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Network Mobility (NEMO) Management Information Base

Status of This Memo

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Abstract

This memo defines a portion of the Management Information Base (MIB), the Network Mobility (NEMO) support MIB, for use with network management protocols in the Internet community. In particular, the NEMO MIB will be used to monitor and control a Mobile IPv6 node with NEMO functionality.

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1. The Internet-Standard Management Framework

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

2. Overview

2.1. The Mobile IPv6 Protocol and NEMO Entities

Mobile IPv6 (MIPv6) [RFC3775] specifies a protocol that allows nodes to remain reachable while moving around in the IPv6 Internet. The Network Mobility (NEMO) Basic Support Protocol [RFC3963] is an extension to the Mobile IPv6 protocol that facilitates the movement of an entire network. The goals of Network Mobility support and related terminology are discussed in [RFC4886] and [RFC4885], respectively.

Typically, mobile routers implement NEMO functionality for achieving network mobility. However, a mobile router may also function as a mobile node. In the context of this document, an entity that implements the NEMO protocol is a NEMO entity.

This document defines a set of managed objects (MOs) that can be used to monitor and control NEMO entities.

2.2. Relationship to Other MIB Modules

This document focuses on the management of a NEMO entity. It is assumed that implementations will support the ifTable from the IF-MIB [RFC2863]. The MOBILEIPV6-MIB [RFC4295] defines the managed objects for a mobile node. Implementations supporting both the mobile node and NEMO functionality SHOULD implement the managed objects defined for the NEMO entities and mobile nodes from both the MOBILEIPV6-MIB and NEMO-MIB. The NEMO-MIB uses the textual conventions defined in the INET-ADDRESS-MIB [RFC4001].

2.3. Terminology

The terminology used in this document is consistent with the definitions used in the Mobile IPv6 protocol specification [RFC3775] and the NEMO Basic Support specification [RFC3963].

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 BCP 14, RFC 2119 [RFC2119].

2.4. MIB Design

The NEMO MIB comprises the following groups of definitions:

nemoCore: a generic group containing objects that are common to all NEMO entities.

nemoHa: this group models the home agent service. It is composed of objects specific to the services and associated advertisement parameters offered by the home agent on each of its links. It also contains objects pertaining to the maintenance of the home agent list on each of the links on which the service is offered.

nemoMr: this group models the mobile router service. It is composed of objects specific to the Dynamic Home Agent discovery function and related parameters. It also contains objects that record the movement of the mobile router.

nemoNotifications: defines the set of notifications that will be used to asynchronously monitor the NEMO entities.

The tables contained in the above groups are as follows:

nemoBindingCacheTable: models the Binding Cache on the home agent and correspondent node. It contains details of the Binding Update requests that have been received and accepted.

nemoMrEgressIfTable: contains information on the configured egress interfaces.

nemoMrBLTable: models the Binding Update List on the mobile router. It contains information about the registration requests sent by the mobile router and the corresponding results.

nemoHaCounterTable: contains registration statistics for all mobile routers registered with the home agent.

nemoHaMobileNetworkPrefixTable: contains the list of the mobile network prefixes that are maintained by the home agent.

3. The NEMO MIB

```
NEMO-MIB DEFINITIONS ::= BEGIN
IMPORTS
  MODULE-IDENTITY,  mib-2, Unsigned32, Counter32,
  Gauge32,
  OBJECT-TYPE, NOTIFICATION-TYPE
              FROM SNMPv2-SMI
  TEXTUAL-CONVENTION,
  TruthValue, DateAndTime, TimeStamp
              FROM SNMPv2-TC
  SnmpAdminString
              FROM SNMP-FRAMEWORK-MIB
  MODULE-COMPLIANCE, OBJECT-GROUP, NOTIFICATION-GROUP
              FROM SNMPv2-CONF
  InetAddressType, InetAddress, InetAddressPrefixLength
              FROM INET-ADDRESS-MIB
  InterfaceIndex
              FROM IF-MIB
  mip6BindingHomeAddressType, mip6BindingHomeAddress,
  mip6MnBLEntry, mip6BindingCacheEntry,
  mip6MnBLCOAType, mip6MnBLCOA
              FROM MOBILEIPV6-MIB
  ;

nemoMIB MODULE-IDENTITY
    LAST-UPDATED "200903100000Z"      -- 10 March 2009
    ORGANIZATION "IETF MEXT Working Group"
```

```
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           "

           DESCRIPTION
            "Copyright (c) 2009 IETF Trust and the persons identified
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```

```
            REVISION    "200903100000Z"      -- 10 March 2009
            DESCRIPTION "Initial version, published as RFC 5488."

                 ::= { mib-2  184 }

    -- The NEMO MIB has the following primary groups

    nemoNotifications        OBJECT IDENTIFIER ::= { nemoMIB 0 }
    nemoObjects              OBJECT IDENTIFIER ::= { nemoMIB 1 }
    nemoConformance          OBJECT IDENTIFIER ::= { nemoMIB 2 }
    nemoCore                 OBJECT IDENTIFIER ::= { nemoObjects 1 }
    nemoMr                   OBJECT IDENTIFIER ::= { nemoObjects 2 }
    nemoCn                   OBJECT IDENTIFIER ::= { nemoObjects 3 }
    nemoHa                   OBJECT IDENTIFIER ::= { nemoObjects 4 }

     -- The sub groups

    nemoSystem               OBJECT IDENTIFIER ::= { nemoCore 1 }
    nemoBindings             OBJECT IDENTIFIER ::= { nemoCore 2 }
```

```
  nemoConfiguration        OBJECT IDENTIFIER ::= { nemoCore 3 }
  nemoStats                OBJECT IDENTIFIER ::= { nemoCore 4 }

  nemoMrSystem             OBJECT IDENTIFIER ::= { nemoMr 1 }
  nemoMrConf               OBJECT IDENTIFIER ::= { nemoMr 2 }
  nemoMrRegistration       OBJECT IDENTIFIER ::= { nemoMr 3 }
  nemoMrGlobalStats        OBJECT IDENTIFIER ::= { nemoMr 4 }

  nemoHaAdvertisement      OBJECT IDENTIFIER ::= { nemoHa 1 }
  nemoHaStats              OBJECT IDENTIFIER ::= { nemoHa 2 }
  nemoHaRegistration       OBJECT IDENTIFIER ::= { nemoHa 3 }
  nemoHaGlobalStats        OBJECT IDENTIFIER ::= { nemoHaStats 1 }

  -- Textual Conventions
NemoBURequestRejectionCode ::= TEXTUAL-CONVENTION
       STATUS        current
       DESCRIPTION
               "The value of the status field in the Binding
                Acknowledgment message when the Binding Update
                was rejected for NEMO-specific reasons.
               "
       REFERENCE
               "RFC 3963: Section 4.2"
       SYNTAX  INTEGER {
               mobileRouterOperationNotPermitted (140),
               invalidPrefix                     (141),
               notAuthorizedForPrefix            (142),
               forwardingSetupFailed             (143)
              }

  --
  --
  -- nemoSystem group
  --
  --

  nemoCapabilities OBJECT-TYPE
      SYNTAX      BITS {
                       mobileRouter       (0),
                       homeAgentSupport   (1)
                  }
      MAX-ACCESS  read-only
      STATUS      current
```

```
        DESCRIPTION
                "This object indicates the NEMO functions that
                 are supported by this managed entity.  Multiple
                 NEMO functions may be supported by a single
                 entity.
                "
        REFERENCE
                "RFC 3963: Section 3"
        ::= { nemoSystem 1 }

    nemoStatus OBJECT-TYPE
        SYNTAX      INTEGER { enabled(1), disabled(2) }
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
                "This object indicates whether the NEMO
                 function is enabled for the managed entity.  If it
                 is enabled, the agent discovery and registration
                 functions will be operational.

                 Changing the status from enabled(1) to disabled(2)
                 will terminate the agent discovery and registration
                 functions.  On the other hand, changing the status
                 from disabled(2) to enabled(1) will start the agent
                 discovery and registration functions.

                 The value of this object MUST remain unchanged
                 across reboots of the managed entity.
                "
        ::= { nemoSystem 2 }

    nemoCounterDiscontinuityTime 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 NEMO entity's counters,
                viz., counters with OID prefix 'nemoMrConf',
                'nemoMrRegnCounters', 'nemoMrGlobalStats', or
                'nemoHaGlobalStats', suffered a discontinuity.  If
                no such discontinuities have occurred since the last
                re-initialization of the local management subsystem,
                then this object will have a zero value.
               "
       ::= { nemoStats 1 }
    --
    --
```

```
     --   nemoConfiguration group
     --
     --

    nemoMrBLTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF NemoMrBLEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
                "This table corresponds to the Binding Update List
                 (BL) that includes NEMO-related information and that
                 is maintained by the mobile router.  The table
                 holds a row for every binding that the mobile
                 router has established or is trying to establish.
                 Entries from the table are deleted as the lifetime
                 of the binding expires.
                "
        REFERENCE
                "RFC 3775: Sections 4.5, 11.1
                 RFC 3963: Section 5.2"
        ::= { nemoMrRegistration 1 }

    nemoMrBLEntry  OBJECT-TYPE
        SYNTAX      NemoMrBLEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
                "An entry pertaining to NEMO-related information
                 contained in a Binding Update sent by a NEMO-enabled
                 mobile router to its home agent.
                "
        AUGMENTS {mip6MnBLEntry}
    ::= { nemoMrBLTable 1 }

    NemoMrBLEntry ::= SEQUENCE {
        nemoMrBLMode     INTEGER,
        nemoMrBLMrFlag   TruthValue,
        nemoMrBLHomeAddressPrefixLength   InetAddressPrefixLength,
        nemoMrBLCareofAddressPrefixLength InetAddressPrefixLength,
        nemoMrBLActiveEgressIfIndex       InterfaceIndex,
        nemoMrBLEstablishedHomeTunnelIfIndex InterfaceIndex
        }
    nemoMrBLMode OBJECT-TYPE
        SYNTAX      INTEGER {
          implicitMode (1),
          explicitMode (2)
                    }
        MAX-ACCESS  read-only
```

```
        STATUS      current
        DESCRIPTION
                "implicitMode(1): the Mobile Network Prefix Option
                 is not included in the Binding Update by the mobile
                 router.

                 explicitMode(2): the mobile router included one or
                 more Mobile Network Prefix Options in the Binding
                 Update.
                "
        REFERENCE
                "RFC 3963: Section 5.2"
        ::= { nemoMrBLEntry 1 }

    nemoMrBLMrFlag OBJECT-TYPE
        SYNTAX      TruthValue
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "true(1): the mobile router sent the Binding Update
                 with Mobile Router Flag set.

                 false(2): the mobile router did not send the Binding
                 Update with Mobile Router Flag set.  This implies that
                 the mobile router is acting as a mobile node.
                "
        REFERENCE
                "RFC 3963: Sections 4.1, 5.1"
        ::= { nemoMrBLEntry 2 }

    nemoMrBLHomeAddressPrefixLength  OBJECT-TYPE
        SYNTAX      InetAddressPrefixLength
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The prefix length of the mobile router's home network.
                "
        REFERENCE
            "RFC 3963: Section 3"
        ::= { nemoMrBLEntry 3 }

    nemoMrBLCareofAddressPrefixLength  OBJECT-TYPE
        SYNTAX      InetAddressPrefixLength
        MAX-ACCESS  read-only
        STATUS      current
```

```
        DESCRIPTION
                "The prefix length of the care-of address of the
                 mobile router.
                "
        REFERENCE
            "RFC 3963: Section 3"
        ::= { nemoMrBLEntry 4 }

    nemoMrBLActiveEgressIfIndex OBJECT-TYPE
        SYNTAX      InterfaceIndex
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The interface index of the currently active
                 egress interface.
                "
        REFERENCE
            "RFC 3963: Section 5.5"
        ::= { nemoMrBLEntry 5 }

    nemoMrBLEstablishedHomeTunnelIfIndex  OBJECT-TYPE
        SYNTAX      InterfaceIndex
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The interface index of the tunnel established
                 between the mobile router and the home agent
                 for NEMO traffic.
                "
        REFERENCE
            "RFC 3963: Section 5.5"
        ::= { nemoMrBLEntry 6 }

    -- Mobile Router Registration Group Counters

    nemoMrRegnCounters OBJECT IDENTIFIER ::= { nemoMrRegistration 2 }

    nemoMrMobilityMessagesSent OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The total number of mobility messages, i.e., IPv6
                 datagrams with Mobility Header, sent by the mobile
                 node.  This will include Binding Updates sent by a
                 mobile router with the Mobile Router Flag set.
```

```
                Discontinuities in the value of this counter can
                occur at re-initialization of the management system,
                and at other times as indicated by the value of
                nemoCounterDiscontinuityTime.
               "
        REFERENCE
                "RFC 3775: Sections 4.2, 6.1
                 RFC 3963: Section 4.1"
        ::= {  nemoMrRegnCounters 1 }

    nemoMrMobilityMessagesRecd OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The total number of mobility messages, i.e., IPv6
                 datagrams with Mobility Header, received by the
                 mobile node.  This will include Binding
                 Acknowledgements with Mobile Router Flag set that
                 are sent to a mobile router.

                 Discontinuities in the value of this counter can
                 occur at re-initialization of the management system,
                 and at other times as indicated by the value of
                 nemoCounterDiscontinuityTime.
                "
        REFERENCE
                "RFC 3775: Sections 4.2, 6.1
                 RFC 3963: Sections 4.1, 4.2"
        ::= {  nemoMrRegnCounters 2 }

    nemoMrPrefixRegMode OBJECT-TYPE
        SYNTAX INTEGER {
                  implicitMode       (1),
                  explicitMode       (2)
               }
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
                "This object indicates the mode in which the mobile
                 network prefixes will be registered with the home
                 agent.

                 implicitMode(1): the Mobile Network Prefix Option will
                 not be included in the Binding Update by the mobile
                 router.
```

```
                explicitMode(2): the mobile router will include one or
                more Mobile Network Prefix Options in the Binding
                Update.

                The value of this object MUST remain unchanged
                across reboots of the managed entity.
               "
        REFERENCE
                "RFC 3963: Section 5.2"

        ::= { nemoMrRegistration 3 }

    nemoHaMobileNetworkPrefixTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF NemoHaMobileNetworkPrefixEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
                "This table contains the mobile network prefixes
                 that the home agent maintains for the mobile router.
                 The mobile network prefixes in this table are
                 registered by Binding Updates or are manually
                 pre-configured.
                "
        REFERENCE
                "RFC 3963: Section 6.1.2"
        ::= { nemoHaRegistration 1 }

    nemoHaMobileNetworkPrefixEntry OBJECT-TYPE
        SYNTAX      NemoHaMobileNetworkPrefixEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
                "An entry for a mobile network prefix.

                 The instances of the columnar objects in this entry
                 pertain to an interface for a particular value of
                 mip6BindingHomeAddressType, mip6BindingHomeAddress,
                 and nemoHaMobileNetworkPrefixSeqNo.

                 The nemoHaMobileNetworkPrefixSeqNo object is used to
                 distinguish between multiple instances of
                 the mobile network prefix in the same Binding Update
                 for the same set of mip6BindingHomeAddressType and
                 mip6BindingHomeAddress.

                 There is no upper-bound on the maximum number of
                 mobile network prefixes in a Binding Update but, for
                 practical purposes, the upper bound of the value
```

```
                nemoHaMobileNetworkPrefixSeqNo is set to 1024.

                Implementers need to be aware that if the total
                number of octets in mip6BindingHomeAddress
                exceeds 112, then OIDs of column
                instances in this row will have more than 128
                sub-identifiers and cannot be accessed using
                SNMPv1, SNMPv2c, or SNMPv3.
               "
        INDEX  { mip6BindingHomeAddressType,
                 mip6BindingHomeAddress,
                 nemoHaMobileNetworkPrefixSeqNo
    }
    ::= { nemoHaMobileNetworkPrefixTable 1 }

    NemoHaMobileNetworkPrefixEntry ::= SEQUENCE {
        nemoHaMobileNetworkPrefixSeqNo       Unsigned32,
        nemoHaMobileNetworkPrefixType        InetAddressType,
        nemoHaMobileNetworkPrefix            InetAddress,
        nemoHaMobileNetworkPrefixLength      Unsigned32,
        nemoHaMobileNetworkPrefixSource      INTEGER
    }

    nemoHaMobileNetworkPrefixSeqNo OBJECT-TYPE
        SYNTAX      Unsigned32 (1..1024)
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
                "A Binding Update may have multiple mobile network
                 prefixes.

                 This object, along with mip6BindingHomeAddressType
                 and mip6BindingHomeAddress, uniquely identifies a
                 row containing a single mobile network prefix for
                 a mobile router in this table.
                "
        REFERENCE
                "RFC 3963: Sections 2, 6.1, 6.2"
        ::= { nemoHaMobileNetworkPrefixEntry 1 }

    nemoHaMobileNetworkPrefixType OBJECT-TYPE
        SYNTAX      InetAddressType
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The address type for the mobile network prefix
                 that follows.
                "
```

```
        ::= { nemoHaMobileNetworkPrefixEntry 2 }

    nemoHaMobileNetworkPrefix OBJECT-TYPE
        SYNTAX      InetAddress
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "A mobile network prefix related to the
                 corresponding Binding Update.

                 The type of the address represented by this object
                 is specified by the corresponding
                 nemoHaMobileNetworkPrefixType object.
                "
        REFERENCE
                "RFC 3963: Sections 2, 6.1, 6.2"
        ::= { nemoHaMobileNetworkPrefixEntry 3 }

    nemoHaMobileNetworkPrefixLength OBJECT-TYPE
        SYNTAX      Unsigned32 (0..128)
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The length of the prefix specified by the corresponding
                 nemoHaMobileNetworkPrefix object.
                "
        REFERENCE
                "RFC 3963: Sections 4.3, 6.1, 6.2"
        ::= { nemoHaMobileNetworkPrefixEntry 4 }


    nemoHaMobileNetworkPrefixSource OBJECT-TYPE
        SYNTAX      INTEGER {
                    configured    (1),
                    bindingUpdate (2)
                    }

        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The information source of the mobile network prefix
                 configured with the Binding Update.

                 configured(1): indicates that the mobile network prefix
                 has been manually pre-configured.

                 bindingUpdate(2): indicates that the information is
                 introduced to the home agent by the Mobile Network
```

```
                Prefix Option in the Binding Updates received by the
                home agent.
               "
        REFERENCE
                "RFC 3963: Sections 4.3, 6.1, 6.2"
        ::= { nemoHaMobileNetworkPrefixEntry 5 }

    nemoBindingCacheTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF NemoBindingCacheEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
               "This table models the Binding Cache that includes
                NEMO-related information and that is maintained by the
                home agent.  Entries in this table are not required
                to survive a reboot of the home agent.
               "
        REFERENCE
                "RFC 3775: Sections 4.5, 9.1, 10.1,
                 RFC 3963: Section 6.1"
        ::= { nemoBindings 1 }

    nemoBindingCacheEntry  OBJECT-TYPE
        SYNTAX      NemoBindingCacheEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
                "An entry containing additional information related
                 to NEMO-enabled entries in the Binding Cache table
                 of the home agent.
                "
        AUGMENTS {mip6BindingCacheEntry}
    ::= { nemoBindingCacheTable 1 }

    NemoBindingCacheEntry ::= SEQUENCE {
         nemoBindingMrFlag     TruthValue,
         nemoBindingMrMode     INTEGER
        }

    nemoBindingMrFlag OBJECT-TYPE
        SYNTAX      TruthValue
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "true(1): indicates that the Binding Cache entry is from
                 an entity acting as a mobile router.
```

```
                false(2): implies that the Binding Cache entry is from
                an entity acting as a mobile node.
               "
        REFERENCE
                "RFC 3963: Sections 6.1.1, 6.2"
        ::= { nemoBindingCacheEntry 1 }

    nemoBindingMrMode OBJECT-TYPE
        SYNTAX      INTEGER {
          implicitMode(1),
          explicitMode(2)
                    }
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "implicitMode(1): the Mobile Network Prefix Option is
                not included in the Binding Update by the mobile
                router.

                explicitMode(2): the mobile router included one or
                more Mobile Network Prefix Options in the Binding
                Update.
               "
        REFERENCE
                "RFC 3963: Sections 5.2, 6.1.1, 6.2"
        ::= { nemoBindingCacheEntry 2 }

    --
    -- nemoMrEgressIfTable
    --
    nemoMrEgressIfTable        OBJECT-TYPE
         SYNTAX      SEQUENCE OF NemoMrEgressIfEntry
         MAX-ACCESS  not-accessible
         STATUS      current
         DESCRIPTION
                 "A table representing the egress interfaces that
                  will be used by the mobile router for roaming to
                  foreign networks.  Each entry in this table
                  represents a configured egress interface.
                 "
         ::= { nemoMrSystem 1 }

    nemoMrEgressIfEntry OBJECT-TYPE
         SYNTAX      NemoMrEgressIfEntry
         MAX-ACCESS  not-accessible
         STATUS      current
         DESCRIPTION
                 "An entry in the egress interface table.  It
```

```
                represents a single egress interface entry.
               "
        INDEX  { nemoMrEgressIfIndex }
        ::= { nemoMrEgressIfTable 1 }

    NemoMrEgressIfEntry ::=
        SEQUENCE {
         nemoMrEgressIfIndex             InterfaceIndex,
         nemoMrEgressIfPriority          Unsigned32,
         nemoMrEgressIfDescription       SnmpAdminString,
         nemoMrEgressIfRoamHoldDownTime  Gauge32
        }

    nemoMrEgressIfIndex  OBJECT-TYPE
        SYNTAX      InterfaceIndex
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
                "The index of the interface on the mobile router.
                "
        ::= { nemoMrEgressIfEntry 1 }

    nemoMrEgressIfPriority   OBJECT-TYPE
        SYNTAX      Unsigned32 (0..255)
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The priority configured to the egress interface.
                 This value will be configured to a value between 0
                 and 255.
                "
        ::= { nemoMrEgressIfEntry 2 }

    nemoMrEgressIfDescription   OBJECT-TYPE
        SYNTAX      SnmpAdminString
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "A human-readable textual description of the egress
                 interface on the mobile router.
                "
        ::= { nemoMrEgressIfEntry 3 }

    nemoMrEgressIfRoamHoldDownTime  OBJECT-TYPE
        SYNTAX      Gauge32
        UNITS       "seconds"
        MAX-ACCESS  read-only
        STATUS      current
```

```
         DESCRIPTION
                 "This object indicates the time for which the
                  egress interface will be held down during roaming
                  to avoid interface flapping.
                 "
         ::= { nemoMrEgressIfEntry 4 }

    nemoMrDiscoveryRequests OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "Total number of Modified Dynamic Home Agent Address
                 Discovery Requests, with Mobile Router Support Flag
                 set, sent by the mobile router.

                 Discontinuities in the value of this counter can
                 occur at re-initialization of the management system,
                 and at other times as indicated by the value of
                 nemoCounterDiscontinuityTime.
                "
        REFERENCE
                "RFC 3775: Sections 10.5, 11.4.1
                 RFC 3963: Section 7.1"
           ::= { nemoMrConf 1 }

    nemoMrDiscoveryReplies OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "Total number of Modified Dynamic Home Agent Address
                 Discovery Replies, with Mobile Router Support Flag
                 set, received by the mobile router.

                 Discontinuities in the value of this counter can
                 occur at re-initialization of the management system,
                 and at other times as indicated by the value of
                 nemoCounterDiscontinuityTime.
                "
        REFERENCE
                "RFC 3775: Sections 10.5, 11.4.1
                 RFC 3963: Section 7.2"
           ::= { nemoMrConf 2 }

    nemoMrDiscoveryRepliesRouterFlagZero OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
```

```
        STATUS      current
        DESCRIPTION
                "Total number of Modified Dynamic Home Agent Address
                 Discovery Replies, with Mobile Router Support Flag set
                 to 0 although the flag in the corresponding request
                 is set to 1.  It implies that there is no home agent
                 that supports mobile router functionality in the home
                 network.

                 Discontinuities in the value of this counter can
                 occur at re-initialization of the management system,
                 and at other times as indicated by the value of
                 nemoCounterDiscontinuityTime.
                "
        REFERENCE
                "RFC 3775: Sections 10.5, 11.4.1
                 RFC 3963: Section 7.2"
           ::= { nemoMrConf 3 }

    nemoMrMovedHome OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "Number of times the mobile router has detected
                 movement from a foreign network to its home
                 network.

                 Discontinuities in the value of this counter can
                 occur at re-initialization of the management system,
                 and at other times as indicated by the value of
                 nemoCounterDiscontinuityTime.
                "
        REFERENCE
            "RFC 3963: Section 3"
            ::= { nemoMrConf 4 }

    nemoMrMovedOutofHome OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "Number of times the mobile router has detected
                 movement to a foreign network from the home
                 network, has acquired a care-of address, and
                 has initiated the care-of address registration
                 process.
```

```
                Discontinuities in the value of this counter can
                occur at re-initialization of the management system,
                and at other times as indicated by the value of
                nemoCounterDiscontinuityTime.
               "
        REFERENCE
            "RFC 3963: Section 3"
            ::= { nemoMrConf 5 }

    nemoMrMovedFNtoFN OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "Number of times the mobile router has detected
                movement to/from a foreign network from/to another
                foreign network.  Note that 'movement' implies
                movement in layer 3, i.e., the mobile router's care-of
                address changed, and it initiated the care-of address
                registration process.

                If there are multiple egress interfaces, this counter
                counts the total number of movements.  The movement
                as a mobile node of the mobile entity is not counted.

                Discontinuities in the value of this counter can
                occur at re-initialization of the management system,
                and at other times as indicated by the value of
                nemoCounterDiscontinuityTime.
               "
        REFERENCE
                "RFC 3963: Section 3"
            ::= { nemoMrConf 6 }

    nemoMrBetterIfDetected OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "Number of times the NEMO entity has found an egress
                interface with better priority.

                Discontinuities in the value of this counter can
                occur at re-initialization of the management system,
                and at other times as indicated by the value of
                nemoCounterDiscontinuityTime.
               "
            ::= { nemoMrConf 7 }
```

```
    --
    -- nemoStats:nemoMrGlobalStats
    --

    nemoMrBindingAcksWONemoSupport  OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The total number of Binding Acknowledgements without
                 NEMO support received by the mobile router.

                 Discontinuities in the value of this counter can
                 occur at re-initialization of the management system,
                 and at other times as indicated by the value of
                 nemoCounterDiscontinuityTime.
                "
        REFERENCE
                "RFC 3963: Section 5.3"
            ::= { nemoMrGlobalStats 1 }

    nemoMrBindingAcksRegTypeChangeDisallowed  OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The total number of Binding Acknowledgements
                 received by the mobile router with status code
                 indicating 'Registration type change disallowed'
                 (Code 139).

                 Discontinuities in the value of this counter can
                 occur at re-initialization of the management system,
                 and at other times as indicated by the value of
                 nemoCounterDiscontinuityTime.
                "
        REFERENCE
                "RFC 3775: Section 9.5.1
                 RFC 3963: Section 6.2"
            ::= { nemoMrGlobalStats 2 }

    nemoMrBindingAcksOperationNotPermitted  OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The total number of Binding Acknowledgements
                 received by the mobile router with status code
```

```
                indicating 'Mobile Router Operation not permitted'
                (Code 140).

                Discontinuities in the value of this counter can
                occur at re-initialization of the management system,
                and at other times as indicated by the value of
                nemoCounterDiscontinuityTime.
               "
        REFERENCE
                "RFC 3963: Section 6.6"
            ::= { nemoMrGlobalStats 3 }

    nemoMrBindingAcksInvalidPrefix  OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The total number of Binding Acknowledgements
                 received by the mobile router with status code
                 indicating 'Invalid Prefix' (Code 141).

                 Discontinuities in the value of this counter can
                 occur at re-initialization of the management system,
                 and at other times as indicated by the value of
                 nemoCounterDiscontinuityTime.
                "
        REFERENCE
                "RFC 3963: Section 6.6"
            ::= { nemoMrGlobalStats 4 }

    nemoMrBindingAcksNotAuthorizedForPrefix OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The total number of Binding Acknowledgements
                 received by the mobile router with status code
                 indicating 'Not Authorized for Prefix' (Code 142).

                 Discontinuities in the value of this counter can
                 occur at re-initialization of the management system,
                 and at other times as indicated by the value of
                 nemoCounterDiscontinuityTime.
                "
        REFERENCE
                "RFC 3963 : Section 6.6"
            ::= { nemoMrGlobalStats 5 }
```

```
    nemoMrBindingAcksForwardingSetupFailed OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The total number of Binding Acknowledgements
                 received by the mobile router with status code
                 indicating 'Forwarding Setup failed' (Code 143).

                 Discontinuities in the value of this counter can
                 occur at re-initialization of the management system,
                 and at other times as indicated by the value of
                 nemoCounterDiscontinuityTime.
                "
        REFERENCE
                "RFC 3963: Section 6.6"
            ::= { nemoMrGlobalStats 6 }

    nemoMrBindingAcksOtherError OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The total number of Binding Acknowledgements
                 received by the mobile router (Mobile Router Flag is
                 set) with status code other than:

                 successfully processed                  --(Code 0  )
                 mobileRouterOperationNotPermitted (140) --(Code 140)
                 invalidPrefix                     (141) --(Code 141)
                 notAuthorizedForPrefix            (142) --(Code 142)
                 forwardingSetupFailed             (143) --(Code 143)

                 Discontinuities in the value of this counter can
                 occur at re-initialization of the management system,
                 and at other times as indicated by the value of
                 nemoCounterDiscontinuityTime.
                "
        REFERENCE
                "RFC 3963 : Section 6.6"
            ::= { nemoMrGlobalStats 7 }

    --
    -- nemoStats:nemoHaGlobalStats
    --

    nemoHaBUAcksWONemoSupport  OBJECT-TYPE
        SYNTAX      Counter32
```

```
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The total number of Binding Acknowledgements
                 without NEMO support sent by the home agent.

                 Discontinuities in the value of this counter can
                 occur at re-initialization of the management system,
                 and at other times as indicated by the value of
                 nemoCounterDiscontinuityTime.
                "
        REFERENCE
                "RFC 3963: Section 5.3"
            ::= { nemoHaGlobalStats 1 }

    nemoHaBUAcksRegTypeChangeDisallowed  OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The total number of Binding Update requests
                 rejected by the home agent with status code
                 in the Binding Acknowledgement indicating
                 'Registration type change disallowed' (Code 139).

                 Discontinuities in the value of this counter can
                 occur at re-initialization of the management system,
                 and at other times as indicated by the value of
                 nemoCounterDiscontinuityTime.
                "
        REFERENCE
                "RFC 3775: Section 9.5.1
                 RFC 3963: Section 6.2"
            ::= { nemoHaGlobalStats 2 }

    nemoHaBUAcksOperationNotPermitted  OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The total number of Binding Update requests
                 rejected by the home agent with status code in
                 the Binding Acknowledgement indicating 'Mobile
                 Router Operation not permitted' (Code 140).

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

```
                nemoCounterDiscontinuityTime.
               "
        REFERENCE
                "RFC 3963: Section 6.6"
            ::= { nemoHaGlobalStats 3 }

    nemoHaBUAcksInvalidPrefix  OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The total number of Binding Update requests
                 rejected by the home agent with status code in
                 the Binding Acknowledgement indicating 'Invalid
                 Prefix' (Code 141).

                 Discontinuities in the value of this counter can
                 occur at re-initialization of the management system,
                 and at other times as indicated by the value of
                 nemoCounterDiscontinuityTime.
                "
        REFERENCE
                "RFC 3963: Section 6.6"
            ::= { nemoHaGlobalStats 4 }

    nemoHaBUAcksNotAuthorizedForPrefix OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The total number of Binding Update requests
                 rejected by the home agent with status code in
                 the Binding Acknowledgement indicating 'Not
                 Authorized for Prefix' (Code 142).

                 Discontinuities in the value of this counter can
                 occur at re-initialization of the management system,
                 and at other times as indicated by the value of
                 nemoCounterDiscontinuityTime.
                "
        REFERENCE
                "RFC 3963: Section 6.6"
            ::= { nemoHaGlobalStats 5 }

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

```
        DESCRIPTION
                "The total number of Binding Update requests
                 rejected by the home agent with status code in
                 the Binding Acknowledgement indicating 'Forwarding
                 Setup failed' (Code 143).

                 Discontinuities in the value of this counter can
                 occur at re-initialization of the management system,
                 and at other times as indicated by the value of
                 nemoCounterDiscontinuityTime.
                "
        REFERENCE
                "RFC 3963: Section 6.6"
            ::= { nemoHaGlobalStats 6 }

    nemoHaBUAcksOtherError OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The total number of Binding Update requests
                 from mobile routers (Mobile Router Flag is set)
                 rejected by the home agent with status code
                 other than:

                 mobileRouterOperationNotPermitted (140)
                 invalidPrefix                     (141)
                 notAuthorizedForPrefix            (142)
                 forwardingSetupFailed             (143)

                 Discontinuities in the value of this counter can
                 occur at re-initialization of the management system,
                 and at other times as indicated by the value of
                 nemoCounterDiscontinuityTime.
                "
        REFERENCE
                "RFC 3963: Section 6.6"
            ::= { nemoHaGlobalStats 7 }

    nemoHaCounterTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF NemoHaCounterEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
                "A table containing registration statistics for all
                 mobile routers registered with the home agent.
                "
        ::= { nemoHaStats 2 }
```

```
    nemoHaCounterEntry  OBJECT-TYPE
        SYNTAX      NemoHaCounterEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
                "Home agent registration statistics for a mobile
                 router.

                 Implementers need to be aware that if the total
                 number of octets in mip6BindingHomeAddress
                 exceeds 113, then OIDs of column instances in
                 this row will have more than 128 sub-identifiers and
                 cannot be accessed using SNMPv1, SNMPv2c, or SNMPv3.
                "
        INDEX   { mip6BindingHomeAddressType,
                  mip6BindingHomeAddress
                }
        ::= { nemoHaCounterTable 1 }

    NemoHaCounterEntry      ::= SEQUENCE {
        nemoHaBURequestsAccepted       Counter32,
        nemoHaBURequestsDenied         Counter32,
        nemoHaBCEntryCreationTime      DateAndTime,
        nemoHaBUAcceptedTime           DateAndTime,
        nemoHaBURejectionTime          DateAndTime,
        nemoHaRecentBURejectionCode    NemoBURequestRejectionCode,
        nemoHaCtrDiscontinuityTime     TimeStamp
        }

    nemoHaBURequestsAccepted OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "Total number of Binding Update requests from the
                 mobile router accepted by the home agent.

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

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

```
        DESCRIPTION
                "Total number of Binding Update requests from the
                 mobile router rejected by the home agent.

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

    nemoHaBCEntryCreationTime   OBJECT-TYPE
        SYNTAX      DateAndTime (SIZE (11))
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The time when the current Binding Cache entry was
                 created for the mobile router.  An implementation
                 MUST return all 11 bytes of the DateAndTime
                 textual-convention so that a manager may retrieve
                 the offset from GMT time.
                "
        ::= { nemoHaCounterEntry 3 }

    nemoHaBUAcceptedTime  OBJECT-TYPE
        SYNTAX      DateAndTime (SIZE (11))
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The time at which the last Binding Update was
                 accepted by the home agent for this mobile router.
                 An implementation MUST return all 11 bytes of the
                 DateAndTime textual-convention so that a manager
                 may retrieve the offset from GMT time.
                "
        ::= { nemoHaCounterEntry 4 }

    nemoHaBURejectionTime  OBJECT-TYPE
        SYNTAX      DateAndTime (SIZE (11))
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The time at which the last Binding Update was
                 rejected by the home agent for this mobile router.
                 If there have been no rejections, then this object
                 will be inaccessible.  An implementation MUST return
                 all 11 bytes of the DateAndTime textual-convention
                 so that a manager may retrieve the offset from GMT
```

```
                time.
               "
        ::= { nemoHaCounterEntry 5 }

    nemoHaRecentBURejectionCode  OBJECT-TYPE
        SYNTAX      NemoBURequestRejectionCode
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
                "The Status code (>= 128) in the latest Binding
                 Acknowledgment indicating a rejection, sent to this
                 mobile router.

                 If a Binding Update request is rejected and a Binding
                 Acknowledgment is not sent to this mobile router,
                 then this will be the value of the Status code that
                 corresponds to the reason of the rejection.  If there
                 have been no Binding Update request rejections, then
                 this object will be inaccessible.
                "
        ::= { nemoHaCounterEntry 6 }

    nemoHaCtrDiscontinuityTime 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 the counters in this row,
                viz., instances of 'nemoHaBURequestsAccepted' and
                'nemoHaBURequestsDenied', suffered a discontinuity.
                If no such discontinuity has occurred since the
                last re-initialization of the local management
                subsystem, then this object will have a zero value.
               "
       ::= { nemoHaCounterEntry 7 }

    --
    --
    -- nemoNotifications
    --
    --

    nemoHomeTunnelEstablished NOTIFICATION-TYPE
        OBJECTS   {
                    nemoMrBLActiveEgressIfIndex,
                    nemoMrBLEstablishedHomeTunnelIfIndex,
                    mip6MnBLCOAType,
```

```
                    mip6MnBLCOA,
                    nemoMrBLHomeAddressPrefixLength,
                    nemoMrBLCareofAddressPrefixLength
                  }

        STATUS    current
        DESCRIPTION
                "This notification is sent by the mobile router
                 every time the tunnel is established between the
                 home agent and the mobile router.
                "
        REFERENCE
                "RFC 3963: Section 5.5"
            ::= { nemoNotifications 1 }

    nemoHomeTunnelReleased NOTIFICATION-TYPE
        OBJECTS {
                    nemoMrBLActiveEgressIfIndex,
                    nemoMrBLEstablishedHomeTunnelIfIndex,
                    mip6MnBLCOAType,
                    mip6MnBLCOA,
                    nemoMrBLHomeAddressPrefixLength,
                    nemoMrBLCareofAddressPrefixLength
                }
        STATUS    current
        DESCRIPTION
                "This notification is sent by the mobile router
                 every time the tunnel is deleted between the home
                 agent and the mobile router.
                "
        REFERENCE
                "RFC 3963: Section 5.5"
            ::= { nemoNotifications 2}

    -- Conformance information
    nemoGroups      OBJECT IDENTIFIER ::= { nemoConformance 1 }
    nemoCompliances OBJECT IDENTIFIER ::= { nemoConformance 2 }

    -- Units of conformance
    nemoSystemGroup    OBJECT-GROUP
         OBJECTS {
                    nemoCapabilities,
                    nemoStatus
        }
         STATUS  current
         DESCRIPTION
                 "A collection of objects for basic NEMO
                  monitoring.
```

```
                "
        ::= { nemoGroups 1 }

    nemoBindingCacheGroup    OBJECT-GROUP
        OBJECTS {
                  nemoBindingMrFlag,
                  nemoBindingMrMode
        }
        STATUS  current
        DESCRIPTION
                "A collection of objects for monitoring the
                 NEMO extensions of the Binding Cache.
                "
        ::= { nemoGroups 2 }

    nemoStatsGroup    OBJECT-GROUP
        OBJECTS {
                  nemoCounterDiscontinuityTime
        }
        STATUS  current
        DESCRIPTION
                "A collection of objects for
                 monitoring NEMO statistics.
                "
        ::= { nemoGroups 3 }

    nemoMrConfGroup   OBJECT-GROUP
        OBJECTS {
                  nemoMrEgressIfPriority,
                  nemoMrEgressIfDescription,
                  nemoMrEgressIfRoamHoldDownTime,
                  nemoMrDiscoveryRequests,
                  nemoMrDiscoveryReplies,
                  nemoMrDiscoveryRepliesRouterFlagZero,
                  nemoMrMovedHome,
                  nemoMrMovedOutofHome,
                  nemoMrMovedFNtoFN,
                  nemoMrBetterIfDetected
        }
        STATUS  current
        DESCRIPTION
                "A collection of objects for monitoring
                 the configuration-related information on
                 the mobile router.
                "
        ::= { nemoGroups 4 }

    nemoMrRegistrationGroup  OBJECT-GROUP
```

```
         OBJECTS {
                   nemoMrBLMode,
                   nemoMrBLMrFlag,
                   nemoMrBLHomeAddressPrefixLength,
                   nemoMrBLCareofAddressPrefixLength,
                   nemoMrBLActiveEgressIfIndex,
                   nemoMrBLEstablishedHomeTunnelIfIndex,
                   nemoMrMobilityMessagesSent,
                   nemoMrMobilityMessagesRecd,
                   nemoMrPrefixRegMode,
                   nemoMrBindingAcksWONemoSupport,
                   nemoMrBindingAcksRegTypeChangeDisallowed,
                   nemoMrBindingAcksOperationNotPermitted,
                   nemoMrBindingAcksInvalidPrefix,
                   nemoMrBindingAcksNotAuthorizedForPrefix,
                   nemoMrBindingAcksForwardingSetupFailed,
                   nemoMrBindingAcksOtherError
        }
         STATUS  current
         DESCRIPTION
                 "A collection of objects for monitoring
                  the registration details and statistics for
                  the mobile router.
                 "
         ::= { nemoGroups 5 }

    nemoHaSystemGroup    OBJECT-GROUP
        OBJECTS {
                   nemoHaMobileNetworkPrefixType,
                   nemoHaMobileNetworkPrefix,
                   nemoHaMobileNetworkPrefixLength,
                   nemoHaMobileNetworkPrefixSource
       }
        STATUS  current
        DESCRIPTION
                "A collection of objects for basic NEMO
                 configuration monitoring at the home agent.
                "
        ::= { nemoGroups 6 }

    nemoHaStatsGroup   OBJECT-GROUP
        OBJECTS {
                   nemoHaBURequestsAccepted,
                   nemoHaBURequestsDenied,
                   nemoHaBCEntryCreationTime,
                   nemoHaBUAcceptedTime,
                   nemoHaBURejectionTime,
                   nemoHaRecentBURejectionCode,
```

```
                  nemoHaCtrDiscontinuityTime
       }
        STATUS  current
        DESCRIPTION
                "A collection of objects for monitoring NEMO
                 registration-related statistics pertaining to
                 the mobile routers registered with the home agent.
                "
        ::= { nemoGroups 7 }

    nemoHaGlobalStatsGroup   OBJECT-GROUP
        OBJECTS {
                  nemoHaBUAcksWONemoSupport,
                  nemoHaBUAcksRegTypeChangeDisallowed,
                  nemoHaBUAcksOperationNotPermitted,
                  nemoHaBUAcksInvalidPrefix,
                  nemoHaBUAcksNotAuthorizedForPrefix,
                  nemoHaBUAcksForwardingSetupFailed,
                  nemoHaBUAcksOtherError
       }
        STATUS  current
        DESCRIPTION
                "A collection of objects for monitoring basic
                 NEMO advertisement and registration statistics
                 on a home agent.
                "
        ::= { nemoGroups 8 }

    nemoNotificationGroup   NOTIFICATION-GROUP
        NOTIFICATIONS {
                 nemoHomeTunnelEstablished,
                 nemoHomeTunnelReleased
       }
        STATUS  current
        DESCRIPTION
                "A collection of notifications from a home agent
                 or correspondent node to the manager about the
                 tunnel status of the mobile router.
                "
        ::= { nemoGroups 9 }

    -- Compliance statements
    nemoCoreCompliance MODULE-COMPLIANCE
         STATUS  current
         DESCRIPTION
                "The compliance statement for SNMP entities
                 that implement the NEMO-MIB.
                 "
```

```
        MODULE  -- this module
            MANDATORY-GROUPS { nemoSystemGroup
                             }
        ::= { nemoCompliances 1 }

    nemoCompliance2 MODULE-COMPLIANCE
        STATUS  current
        DESCRIPTION
               "The compliance statement for SNMP entities that
                implement the NEMO-MIB and support monitoring of
                the Binding Cache.

                There are a number of INDEX objects that cannot be
                represented in the form of OBJECT clauses in SMIv2,
                but for which there are compliance requirements,
                expressed in OBJECT-clause form in this description:

                -- OBJECT      mip6BindingHomeAddressType
                -- SYNTAX      InetAddressType { ipv6(2) }
                -- DESCRIPTION
                --     This MIB module requires support for global
                --     IPv6 addresses for the mip6BindingHomeAddress
                --     object.
                --
                -- OBJECT      mip6BindingHomeAddress
                -- SYNTAX      InetAddress (SIZE(16))
                -- DESCRIPTION
                --     This MIB module requires support for global
                --     IPv6 addresses for the mip6BindingHomeAddress
                --     object.
                --
                "
        MODULE  -- this module
            MANDATORY-GROUPS { nemoSystemGroup,
                               nemoBindingCacheGroup
                             }
        ::= { nemoCompliances 2 }

    nemoCoreReadOnlyCompliance MODULE-COMPLIANCE
        STATUS  current
        DESCRIPTION
               "The compliance statement for SNMP entities
                that implement the NEMO-MIB without support
                for read-write (i.e., in read-only mode).
                "
        MODULE  -- this module
            MANDATORY-GROUPS { nemoSystemGroup
                             }
```

```
        OBJECT      nemoStatus
        MIN-ACCESS  read-only
        DESCRIPTION
               "Write access is not required."
        ::= { nemoCompliances 3 }

    nemoReadOnlyCompliance2 MODULE-COMPLIANCE
        STATUS  current
        DESCRIPTION
               "The compliance statement for SNMP entities that
                implement the NEMO-MIB without support for read-write
                (i.e., in read-only mode) and with support for
                monitoring of the Binding Cache.

                There are a number of INDEX objects that cannot be
                represented in the form of OBJECT clauses in SMIv2,
                but for which there are compliance requirements,
                expressed in OBJECT-clause form in this description:

                -- OBJECT      mip6BindingHomeAddressType
                -- SYNTAX      InetAddressType { ipv6(2) }
                -- DESCRIPTION
                --     This MIB module requires support for global
                --     IPv6 addresses for the mip6BindingHomeAddress
                --     object.
                --
                -- OBJECT      mip6BindingHomeAddress
                -- SYNTAX      InetAddress (SIZE(16))
                -- DESCRIPTION
                --     This MIB module requires support for global
                --     IPv6 addresses for the mip6BindingHomeAddress
                --     object.
                --
                "
        MODULE  -- this module
            MANDATORY-GROUPS { nemoSystemGroup,
                               nemoBindingCacheGroup
                             }
        OBJECT      nemoStatus
        MIN-ACCESS  read-only
        DESCRIPTION
               "Write access is not required."
        ::= { nemoCompliances 4 }

    nemoMrCompliance MODULE-COMPLIANCE
        STATUS  current
        DESCRIPTION
               "The compliance statement for SNMP entities that
```

```
                implement the NEMO-MIB for monitoring configuration-
                related information, registration details, and
                statistics on a mobile router.

                There are a number of INDEX objects that cannot be
                represented in the form of OBJECT clauses in SMIv2,
                but for which there are compliance requirements,
                expressed in OBJECT-clause form in this description:

                -- OBJECT      mip6MnHomeAddressType
                -- SYNTAX      InetAddressType { ipv6(2) }
                -- DESCRIPTION
                --     This MIB module requires support for global
                --     IPv6 addresses for the mip6MnHomeAddress
                --     object.
                --
                -- OBJECT      mip6MnHomeAddress
                -- SYNTAX      InetAddress (SIZE(16))
                -- DESCRIPTION
                --     This MIB module requires support for global
                --     IPv6 addresses for the mip6MnHomeAddress
                --     object.
                --
                -- OBJECT      mip6MnBLNodeAddressType
                -- SYNTAX      InetAddressType { ipv6(2) }
                -- DESCRIPTION
                --     This MIB module requires support for global
                --     IPv6 addresses for the mip6MnBLNodeAddress
                --     object.
                --
                -- OBJECT      mip6MnBLNodeAddress
                -- SYNTAX      InetAddress (SIZE(16))
                -- DESCRIPTION
                --     This MIB module requires support for global
                --     IPv6 addresses for the mip6MnBLNodeAddress
                --     object.
                "
          MODULE  -- this module
              MANDATORY-GROUPS { nemoStatsGroup,
                                 nemoMrConfGroup,
                                 nemoMrRegistrationGroup
                               }
          ::= { nemoCompliances 5 }

     nemoMrReadOnlyCompliance2 MODULE-COMPLIANCE
          STATUS  current
          DESCRIPTION
                 "The compliance statement for SNMP entities that
```

```
                implement the NEMO-MIB without support for read-
                write (i.e., in read-only mode) and with support for
                monitoring of configuration-related information,
                registration details, and statistics on a mobile
                router.

                There are a number of INDEX objects that cannot be
                represented in the form of OBJECT clauses in SMIv2,
                but for which there are compliance requirements,
                expressed in OBJECT-clause form in this description:

                -- OBJECT      mip6MnHomeAddressType
                -- SYNTAX      InetAddressType { ipv6(2) }
                -- DESCRIPTION
                --     This MIB module requires support for global
                --     IPv6 addresses for the mip6MnHomeAddress
                --     object.
                --
                -- OBJECT      mip6MnHomeAddress
                -- SYNTAX      InetAddress (SIZE(16))
                -- DESCRIPTION
                --     This MIB module requires support for global
                --     IPv6 addresses for the mip6MnHomeAddress
                --     object.
                --
                -- OBJECT      mip6MnBLNodeAddressType
                -- SYNTAX      InetAddressType { ipv6(2) }
                -- DESCRIPTION
                --     This MIB module requires support for global
                --     IPv6 addresses for the mip6MnBLNodeAddress
                --     object.
                --
                -- OBJECT      mip6MnBLNodeAddress
                -- SYNTAX      InetAddress (SIZE(16))
                -- DESCRIPTION
                --     This MIB module requires support for global
                --     IPv6 addresses for the mip6MnBLNodeAddress
                --     object.
                "
        MODULE  -- this module
            MANDATORY-GROUPS { nemoStatsGroup,
                               nemoMrConfGroup,
                               nemoMrRegistrationGroup
                             }

        OBJECT      nemoMrPrefixRegMode
        MIN-ACCESS  read-only
        DESCRIPTION
```

```
                "Write access is not required."
        ::= { nemoCompliances 6 }


    nemoHaCoreCompliance MODULE-COMPLIANCE
         STATUS  current
         DESCRIPTION
                "The compliance statement for SNMP entities that
                 implement the NEMO-MIB for configuration monitoring
                 at the home agent.

                 There are a number of INDEX objects that cannot be
                 represented in the form of OBJECT clauses in SMIv2,
                 but for which there are compliance requirements,
                 expressed in OBJECT-clause form in this description:

                 -- OBJECT      mip6BindingHomeAddressType
                 -- SYNTAX      InetAddressType { ipv6(2) }
                 -- DESCRIPTION
                 --     This MIB module requires support for global
                 --     IPv6 addresses for the mip6BindingHomeAddress
                 --     object.
                 --
                 -- OBJECT      mip6BindingHomeAddress
                 -- SYNTAX      InetAddress (SIZE(16))
                 -- DESCRIPTION
                 --     This MIB module requires support for global
                 --     IPv6 addresses for the mip6BindingHomeAddress
                 --     object.
                 --
                 "
         MODULE  -- this module
             MANDATORY-GROUPS { nemoHaSystemGroup
                              }
         ::= { nemoCompliances 7 }

    nemoHaCompliance2 MODULE-COMPLIANCE
         STATUS  current
         DESCRIPTION
                "The compliance statement for SNMP entities that
                 implement the NEMO-MIB with support for monitoring
                 of the home agent functionality, specifically the
                 home-agent-registration-related statistics.

                 There are a number of INDEX objects that cannot be
                 represented in the form of OBJECT clauses in SMIv2,
                 but for which there are compliance requirements,
                 expressed in OBJECT-clause form in this description:
```

```
                -- OBJECT      mip6BindingHomeAddressType
                -- SYNTAX      InetAddressType { ipv6(2) }
                -- DESCRIPTION
                --     This MIB module requires support for global
                --     IPv6 addresses for the mip6BindingHomeAddress
                --     object.
                --
                -- OBJECT      mip6BindingHomeAddress
                -- SYNTAX      InetAddress (SIZE(16))
                -- DESCRIPTION
                --     This MIB module requires support for global
                --     IPv6 addresses for the mip6BindingHomeAddress
                --     object.
                --
                "
        MODULE  -- this module
            MANDATORY-GROUPS { nemoHaSystemGroup,
                               nemoHaStatsGroup,
                               nemoHaGlobalStatsGroup
                             }
        ::= { nemoCompliances 8 }

    nemoNotificationCompliance MODULE-COMPLIANCE
        STATUS  current
        DESCRIPTION
                "The compliance statement for SNMP entities that
                 implement the NEMO-MIB and support Notification
                 from the home agent.
                 "
        MODULE  -- this module
            MANDATORY-GROUPS { nemoNotificationGroup
                             }
        ::= { nemoCompliances 9 }

    END
```

4. IANA Considerations

IANA has assigned a base arc in the mib-2 (Standards Track) OID tree for the 'nemoMIB' (184).

5. Security Considerations

There are a number of management objects defined in this MIB module with a MAX-ACCESS clause of read-write. Such objects may be considered sensitive or vulnerable in some network environments. The support for SET operations in a non-secure environment without proper protection can have a negative effect on network operations. These are the tables and objects and their sensitivity/vulnerability:

nemoStatus: The value of this object is used to enable or disable the NEMO functionality on a NEMO entity. Access to this MO may be abused to disrupt the communication that depends on NEMO.

nemoMrPrefixRegMode: The value of this object is used to control the mode in which mobile network prefixes will be registered with the home agent. Access to this object may be abused to disrupt the setting up of mobile network prefixes.

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:

nemoHaMobileNetworkPrefixType

nemoHaMobileNetworkPrefix

nemoHaMobileNetworkPrefixLength:

The above address-related objects may be considered to be particularly sensitive and/or private. The mobile-network-prefix-related objects reveal the configuration of the mobile router and, as such, may be considered to be sensitive.

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

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

Further, deployment of SNMP versions prior to SNMPv3 is NOT RECOMMENDED. Instead, it is RECOMMENDED to deploy SNMPv3 and to enable cryptographic security. It is then a customer/operator responsibility to ensure that the SNMP entity giving access to an instance of this MIB module is properly configured to give access to the objects only to those principals (users) that have legitimate rights to indeed GET or SET (change/create/delete) them.

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