdpDiscIfSetEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"A router’s set of discovered interfaces on neighboring routers."

Herberg, et al. Standards Track [Page 36]
NhdpDiscIfSetEntry OBJECT-TYPE
SYNTAX NhdpDiscIfSetEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"The entries include the nhdpDiscRouterIndex of the discovered router, the nhdpDiscIfIndex of the discovered interface, and the current set of addresses associated with this neighbor interface. The nhdpDiscIfIndex uniquely identifies the remote interface address sets through this table. It does not need to be unique across the MANET but MUST be locally unique within this router."
REFERENCE
"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"
::= { nhdpStateObjGrp 3 }

NhdpDiscIfSetIndex  OBJECT-TYPE
SYNTAX Integer32 (0..65535)
MAX-ACCESS not-accessible
STATUS current

NhdpDiscIfSetEntry ::=  
SEQUENCE {
    nhdpDiscIfSetIndex  Integer32,
    nhdpDiscIfIndex  NeighborIfIndex,
    nhdpDiscRouterIndex  NeighborRouterIndex,
    nhdpDiscIfSetIpAddrType  InetAddressType,
    nhdpDiscIfSetIpAddr  InetAddress,
    nhdpDiscIfSetIpAddrPrefixLen  InetAddressPrefixLength
}

NhdpDiscIfSetIndex  OBJECT-TYPE
SYNTAX Integer32 (0..65535)
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"The index for this table. Necessary because multiple addresses may be associated with a given nhdpDiscIfIndex."

REFERENCE
"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"

::= { nhdpDiscIfSetEntry 1 }

nhdpDiscIfIndex  OBJECT-TYPE
SYNTAX      NeighborIfIndex
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
"The NHDP interface index (locally created) of a neighbor’s interface. Used for cross-indexing into other NHDP tables and other MIB modules."

REFERENCE
"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"

::= { nhdpDiscIfSetEntry 2 }

nhdpDiscRouterIndex  OBJECT-TYPE
SYNTAX      NeighborRouterIndex
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
"The NHDP neighbor index (locally created) of a neighboring router. Used for cross-indexing into other NHDP tables and other MIB modules."

REFERENCE
"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"

::= { nhdpDiscIfSetEntry 3 }

nhdpDiscIfSetIpAddrType  OBJECT-TYPE
SYNTAX      InetAddressType
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
"The type of the nhdpDiscIfSetIpAddr in the InetAddress MIB (RFC 4001)."
Only the values ‘ipv4(1)’ and ‘ipv6(2)’ are supported.

REFERENCE
"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"

::= { nhdpDiscIfSetEntry 4 }

nhdpDiscIfSetIpAddr OBJECT-TYPE
SYNTAX InetAddress (SIZE(4|16))
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The nhdpDiscIfSetIpAddr is a recently used address of a neighbor of this router."

REFERENCE
"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"

::= { nhdpDiscIfSetEntry 5 }

nhdpDiscIfSetIpAddrPrefixLen OBJECT-TYPE
SYNTAX InetAddressPrefixLength
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Indicates the number of leading one bits that form the mask. The mask is logically ANDed to the nhdpDiscIfSetIpAddr to determine the address prefix. A row match is true if the address used as an index falls within the network address range defined by the address prefix."

REFERENCE
"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"

::= { nhdpDiscIfSetEntry 6 }

-- Interface Information Base (IIB)
--
-- Link Set
--
nhdpIibLinkSetTable  OBJECT-TYPE
SYNTAX  SEQUENCE OF NhdpIibLinkSetEntry
MAX-ACCESS  not-accessible
STATUS  current
DESCRIPTION
"A Link Set of an interface records all links from other routers that are, or recently were, 1-hop neighbors."
REFERENCE
"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"
 ::= { nhdpStateObjGrp 4 }

nhdpIibLinkSetEntry  OBJECT-TYPE
SYNTAX  NhdpIibLinkSetEntry
MAX-ACCESS  not-accessible
STATUS  current
DESCRIPTION
"A Link Set consists of Link Tuples, each representing a single link indexed by the local and remote interface pair:

(L_neighbor_iface_addr_list, L_HEARD_time, L_SYM_time, L_quality, L_pending, L_lost, L_time).

The local interface is indexed via the nhdpIfIndex. The 1-hop interface is indexed via the nhdpDiscIfIndex. There SHOULD be an entry in this table for each local interface and associated 1-hop neighbor reachable on this local interface.

Note that L_quality is not included in the entries below, because updates may be required too frequently."
REFERENCE
"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"
INDEX { nhdpIfIndex, 
nhdpDiscIfIndex }
 ::= { nhdpIibLinkSetTable 1 }
NhdpIibLinkSetEntry ::=  
SEQUENCE {  
  nhdpIibLinkSetLHeardTime  
  TimeStamp,  
  nhdpIibLinkSetLSymTime  
  TimeStamp,  
  nhdpIibLinkSetLPending  
  TruthValue,  
  nhdpIibLinkSetLLost  
  TruthValue,  
  nhdpIibLinkSetLTime  
  TimeStamp  
}

NhdpIibLinkSetLHeardTime OBJECT-TYPE  
SYNTAX TimeStamp  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
"NhdpIibLinkSetLHeardTime corresponds to L_HEARD_time of NHDP and represents the time up to which the MANET interface of the 1-hop neighbor would be considered heard if not considering link quality."

REFERENCE  
"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"

::= { nhdpIibLinkSetEntry 1 }

NhdpIibLinkSetLSymTime OBJECT-TYPE  
SYNTAX TimeStamp  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
"NhdpIibLinkSetLSymTime corresponds to L_SYM_time of NHDP and represents the time up to which the link to the 1-hop neighbor would be considered symmetric if not considering link quality."

REFERENCE  
"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"

::= { nhdpIibLinkSetEntry 2 }
nhdpIibLinkSetLPending OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"nhdpIibLinkSetLPending corresponds
to L_pending of NHDP and is a boolean flag,
describing if a link is considered pending
(i.e., a candidate, but not yet established,
link)."
REFERENCE
"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood
Discovery Protocol (NHDP), Clausen, T., Dearlove,
C., and J. Dean, April 2011"
 ::= { nhdpIibLinkSetEntry 3 }
nhdpIibLinkSetLLost OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"nhdpIibLinkSetLLost corresponds
to L_lost of NHDP and is a boolean flag,
describing if a link is considered lost due
to low link quality."
REFERENCE
"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood
Discovery Protocol (NHDP), Clausen, T., Dearlove,
C., and J. Dean, April 2011"
 ::= { nhdpIibLinkSetEntry 4 }
nhdpIibLinkSetLTime OBJECT-TYPE
SYNTAX TimeStamp
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"nhdpIibLinkSetLTime specifies the value
of sysUpTime when this entry should expire and be
removed from the nhdpIibLinkSetTable."
REFERENCE
"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood
Discovery Protocol (NHDP), Clausen, T., Dearlove,
C., and J. Dean, April 2011"
 ::= { nhdpIibLinkSetEntry 5 }
nhdpIib2HopSetTable  OBJECT-TYPE
SYNTAX      SEQUENCE OF NhdpIib2HopSetEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"A 2-Hop Set of an interface records network
addresses of symmetric 2-hop neighbors and
the symmetric links to symmetric 1-hop neighbors
through which these symmetric 2-hop neighbors
can be reached. It consists of 2-Hop Tuples."
REFERENCE
"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood
Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"
::= { nhdpStateObjGrp 5 }

nhdpIib2HopSetEntry  OBJECT-TYPE
SYNTAX      NhdpIib2HopSetEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"nhdpIib2HopSetTable consists of 2-Hop Tuples, each
representing a single network address of a symmetric
2-hop neighbor and a single MANET interface of a
symmetric 1-hop neighbor.

(N2_neighbor_iface_addr_list,
N2_2hop_addr, N2_lost, N2_time).

The entries include:
- the 2-hop neighbor addresses
  (‘N2_neighbor_iface_addr_list’), which
  act as the table index,
- the associated symmetric 1-hop
  neighbor address set (‘N2_2hop_addr’), designated
  through nhdpDiscIfIndex,
- a flag indicating if the 1-hop neighbor
  through which this 2-hop neighbor is reachable
  (‘N2_lost’) is considered lost due to link quality,
  or not,
- and the expiration time (‘N2_time’).

The nhdpIfIndex in the INDEX is the interface index of
the local interface through which these 2-hop addresses
are accessible. The nhdpDiscIfIndex in the INDEX
represents the 1-hop neighbor interface through which these 2-hop neighbor addresses are reachable."

REFERENCE


INDEX { nhdpIfIndex,
        nhdpDiscIfIndex,
        nhdpIib2HopSetIpAddressType,
        nhdpIib2HopSetIpAddress
    }

 ::= { nhdpIib2HopSetTable 1 }

NhdpIib2HopSetEntry ::= SEQUENCE {
    nhdpIib2HopSetIpAddressType
        InetAddressType,
    nhdpIib2HopSetIpAddress
        InetAddress,
    nhdpIib2HopSetIpAddrPrefixLen
        InetAddressPrefixLength,
    nhdpIib2HopSet1HopIfIndex
        NeighborIfIndex,
    nhdpIib2HopSetN2Time
        TimeStamp,
    nhdpIib2HopSetN2Lost
        TruthValue
}

NhdpIib2HopSetIpAddressType OBJECT-TYPE
SYNTAX InetAddressType
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"The type of the nhdpIib2HopSetIpAddress in the InetAddress MIB module (RFC 4001).

Only the values ‘ipv4(1)’ and ‘ipv6(2)’ are supported."
nhdpIib2HopSetEntry  OBJECT-TYPE
   SYNTAX          Integer32
   MAX-ACCESS      not-accessible
   STATUS          current
   DESCRIPTION     

::= { nhdpIib2HopSetEntry 1 }

nhdpIib2HopSetIpAddress  OBJECT-TYPE
   SYNTAX          InetAddress (SIZE(4|16))
   MAX-ACCESS      not-accessible
   STATUS          current
   DESCRIPTION     

::= { nhdpIib2HopSetEntry 2 }

nhdpIib2HopSetIpAddrPrefixLen  OBJECT-TYPE
   SYNTAX          InetAddressPrefixLength
   MAX-ACCESS      read-only
   STATUS          current
   DESCRIPTION     

::= { nhdpIib2HopSetEntry 3 }

nhdpIib2HopSet1HopIfIndex  OBJECT-TYPE
   SYNTAX          NeighborIfIndex
   MAX-ACCESS      read-only
   STATUS          current
   DESCRIPTION     

::= { nhdpIib2HopSetEntry 3 }
neighbor that communicated the ipAddress of the 2-hop neighbor in this row entry.

REFERENCE

"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"

 ::= { nhdpIib2HopSetEntry 4 }

nhdpIib2HopSetN2Time OBJECT-TYPE
SYNTAX TimeStamp
MAX-ACCESS read-only
STATUS current
DESCRIPTION

"nhdpIib2HopSetN2Time specifies the value of sysUpTime when this entry should expire and be removed from the nhdpIib2HopSetTable."

REFERENCE

"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"

 ::= { nhdpIib2HopSetEntry 5 }

nhdpIib2HopSetN2Lost OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-only
STATUS current
DESCRIPTION

"nhdpIib2HopSetN2Lost corresponds to N2_lost of NHDP and is a boolean flag, describing if for a 2-Hop Tuple, the corresponding Link Tuple currently is considered lost due to link quality."

REFERENCE

"RFC 7466 - An Optimization for the Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Dearlove, C., and T. Clausen, March 2015"

 ::= {nhdpIib2HopSetEntry 6}

--
-- Neighbor Information Base (NIB)
--
-- Each router maintains a Neighbor Information Base that records information about addresses of current and recently symmetric 1-hop neighbors.
The Neighbor Set Table is small because most of the corresponding information is found in the nhdpDiscoveredIfTable above.

```
NhdpNibNeighborSetEntry OBJECT-TYPE
   SYNTAX     NhdpNibNeighborSetEntry
   MAX-ACCESS not-accessible
   STATUS     current
   DESCRIPTION
      "A router’s Neighbor Set consists of Neighbor Tuples, each representing a single 1-hop neighbor:

      (N_neighbor_addr_list, N_symmetric)"
   REFERENCE
      "RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"
::= { nhdpNibNeighborSetTable 1 }
```

```
NhdpNibNeighborSetNSymmetric OBJECT-TYPE
   SYNTAX     TruthValue
   MAX-ACCESS read-only
```

nhdpNibNeighborNSymmetric corresponds
to N_symmetric of NHDP and is a boolean flag,
describing if this is a symmetric 1-hop neighbor.

REFERENCE
"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood
discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"

::= { nhdpNibNeighborSetEntry 1 }

--
-- Lost Neighbor Set
--

nhdpNibLostNeighborSetTable OBJECT-TYPE
SYNTAX SEQUENCE OF NhdpNibLostNeighborSetEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"A router’s Lost Neighbor Set records network
addresses of routers that were recently
symmetric 1-hop neighbors but are now
advertised as lost."

REFERENCE
"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood
discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"

::= { nhdpStateObjGrp 7 }

nhdpNibLostNeighborSetEntry OBJECT-TYPE
SYNTAX NhdpNibLostNeighborSetEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"A router’s Lost Neighbor Set consists of
Lost Neighbor Tuples, each representing a
single such network address:

(NL_neighbor_addr, NL_time)"

REFERENCE
"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood
discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"

INDEX { nhdpDiscRouterIndex }

::= { nhdpNibLostNeighborSetTable 1 }
NhdpNibLostNeighborSetEntry ::=  
  SEQUENCE {  
    nhdpNibLostNeighborSetNLTime  
      TimeStamp  
  }

NhdpNibLostNeighborSetNLTime  OBJECT-TYPE  
  SYNTAX  TimeStamp  
  MAX-ACCESS  read-only  
  STATUS  current  
  DESCRIPTION  
    "nhdpNibLostNeighborSetNLTime  
      specifies the value of sysUpTime when this entry  
      should expire and be removed from the  
      nhdpNibLostNeighborSetTable."

REFERENCE  
  "RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood  
  Discovery Protocol (NHDP), Clausen, T., Dearlove,  
  C., and J. Dean, April 2011"
  ::= { nhdpNibLostNeighborSetEntry 1 }

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

NhdpPerformanceObjGrp  OBJECT IDENTIFIER ::= { nhdpObjects 3 }

--
--  Objects per local interface
--

NhdpInterfacePerfTable  OBJECT-TYPE  
  SYNTAX  SEQUENCE OF NhdpInterfacePerfEntry  
  MAX-ACCESS  not-accessible  
  STATUS  current  
  DESCRIPTION  
    "This table summarizes performance objects that are  
    measured per local NHDP interface.  
    nhdpIfPerfCounterDiscontinuityTime indicates  
    the most recent occasion at which any one or more  
    of this interface’s counters listed in this table  
    suffered a discontinuity."

Herberg, et al. Standards Track [Page 49]
nhdpInterfacePerfEntry  OBJECT-TYPE
SYNTAX      NhdpInterfacePerfEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
 "A single entry contains performance counters for
 a local NHDP interface."
INDEX { nhdpIfIndex }
 ::= { nhdpInterfacePerfTable 1 }

NhdpInterfacePerfEntry ::=  
SEQUENCE {  
  nhdpIfHelloMessageXmits  
      Counter32,  
  nhdpIfHelloMessageRecvd  
      Counter32,  
  nhdpIfHelloMessageXmitAccumulatedSize  
      Counter64,  
  nhdpIfHelloMessageRecvdAccumulatedSize  
      Counter64,  
  nhdpIfHelloMessageTriggeredXmits  
      Counter32,  
  nhdpIfHelloMessagePeriodicXmits  
      Counter32,  
  nhdpIfHelloMessageXmitAccumulatedSymmetricNeighborCount  
      Counter32,  
  nhdpIfHelloMessageXmitAccumulatedHeardNeighborCount  
      Counter32,  
  nhdpIfHelloMessageXmitAccumulatedLostNeighborCount  
      Counter32,  
  nhdpIfPerfCounterDiscontinuityTime  
      TimeStamp  
}

nhdpIfHelloMessageXmits  OBJECT-TYPE
SYNTAX      Counter32
UNITS       "messages"
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
 "A counter is incremented each time a HELLO
 message has been transmitted on that interface."
::= { nhdpInterfacePerfEntry 1 }

nhdpIfHelloMessageRecvd OBJECT-TYPE
SYNTAX Counter32
UNITS "messages"
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"A counter is incremented each time a HELLO message has been received on that interface."
::= { nhdpInterfacePerfEntry 2 }

nhdpIfHelloMessageXmitAccumulatedSize OBJECT-TYPE
SYNTAX Counter64
UNITS "octets"
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"A counter is incremented by the number of octets in a HELLO message each time a HELLO message has been sent."
::= { nhdpInterfacePerfEntry 3 }

nhdpIfHelloMessageRecvdAccumulatedSize OBJECT-TYPE
SYNTAX Counter64
UNITS "octets"
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"A counter is incremented by the number of octets in a HELLO message each time a HELLO message has been received."
::= { nhdpInterfacePerfEntry 4 }

nhdpIfHelloMessageTriggeredXmits OBJECT-TYPE
SYNTAX Counter32
UNITS "messages"
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"A counter is incremented each time a triggered HELLO message has been sent."
::= { nhdpInterfacePerfEntry 5 }

nhdpIfHelloMessagePeriodicXmits OBJECT-TYPE
SYNTAX Counter32
UNITS "messages"
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"A counter is incremented each time a periodic
HELLO message has been sent."
::= { nhdpInterfacePerfEntry 6 }

nhdpIfHelloMessageXmitAccumulatedSymmetricNeighborCount  OBJECT-TYPE
SYNTAX      Counter32
UNITS       "neighbors"
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
  "A counter is incremented by the number of advertised
  symmetric neighbors in a HELLO each time a HELLO
  message has been sent."
::= { nhdpInterfacePerfEntry 7 }

nhdpIfHelloMessageXmitAccumulatedHeardNeighborCount  OBJECT-TYPE
SYNTAX      Counter32
UNITS       "neighbors"
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
  "A counter is incremented by the number of advertised
  heard neighbors in a HELLO each time a HELLO
  message has been sent."
::= { nhdpInterfacePerfEntry 8 }

nhdpIfHelloMessageXmitAccumulatedLostNeighborCount  OBJECT-TYPE
SYNTAX      Counter32
UNITS       "neighbors"
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
  "A counter is incremented by the number of advertised
  lost neighbors in a HELLO each time a HELLO
  message has been sent."
::= { nhdpInterfacePerfEntry 9 }

nhdpIfPerfCounterDiscontinuityTime  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 interface’s counters suffered a
discontinuity.  If no such discontinuities have occurred
  since the last reinitialization of the local management
  subsystem, then this object contains a zero value."
::= { nhdpInterfacePerfEntry 10 }
Objects per discovered neighbor interface

nhdpDiscIfSetPerfTable OBJECT-TYPE
SYNTAX SEQUENCE OF NhdpDiscIfSetPerfEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "A router’s set of performance properties for each discovered interface of a neighbor."
REFERENCE "RFC 6130 – Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"
::= { nhdpPerformanceObjGrp 2 }

NhdpDiscIfSetPerfEntry OBJECT-TYPE
SYNTAX NhdpDiscIfSetPerfEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "There is an entry for each discovered interface of a neighbor."
REFERENCE "RFC 6130 – Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"
INDEX { nhdpDiscIfIndex }
::= { nhdpDiscIfSetPerfTable 1 }

NhdpDiscIfSetPerfEntry ::= SEQUENCE {
  nhdpDiscIfRecvdPackets Counter32,
  nhdpDiscIfExpectedPackets Counter32
}

NhdpDiscIfRecvdPackets OBJECT-TYPE
SYNTAX Counter32
UNITS "packets"
MAX-ACCESS read-only
STATUS current
DESCRIPTION "This counter increments each time this router receives a packet from that interface of the neighbor."
REFERENCE
nhdpDiscIfExpectedPackets  OBJECT-TYPE
SYNTAX      Counter32
UNITS       "packets"
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
"This counter increments by the number
of missed packets from this neighbor based
on the packet sequence number each time this
router receives a packet from that interface
of the neighbor."
REFERENCE
"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood
Discovery Protocol (NHDP), Clausen, T., Dearlove,
C., and J. Dean, April 2011"
::= { nhdpDiscIfSetPerfEntry 1 }

nhdpNibNeighborSetChanges  OBJECT-TYPE
SYNTAX      Counter32
UNITS       "changes"
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
"This counter increments each time the Neighbor Set changes.
A change occurs whenever a new Neighbor Tuple has been
added, a Neighbor Tuple has been removed, or any entry of
a Neighbor Tuple has been modified."
::= { nhdpPerformanceObjGrp 3 }

---

--- Objects concerning the Neighbor Set
---

nhdpDiscNeighborSetPerfTable OBJECT-TYPE
SYNTAX       SEQUENCE OF NhdpDiscNeighborSetPerfEntry
MAX-ACCESS   not-accessible
STATUS       current

---

--- Objects per discovered neighbor
---

---
DESCRIPTION
"A router's set of discovered neighbors and their properties."
REFERENCE
"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"

::= { nhdpPerformanceObjGrp 4 }

nhdpDiscNeighborSetPerfEntry OBJECT-TYPE
SYNTAX NhdpDiscNeighborSetPerfEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"The entries include the nhdpDiscRouterIndex of the discovered router as well as performance objects related to changes of the Neighbor Set."
REFERENCE
"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"
INDEX { nhdpDiscRouterIndex }
 ::= { nhdpDiscNeighborSetPerfTable 1 }

NhdpDiscNeighborSetPerfEntry ::= SEQUENCE {
 nhdpDiscNeighborNibNeighborSetChanges Counter32,
 nhdpDiscNeighborNibNeighborSetUpTime TimeStamp,
 nhdpDiscNeighborNibNeighborSetReachableLinkChanges Counter32
}

NhdpDiscNeighborNibNeighborSetChanges OBJECT-TYPE
SYNTAX Counter32
UNITS "changes"
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object returns the number of changes to the given Neighbor Tuple."
REFERENCE
"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"
 ::= { nhdpDiscNeighborSetPerfEntry 1 }
nhdpDiscNeighborNibNeighborSetUpTime OBJECT-TYPE
SYNTAX       TimeStamp
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION  "This object returns the sysUpTime when a new
nhdpNibNeighborSetEntry has been created for a
particular nhdpNibNeighborSetRouterIndex."
REFERENCE    "RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood
Discovery Protocol (NHDP), Clausen, T., Dearlove,
C., and J. Dean, April 2011"
::= { nhdpDiscNeighborSetPerfEntry 2 }

nhdpDiscNeighborNibNeighborSetReachableLinkChanges OBJECT-TYPE
SYNTAX       Counter32
UNITS        "changes"
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION  "This object counts each time the neighbor changes
the interface(s) over which it is reachable.
A change in the set of Link Tuples corresponding
to the appropriate Neighbor Tuple is registered,
i.e., a corresponding Link Tuple is added or removed
from the set of all corresponding Link Tuples."
REFERENCE    "RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood
Discovery Protocol (NHDP), Clausen, T., Dearlove,
C., and J. Dean, April 2011"
::= { nhdpDiscNeighborSetPerfEntry 3 }

--
-- Objects per discovered 2-hop neighbor
--

nhdpIib2HopSetPerfTable OBJECT-TYPE
SYNTAX      SEQUENCE OF NhdpIib2HopSetPerfEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION  "This table contains performance objects per
discovered 2-hop neighbor."
REFERENCE    "RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood
Discovery Protocol (NHDP), Clausen, T., Dearlove,
C., and J. Dean, April 2011"
::= { nhdpPerformanceObjGrp 5 }
The entries contain performance objects per discovered 2-hop neighbor.

REFERENCE

"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"

INDEX { nhdpDiscRouterIndex }
::= { nhdpIib2HopSetPerfTable 1 }

NhdpIib2HopSetPerfEntry ::= SEQUENCE {
    nhdpIib2HopSetPerfChanges Counter32,
    nhdpIib2HopSetPerfUpTime TimeStamp
}

NhdpIib2HopSetPerfChanges OBJECT-TYPE
SYNTAX Counter32
UNITS "changes"
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object counts the changes of the union of all N2_neighbor_iface_addr_list of 2-Hop Tuples with an N2_2hop_addr equal to one of the given 2-hop neighbor’s addresses."

REFERENCE

"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"
::= { nhdpIib2HopSetPerfEntry 1 }

NhdpIib2HopSetPerfUpTime OBJECT-TYPE
SYNTAX TimeStamp
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object returns the sysUpTime when the 2-Hop Tuple corresponding to the given 2-hop neighbor IP address was registered in the nhdpIib2HopSetTable."
REFERENCE

"RFC 6130 - Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP), Clausen, T., Dearlove, C., and J. Dean, April 2011"

::= { nhdpIib2HopSetPerfEntry 2 }

--
-- nhdpNotifications
--

nhdpNotificationsObjects OBJECT IDENTIFIER ::= { nhdpNotifications 0 }
nhdpNotificationsControl OBJECT IDENTIFIER ::= { nhdpNotifications 1 }
nhdpNotificationsStates OBJECT IDENTIFIER ::= { nhdpNotifications 2 }

-- nhdpNotificationsObjects

nhdpNbrStateChange NOTIFICATION-TYPE
OBJECTS { nhdpIfName, -- The originator of the notification.
          nhdpNbrState -- The new state
        }
STATUS current
DESCRIPTION
"nhdpNbrStateChange is a notification sent when more than nhdpNbrStateChangeThreshold neighbors change their status (i.e., 'down(0)', 'asymmetric(1)', or 'symmetric(2)') within a time window of nhdpNbrStateChangeWindow."
::= { nhdpNotificationsObjects 1 }

nhdp2HopNbrStateChange NOTIFICATION-TYPE
OBJECTS { nhdpIfName, -- The originator
           nhdp2HopNbrState -- The new state
         }
STATUS current
DESCRIPTION
"nhdp2HopNbrStateChange is a notification sent when more than nhdp2HopNbrStateChangeThreshold 2-hop neighbors change their nhdp2HopNbrState within a time window of nhdp2HopNbrStateChangeWindow."
::= { nhdpNotificationsObjects 2 }
nhdpIfStateChange  NOTIFICATION-TYPE
OBJECTS {  nhdpIfName,  -- The local interface
            nhdpIfStatus  -- The new status
}
STATUS       current
DESCRIPTION
"nhdpIfStateChange is a notification sent when
nhdpIfStatus has changed on this interface."
::= {  nhdpNotificationsObjects 3 }

-- nhdpNotificationsControl

nhdpNbrStateChangeThreshold  OBJECT-TYPE
SYNTAX      Integer32 (0..255)
UNITS       "changes"
MAX-ACCESS  read-write
STATUS      current
DESCRIPTION
"A threshold value for the
nhdpNbrStateChange object. If the
number of occurrences exceeds this threshold
within the previous nhdpNbrStateChangeWindow,
then the nhdpNbrStateChange notification
is to be sent.

It is recommended that the value of this
threshold be set to at least 10 and higher
in dense topologies with frequent expected
topology changes."
DEFVAL { 10 }
::= {  nhdpNotificationsControl 1 }

nhdpNbrStateChangeWindow  OBJECT-TYPE
SYNTAX      TimeTicks
MAX-ACCESS  read-write
STATUS      current
DESCRIPTION
"A time window for the
nhdpNbrStateChange object. If the
number of occurrences exceeds the
nhdpNbrStateChangeThreshold
within the previous nhdpNbrStateChangeWindow,
then the nhdpNbrStateChange notification
is to be sent.

It is recommended that the value for this
window be set to at least 5 times the
nhdpHelloInterval."
This object represents the time in hundredths of a second.

DEFVAL { 1000 }
::= { nhdpNotificationsControl 2 }

nhdp2HopNbrStateChangeThreshold OBJECT-TYPE
SYNTAX Integer32 (0..255)
UNITS "changes"
MAX-ACCESS read-write
STATUS current
DESCRIPTION
"A threshold value for the nhdp2HopNbrStateChange object. If the number of occurrences exceeds this threshold within the previous nhdp2HopNbrStateChangeWindow, then the nhdp2HopNbrStateChange notification is to be sent.

It is recommended that the value of this threshold be set to at least 10 and higher when topologies are expected to be highly dynamic."

DEFVAL { 10 }
::= { nhdpNotificationsControl 3 }

nhdp2HopNbrStateChangeWindow OBJECT-TYPE
SYNTAX TimeTicks
MAX-ACCESS read-write
STATUS current
DESCRIPTION
"A time window for the nhdp2HopNbrStateChange object. If the number of occurrences exceeds the nhdp2HopNbrStateChangeThreshold within the previous nhdp2HopNbrStateChangeWindow, then the nhdp2HopNbrStateChange notification is to be sent.

It is recommended that the value for this window be set to at least 5 times nhdpHelloInterval.

This object represents the time in hundredths of a second."

DEFVAL { 1000 }
::= { nhdpNotificationsControl 4 }
nhdpNbrState OBJECT-TYPE
SYNTAX INTEGER {
   down(0),
   asymmetric(1),
   symmetric(2)
}
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"NHDP neighbor states. In NHDP, it is not necessary to remove Protocol Tuples from Protocol Sets at the exact time indicated, only to behave as if the Protocol Tuples were removed at that time. This case is indicated here as 'down(0)', all other cases being indicated as 'asymmetric(1)' or 'symmetric(2)'. If 'down(0)', the direct neighbor is also added to the nhdpNibLostNeighborSetTable."
::= { nhdpNotificationsStates 1 }

nhdp2HopNbrState OBJECT-TYPE
SYNTAX INTEGER {
   down(0),
   up(1),
   notconsidered(2)
}
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"NHDP 2-hop neighbor states. In NHDP, it is not necessary to remove Protocol Tuples from Protocol Sets at the exact time indicated, only to behave as if the Protocol Tuples were removed at that time. This case is indicated here as 'down(0)'; otherwise, it is either 'up(1)', if N2_lost for the 2-Hop Tuple is equal to false, or 'notconsidered(2)' otherwise."
::= { nhdpNotificationsStates 2 }

-- nhdpConformance information

nhdpCompliances OBJECT IDENTIFIER ::= { nhdpConformance 1 }
nhdpMIBGroups OBJECT IDENTIFIER ::= { nhdpConformance 2 }
-- Compliance Statements
nhdpBasicCompliance  MODULE-COMPLIANCE
  STATUS      current
  DESCRIPTION
    "The basic implementation requirements for
    managed network entities that implement
    NHDP."
  MODULE -- this module
  MANDATORY-GROUPS { nhdpConfigurationGroup }
 ::= { nhdpCompliances 1 }

nhdpFullCompliance2  MODULE-COMPLIANCE
  STATUS      current
  DESCRIPTION
    "The full implementation requirements for
    managed network entities that implement
    NHDP."
  MODULE -- this module
  MANDATORY-GROUPS { nhdpConfigurationGroup,
                      nhdpStateGroup2,
                      nhdpNotificationObjectGroup,
                      nhdpNotificationGroup,
                      nhdpPerformanceGroup
                      }
 ::= { nhdpCompliances 3 }

--
-- Units of Conformance
--

nhdpConfigurationGroup  OBJECT-GROUP
OBJECTS {
  nhdpIfName,
  nhdpIfStatus,
  nhdpHelloInterval,
  nhdpHelloMinInterval,
  nhdpRefreshInterval,
  nhdpLHoldTime,
  nhdpHHoldTime,
  nhdpHystAcceptQuality,
  nhdpHystRejectQuality,
  nhdpInitialQuality,
  nhdpInitialPending,
  nhdpHpMaxJitter,
  nhdpHtMaxJitter,
  nhdpNHoldTime,
  nhdpIPHoldTime,
nhdpIfRowStatus,
nhdpLibLocalIfSetIfIndex,
nhdpLibLocalIfSetIpAddrType,
nhdpLibLocalIfSetIpAddr,
nhdpLibLocalIfSetIpAddrPrefixLen,
nhdpLibLocalIfSetRowStatus,
nhdpLibRemovedIfAddrSetIpAddrType,
nhdpLibRemovedIfAddrSetIpAddr,
nhdpLibRemovedIfAddrSetIpAddrPrefixLen,
nhdpLibRemovedIfAddrSetIfIndex,
nhdpLibRemovedIfAddrSetIRTime

} STATUS current
DESCRIPTION
"Set of NHDP configuration objects implemented in this module."
::= { nhdpMIBGroups 2 }

nhdpPerformanceGroup OBJECT-GROUP
OBJECTS {
  nhdpIfHelloMessageXmits,
nhdpIfHelloMessageRecvd,
nhdpIfHelloMessageXmitAccumulatedSize,
nhdpIfHelloMessageRecvdAccumulatedSize,
nhdpIfHelloMessageTriggeredXmits,
nhdpIfHelloMessagePeriodicXmits,
nhdpIfHelloMessageXmitAccumulatedSymmetricNeighborCount,
nhdpIfHelloMessageXmitAccumulatedHeardNeighborCount,
nhdpIfHelloMessageXmitAccumulatedLostNeighborCount,
nhdpIfPerfCounterDiscontinuityTime,
nhdpDiscIfRecvdPackets,
nhdpDiscIfExpectedPackets,
nhdpNibNeighborSetChanges,
nhdpDiscNeighborNibNeighborSetChanges,
nhdpDiscNeighborNibNeighborSetUpTime,
nhdpDiscNeighborNibNeighborSetReachableLinkChanges,
nhdpIib2HopSetPerfChanges,
nhdpIib2HopSetPerfUpTime
}
STATUS current
DESCRIPTION
"Set of NHDP performance objects implemented in this module."
::= { nhdpMIBGroups 4 }
nhdpNotificationObjectGroup  OBJECT-GROUP
   OBJECTS {
      nhdpNbrStateChangeThreshold,
      nhdpNbrStateChangeWindow,
      nhdp2HopNbrStateChangeThreshold,
      nhdp2HopNbrStateChangeWindow,
      nhdpNbrState,
      nhdp2HopNbrState
   }
   STATUS     current
   DESCRIPTION
      "Set of NHDP notification objects implemented
       in this module."
::= { nhdpMIBGroups 5 }

nhdpNotificationGroup  NOTIFICATION-GROUP
   NOTIFICATIONS {
      nhdpNbrStateChange,
      nhdp2HopNbrStateChange,
      nhdpIfStateChange
   }
   STATUS     current
   DESCRIPTION
      "Set of NHDP notifications implemented
       in this module."
::= { nhdpMIBGroups 6 }

nhdpStateGroup2  OBJECT-GROUP
   OBJECTS {
      nhdpUpTime,
      nhdpIfStateUpTime,
      nhdpDiscRouterIndex,
      nhdpDiscIfIndex,
      nhdpDiscIfSetIpAddrType,
      nhdpDiscIfSetIpAddr,
      nhdpDiscIfSetIpAddrPrefixLen,
      nhdpIibLinkSetLHeardTime,
      nhdpIibLinkSetLSymTime,
      nhdpIibLinkSetLPending,
      nhdpIibLinkSetLLost,
      nhdpIibLinkSetLTime,
      nhdpIib2HopSetIpAddrPrefixLen,
      nhdpIib2HopSet1HopIfIndex,
      nhdpIib2HopSetN2Time,
      nhdpIib2HopSetN2Lost,
      nhdpNibNeighborSetNSymmetric,
      nhdpNibLostNeighborSetNLTime
   }
STATUS current
DESCRIPTION "Set of NHDP state objects implemented in this module."
::= { nhdpMIBGroups 7 }

--
-- Deprecated compliance statements and groups
--

nhdpFullCompliance MODULE-COMPLIANCE
STATUS deprecated
DESCRIPTION "The full implementation requirements for managed network entities that implement NHDP.

For version-independence, this compliance statement is deprecated in favor of nhdpFullCompliance2."
MODULE -- this module
MANDATORY-GROUPS { nhdpConfigurationGroup,
    nhdpStateGroup,
    nhdpNotificationObjectGroup,
    nhdpNotificationGroup,
    nhdpPerformanceGroup
}
::= { nhdpCompliances 2 }

nhdpStateGroup OBJECT-GROUP
OBJECTS {
    nhdpUpTime,
    nhdpIfStateUpTime,
    nhdpDiscRouterIndex,
    nhdpDiscIfIndex,
    nhdpDiscIfSetIpAddrType,
    nhdpDiscIfSetIpAddr,
    nhdpDiscIfSetIpAddrPrefixLen,
    nhdpIibLinkSetLHeardTime,
    nhdpIibLinkSetLSymTime,
    nhdpIibLinkSetLPending,
    nhdpIibLinkSetLLost,
    nhdpIibLinkSetLTime,
    nhdpIib2HopSetIpAddrPrefixLen,
    nhdpIib2HopSet1HopIfIndex,
    nhdpIib2HopSetN2Time,
    nhdpNibNeighborSetNSymmetric,
    nhdpNibLostNeighborSetNLTime
8. Security Considerations

This MIB module defines objects for the configuration, monitoring, and notification of the Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP) [RFC6130]. NHDP allows routers to acquire topological information up to two hops away by virtue of exchanging HELLO messages. The information acquired by NHDP may be used by routing protocols. The neighborhood information, exchanged between routers using NHDP, serves these routing protocols as a baseline for calculating paths to all destinations in the MANET, relay set selection for network-wide transmissions, etc.

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 opens devices to attack. These are the tables and objects and their sensitivity/vulnerability:

- nhdpIfStatus - This writable object turns on or off the NHDP process for the specified interface. If disabled, higher-level protocol functions, e.g., routing, would fail, causing network-wide disruptions.

- nhdpHelloInterval, nhdpHelloMinInterval, and nhdpRefreshInterval - These writable objects control the rate at which HELLO messages are sent on an interface. If set at too high a rate, this could represent a form of denial-of-service (DoS) attack by overloading interface resources.

- nhdpHystAcceptQuality, nhdpHystRejectQuality, nhdpInitialQuality, and nhdpInitialPending - These writable objects affect the perceived quality of the NHDP links and hence the overall stability of the network. If improperly set, these settings could result in network-wide disruptions.
o nhdpInterfaceTable - This table contains writable objects that affect the overall performance and stability of the NHDP process. Failure of the NHDP process would result in network-wide failure. Particularly sensitive objects from this table are discussed in the previous list items. This is the only table in the NHDP-MIB module with writable objects.

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 nhdpDiscIfSetTable - The object contains information on discovered neighbors, specifically their IP address in the nhdpDiscIfSetIpAddr object. This information provides an adversary broad information on the members of the MANET, located within this single table. This information can be used to expedite attacks on the other members of the MANET without having to go through a laborious discovery process on their own. This object is the index into the table and has a MAX-ACCESS of 'not-accessible'. However, this information can be exposed using SNMP operations.

MANET technology is often deployed to support communications of emergency services or military tactical applications. In these applications, it is imperative to maintain the proper operation of the communications network and to protect sensitive information related to its operation. Therefore, it is RECOMMENDED to provide support for the Transport Security Model (TSM) [RFC5591] in combination with TLS/DTLS [RFC6353].

SNMP versions prior to SNMPv3 did not include adequate security. Even if the network itself is secure (for example by using IPsec), 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.

Implementations SHOULD provide the security features described by the SNMPv3 framework (see [RFC3410]), and implementations claiming compliance to the SNMPv3 standard MUST include full support for authentication and privacy via the User-based Security Model (USM) [RFC3414] with the AES cipher algorithm [RFC3826]. Implementations MAY also provide support for the Transport Security Model (TSM) [RFC5591] in combination with a secure transport such as SSH [RFC5592] or TLS/DTLS [RFC6353].
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. Applicability Statement

This document describes objects for configuring parameters of the Mobile Ad Hoc Network (MANET) Neighborhood Discovery Protocol (NHDP) [RFC6130] process on a router. This MIB module, denoted NHDP-MIB, also reports state, performance information, and notifications. This section provides some examples of how this MIB module can be used in MANET network deployments.

NHDP is designed to allow routers to automatically discover and track routers one hop remote (denoted "neighbors") and routers two hops remote (denoted "2-hop neighbors"). This information is used by other MANET protocols in operation on the router to perform routing, multicast forwarding, and other functions with ad hoc and mobile networks. In the following, three example scenarios are listed where this MIB module is useful:

- For a Parking Lot Initial Configuration Situation - It is common for the vehicles comprising the MANET being forward deployed at a remote location, e.g., the site of a natural disaster, to be off-loaded in a parking lot where an initial configuration of the networking devices is performed. The configuration is loaded into the devices from a fixed location Network Operations Center (NOC) at the parking lot, and the vehicles are stationary at the parking lot while the configuration changes are made. Standards-based methods for configuration management from the co-located NOC are necessary for this deployment option.

- For Mobile Vehicles with Low-Bandwidth Satellite Link to a Fixed NOC - Here, the vehicles carrying the MANET routers carry multiple wireless interfaces, one of which is a relatively low-bandwidth, on-the-move satellite connection that interconnects a fix NOC to the nodes of the MANET. Standards-based methods for monitoring and fault management from the fixed NOC are necessary for this deployment option.

- For Fixed NOC and Mobile Local Manager in Larger Vehicles - for larger vehicles, a hierarchical network management arrangement is useful. Centralized network management is performed from a fixed NOC while local management is performed locally from within the
vehicles. Standards-based methods for configuration, monitoring, and fault management are necessary for this deployment option.

10. IANA Considerations

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

<table>
<thead>
<tr>
<th>Description</th>
<th>OBJECT IDENTIFIER value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NHDP-MIB</td>
<td>{ mib-2 213 }</td>
</tr>
</tbody>
</table>

11. References

11.1. Normative References


11.2. Informative References


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