Definition of Managed Objects for the DYMO Manet Routing Protocol

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Abstract

This memo defines a portion of the Management Information Base (MIB)
for use with network management protocols in the Internet community.
In particular, it describes objects for configuring aspects of the
DYMO routing process. The DYMO MIB also reports state information,
performance metrics, and notifications. In addition to
configuration, this additional state and performance information is useful to management stations troubleshooting routing problems.

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1. Introduction

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular, it describes objects for configuring aspects of a Dynamic MANET On-demand (DYMO) routing [I-D.ietf-manet-dymo] process. The DYMO MIB also reports state information, performance metrics, and notifications. In addition to configuration, this additional state and performance information is useful to management stations troubleshooting routing problems.

2. The Internet-Standard Management Framework

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

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

3. Conventions

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

4. Overview

The Dynamic MANET On-demand (DYMO) routing protocol [I-D.ietf-manet-dymo] is intended for use by mobile nodes in wireless, multihop networks. DYMO determines unicast routes among DYMO routers within the network in an on-demand fashion, offering improved convergence in dynamic topologies.

A DYMO routers’ MIB contains DYMO process configuration parameters (e.g. interfaces), state information (e.g. sequence number), performance counters (e.g. number of control messages), and notifications.
4.1. DYMO Management Model

This section describes the management model for the DYMO routing protocol.

4.2. Terms

The following definitions apply throughout this document:

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

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

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

- Statistics Objects - automatically generated values which help an administrator or automated tool to assess the performance of the DYMO protocol process on the router and the overall routing performance within the DYMO routing domain.

5. Structure of the MIB Module

This section presents the structure of the DYMO MIB module. The objects are arranged into the following groups:

- dymoMIBNotifications - defines the notifications associated with the DYMO MIB. These are currently limited to notifications of interface state changes.

- dymoMIBObjects - defines the objects forming the basis for the DYMO MIB. These objects are divided up by function into the following groups:
  - Configuration Group - This group contains the DYMO objects that configure specific options that determine the overall performance and operation of the routing protocol for the router device and its interfaces.
  - State Group - Contains information describing the current state of the DYMO process such as the DYMO routing table.
  - Statistics Group - Contains objects which help to characterize the performance of the DYMO process, typically statistics.
counters. There are two types of DYMO statistics: global counters and per interface counters.

- dymoMIBConformance - defines minimal and full conformance of implementations to this DYMO MIB.

5.1. Textual Conventions

The textual conventions used in the DYMO MIB are as follows. The RowStatus textual convention is imported from RFC 2579 [RFC2579]. The DymoInterfaceOperStatus is defined within the DYMO MIB. This contains the current operational status of the DYMO interface.

5.2. The Configuration Group

The DYMO device is configured with a set of controls. The list of configuration controls for the DYMO device follow.

Protocol Tuning Configuration Parameters:

- MSG_HOPLIMIT
- ROUTE_TIMEOUT
- ROUTE_AGE_MIN_TIMEOUT
- ROUTE_AGE_MAX_TIMEOUT
- ROUTE_USED_TIMEOUT
- ROUTE_DELETE_TIMEOUT
- ROUTE_RREQ_WAIT_TIME
- RREQ_RETRIES
- UNICAST_MESSAGE_SENT_TIMEOUT

Protocol Configuration Tables:

- Interfaces - If DYMO_INTERFACES is set to other than all, then the DYMO router must be told which interfaces to run the DYMO protocol over. This is a table containing the interfaces and associated information.

- Responsible Hosts - If RESPONSIBLE_ADDRESSES is set to other than self address, then the DYMO router must be configured with the set of host addresses for which it is to generate RREP messages.
5.3. The State Group

The State Subtree reports current state information. State information from the DYMO-MIB is contained in the ‘Peers’ Table.

5.3.1. Peers Table

The DYMO peers table contains a list of recently known DYMO peer nodes participating in the routing within the DYMO MANET. These entries age out after a preset time.

5.3.2. Routing Table

The DYMO routing table contains DYMO specific information related to IP forwarding entries found in the node’s IP forwarding table MIB. DYMO additional information includes the sequence number associated with the DYMO message which generated the forwarding table entry.

5.4. The Statistics Group

The Statistics subtree reports primarily counters that relate to DYMO protocol activity. The DYMO performance statistics consists of per node and per interface objects:

- OwnSequenceNumber
- RREQ initiated
- RREQ sent
- RREQ received
- RREP initiated
- RREP sent
- RREP received
- RRER initiated
- RRER sent
- RRER received
- Per interface statistics table with the following entries:
  * RREQ initiated
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* RREQ sent
* RREQ received
* RREP initiated
* RREP sent
* RREP received
* RRER initiated
* RRER sent
* RRER received

5.5. The Notifications Group

The Notifications Subtree contains the list of notifications supported within the DYMO-MIB and their intended purpose or utility. This group is currently contains a single notification object related to status changes in DYMO interfaces.

6. Relationship to Other MIB Modules

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

6.1. Relationship to the SNMPv2-MIB

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

6.2. Relationship to the IF-MIB

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

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

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

7. Definitions

MANET-DYMO-MIB DEFINITIONS ::= BEGIN

IMPORTS

  MODULE-IDENTITY, OBJECT-TYPE, NOTIFICATION-TYPE,
  Counter32, Unsigned32, mib-2
  FROM SNMPv2-SMI -- [RFC2578]
  TEXTUAL-CONVENTION, RowStatus
  FROM SNMPv2-TC -- [RFC2579]
  MODULE-COMPLIANCE, OBJECT-GROUP,
  NOTIFICATION-GROUP
  FROM SNMPv2-CONF -- [RFC2580]
  InetAddress, InetAddressType,
  InetAddressPrefixLength
  FROM INET-ADDRESS-MIB -- [RFC4001]
  InterfaceIndex
  FROM IF-MIB -- [RFC2863]

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DESCRIPTION

"This MIB module contains managed object definitions for
the Dynamic MANET On-demand (DYMO) routing protocol as
defined in: Charkeres,I., and C. Perkins, Dynamic MANET
On-demand (DYMO) Routing, draft-ietf-manet-dymo-13,
April 10, 2008.

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of this MIB module is part of RFC xxxx; see the RFC
itself for full legal notices."

-- Revision History
REVISION   "200811031200Z"   -- November 03, 2008
DESCRIPTION

"Second draft of this MIB module published as
draft-ietf-manet-dymo-mib-01.txt. Minor changes to
dymoInterfacesTable and dymoResponsibleAddrTable."
REVISION   "200805141200Z"   -- May 14, 2008
DESCRIPTION

"Initial draft of this MIB module published as
draft-ietf-manet-dymo-mib-00.txt."

-- RFC-Editor assigns XXXX
::= { mib-2 999 }  -- to be assigned by IANA
Note: Need to determine the appropriate set of states for the DymoInterfacesOperStatus textual convention.

DymoInterfaceOperStatus ::= TEXTUAL-CONVENTION
  STATUS current
  DESCRIPTION "The current operational status of the DYMO interface."
  SYNTAX INTEGER {
    up(1),
    down(2),
    waiting(3),
    loopback(4),
    unknown(5)
  }

-- Top-Level Object Identifier Assignments
--
dymoMIBNotifications OBJECT IDENTIFIER ::= { manetDymoMIB 0 }
dymoMIBObjects OBJECT IDENTIFIER ::= { manetDymoMIB 1 }
dymoMIBConformance OBJECT IDENTIFIER ::= { manetDymoMIB 2 }

-- dymoConfigurationGroup
--
-- This group contains the DYMO objects that configure specific options that determine the overall performance and operation of the routing protocol for the router device and its interfaces.
--
dymoConfigurationGroup OBJECT IDENTIFIER ::= { dymoMIBObjects 1 }

-- DYMO Global Router Configuration Group
--
dymoRouterConfigGroup OBJECT IDENTIFIER ::= {dymoConfigurationGroup 1}

dymoMaxHopLimit OBJECT-TYPE
  SYNTAX Unsigned32 (0..255)
  UNITS "hops"
The maximum number of hops. The suggested default is 10 hops. This is the DYMO MSG_HOPLIMIT parameter value.

Reference:
"Dynamic MANET On-demand (DYMO) Routing, Chakeres, I., and C. Perkins, April 2008. Table 2 Suggested Parameter Values."

::= { dymoRouterConfigGroup 1 }

**dymoRouteTimeout**

SYNTAX Unsigned32 (1..65535)

UNITS "milliseconds"

MAX-ACCESS read-write

STATUS current

DESCRIPTION
"The route timeout value. The suggested default value is 5000 milliseconds. This is the DYMO ROUTE_TIMEOUT parameter value."

Reference:
"Dynamic MANET On-demand (DYMO) Routing, Chakeres, I., and C. Perkins, April 2008. Table 2 Suggested Parameter Values."

::= { dymoRouterConfigGroup 2 }

**dymoRouteAgeMinTimeout**

SYNTAX Unsigned32 (1..65535)

UNITS "milliseconds"

MAX-ACCESS read-write

STATUS current

DESCRIPTION
"The minimum route age timeout value. The suggested default value is 1000 milliseconds. This is the DYMO ROUTE_AGE_MIN_TIMEOUT parameter value."

Reference:
"Dynamic MANET On-demand (DYMO) Routing, Chakeres, I., and C. Perkins, April 2008. Table 2 Suggested Parameter Values."

::= { dymoRouterConfigGroup 3 }

**dymoRouteAgeMaxTimeout**

SYNTAX Unsigned32 (1..65535)

UNITS "milliseconds"

MAX-ACCESS read-write

STATUS current
DESCRIPTION

"The maximum route age timeout value. The suggested default value is 60,000 milliseconds. This is the DYMO ROUTE_AGE_MAX_TIMEOUT parameter value."

REFERENCE

"Dynamic MANET On-demand (DYMO) Routing, Chakeres, I., and C. Perkins, April 2008. Table 2 Suggested Parameter Values."

::= { dymoRouterConfigGroup 4 }

dymoRouteUsedTimeout OBJECT-TYPE
SYNTAX      Unsigned32 (1..65535)
UNITS       "milliseconds"
MAX-ACCESS  read-write
STATUS      current
DESCRIPTION

"The route used timeout value. The suggested default value is 5000 milliseconds (the same default as the dymoRouteTimeout value). This is the DYMO ROUTE_USED_TIMEOUT parameter value."

REFERENCE

"Dynamic MANET On-demand (DYMO) Routing, Chakeres, I., and C. Perkins, April 2008. Table 2 Suggested Parameter Values."

::= { dymoRouterConfigGroup 5 }

dymoRouteDeleteTimeout OBJECT-TYPE
SYNTAX      Unsigned32 (1..65535)
UNITS       "milliseconds"
MAX-ACCESS  read-write
STATUS      current
DESCRIPTION

"The route delete timeout value. The suggested default value is 10,000 milliseconds (this is 2 * dymoRouteTimeout value). This is the DYMO ROUTE_DELETE_TIMEOUT parameter value."

REFERENCE

"Dynamic MANET On-demand (DYMO) Routing, Chakeres, I., and C. Perkins, April 2008. Table 2 Suggested Parameter Values."

::= { dymoRouterConfigGroup 6 }

dymoRouteRREQWaitTime OBJECT-TYPE
SYNTAX      Unsigned32 (1..65535)
UNITS "milliseconds"
MAX-ACCESS read-write
STATUS current
DESCRIPTION
"The Route Request wait time. The suggested default
value is 2000 milliseconds. This is the DYMO
ROUTE_RREQ_WAIT_TIME parameter value."
REFERENCE
"Dynamic MANET On-demand (DYMO) Routing, Chakeres,
I., and C. Perkins, April 2008. Table 2 Suggested Parameter Values."
::= { dymoRouterConfigGroup 7 }

dymoRREQTries OBJECT-TYPE
SYNTAX Unsigned32 (1..16)
UNITS "attempts"
MAX-ACCESS read-write
STATUS current
DESCRIPTION
"The number of Route Request retry attempts. The
suggested default value is 3. This is the
DYMO RREQ_TRIES parameter value."
REFERENCE
"Dynamic MANET On-demand (DYMO) Routing, Chakeres,
I., and C. Perkins, April 2008. Table 2 Suggested Parameter Values."
::= { dymoRouterConfigGroup 8 }

dymoUnicastMsgSentTimeout OBJECT-TYPE
SYNTAX Unsigned32 (1..65535)
UNITS "milliseconds"
MAX-ACCESS read-write
STATUS current
DESCRIPTION
"The message sent timeout value for unicast packets.
The suggested default value is 1000 milliseconds.
This is the DYMO UNICAST_MESSAGE_SENT_TIMEOUT parameter value."
REFERENCE
"Dynamic MANET On-demand (DYMO) Routing, Chakeres,
I., and C. Perkins, April 2008. Table 2 Suggested Parameter Values."
::= { dymoRouterConfigGroup 9 }

--
-- DYMO Interfaces Configuration Table
dymoInterfaceTable OBJECT-TYPE
   SYNTAX       SEQUENCE OF DymoInterfaceEntry
   MAX-ACCESS  not-accessible
   STATUS      current
   DESCRIPTION
      "The DYMO Interface Table describes the DYMO
       interfaces that are participating in the
       DYMO routing protocol. The ifIndex is from
       the interfaces group defined in the Interfaces
       Group MIB."
   REFERENCE
      "RFC 2863 - The Interfaces Group MIB, McCloghrie,
       K., and F. Kastenholtz, June 2000."
 ::= { dymoConfigurationGroup 2 }

DymoInterfaceEntry OBJECT-TYPE
   SYNTAX       DymoInterfaceEntry
   MAX-ACCESS  not-accessible
   STATUS      current
   DESCRIPTION
      "The DYMO interface entry describes one DYMO
       interface as indexed by its ifIndex."
   INDEX { dymoIfIndex }
 ::= { dymoInterfaceTable 1 }

DymoInterfaceEntry ::= 
   SEQUENCE {
      dymoIfIndex InterfaceIndex,
      dymoIfOperStatus DymoInterfaceOperStatus,
      dymoIfRowStatus RowStatus
   }

dymoIfIndex OBJECT-TYPE
   SYNTAX       InterfaceIndex
   MAX-ACCESS  not-accessible
   STATUS      current
   DESCRIPTION
      "The ifIndex for this DYMO interface."
 ::= { dymoInterfaceEntry 1 }

dymoIfOperStatus OBJECT-TYPE
   SYNTAX       DymoInterfaceOperStatus
   MAX-ACCESS  read-write
The current operational status of this DYMO interface. The default value is down(2).

::= {dymoInterfaceEntry 2 }

dymoIfRowStatus 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.

::= {dymoInterfaceEntry 3 }

--
-- DYMO Responsible Address Table
--

dymoResponsibleAddrTable OBJECT-TYPE
SYNTAX SEQUENCE OF DymoResponsibleAddrEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
The DYMO Responsible Address Table is a list of IP address prefixes, and their associated prefix length for which the DYMO router is responsible.

REFERENCE
"Dynamic MANET On-demand (DYMO) Routing, Chakeres, I., and C. Perkins, April 2008. Table 3 Important Settings."

::= {dymoConfigurationGroup 3 }

dymoResponsibleAddrEntry OBJECT-TYPE
SYNTAX DymoResponsibleAddrEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
A single host address range. Information in this table is persistent and when this object is written, the entity SHOULD save the change to
non-volatile storage."

REFERENCE
"Dynamic MANET On-demand (DYMO) Routing, Chakeres, I., and C. Perkins, April 2008. Table 3 Important Settings."

INDEX { dymoResponsibleAddrIndex }
::= { dymoResponsibleAddrTable 1 }

DymoResponsibleAddrEntry ::= 
  SEQUENCE {
    dymoResponsibleAddrIndex
      Unsigned32,
    dymoResponsibleAddrType
      InetAddressType,
    dymoResponsibleAddr
      InetAddress,
    dymoResponsibleAddrPrefixLen
      InetAddressPrefixLength,
    dymoResponsibleAddrRowStatus
      RowStatus
  }

dymoResponsibleAddrIndex  OBJECT-TYPE
SYNTAX      Unsigned32
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"This object is the index into this table."
::= { dymoResponsibleAddrEntry 1 }

dymoResponsibleAddrType  OBJECT-TYPE
SYNTAX      InetAddressType
MAX-ACCESS  read-write
STATUS      current
DESCRIPTION
"The type of the dymoResponsibleAddr, as defined in the InetAddress MIB [RFC 4001]."

REFERENCE
"Dynamic MANET On-demand (DYMO) Routing, Chakeres, I., and C. Perkins, April 2008. Table 3 Important Settings."
::= { dymoResponsibleAddrEntry 2 }

dymoResponsibleAddr  OBJECT-TYPE
SYNTAX      InetAddress
MAX-ACCESS  read-write
STATUS      current
DESCRIPTION
"The destination IP address of this route. The type of this address is determined by the value of the dymoResponsibleAddrType object."

REFERENCE
"Dynamic MANET On-demand (DYMO) Routing, Chakeres, I., and C. Perkins, April 2008. Table 3 Important Settings."

::= { dymoResponsibleAddrEntry 3 }

dymoResponsibleAddrPrefixLen  OBJECT-TYPE
SYNTAX      InetAddressPrefixLength
MAX-ACCESS  read-write
STATUS      current
DESCRIPTION
"Indicates the number of leading one bits that form the mask to be logical-ANDed with the destination address before being compared to the value in the dymoResponsibleAddr field."

REFERENCE
"Dynamic MANET On-demand (DYMO) Routing, Chakeres, I., and C. Perkins, April 2008. Table 3 Important Settings."

::= { dymoResponsibleAddrEntry 4 }

dymoResponsibleAddrRowStatus  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."

::= { dymoResponsibleAddrEntry 5 }

--
-- dymoStateGroup
--
-- Contains information describing the current state of the DYMO process such as the DYMO routing table.
--

dymoStateGroup  OBJECT IDENTIFIER ::= { dymoMIBObjects 2 }

dymoCurrentSeqNum  OBJECT-TYPE
SYNTAX      Unsigned32 (1..65535)
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The current DYMO sequence number. The DYMO sequence
numbers allow nodes to judge the freshness of routing
information and ensures loop freedom. If the sequence
number has been assigned to be the largest possible
number representable as a 16-bit unsigned integer
(i.e., 65,535), then the sequence number is set to
256 when incremented. Setting the sequence number
to 256 allows other nodes to detect that the number
has rolled over and the node has not lost its sequence
number (e.g., via reboot)."
}

--
-- DYMO Routing Table
--

dymoRoutingTable OBJECT-TYPE
SYNTAX SEQUENCE OF DymoRoutingEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"The DYMO Routing Table describes the
current routing information learned
via DYMO control messages."
REFERENCE
"Dynamic MANET On-demand (DYMO) Routing, Chakeres,
I., and C. Perkins, April 2008. Table 2 Suggested
Parameter Values."
}

::= { dymoStateGroup 2 }

dymoRoutingEntry OBJECT-TYPE
SYNTAX DymoRoutingEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"The DYMO routing entry contains a
piece of routing information for a
particular set of addresses."
INDEX { dymoRoutingIpAddrType,
dymoRoutingIpAddr,
dymoRoutingPrefixLen }

::= { dymoRoutingTable 1 }

DymoRoutingEntry ::=
SEQUENCE {

dymoRoutingIpAddrType
   InetAddressType,
dymoRoutingIpAddr
   InetAddress,
dymoRoutingPrefixLen
   InetAddressPrefixLength,
dymoRoutingSeqNum
   Unsigned32,
dymoRoutingNextHopIpAddrType
   InetAddressType,
dymoRoutingNextHopIpAddress
   InetAddress,
dymoRoutingNextHopInterface
   InterfaceIndex,
dymoRoutingDist
   Unsigned32
}

dymoRoutingIpAddrType  OBJECT-TYPE
   SYNTAX      InetAddressType
   MAX-ACCESS  not-accessible
   STATUS      current
   DESCRIPTION
     "The routing table address IP address type."
   REFERENCE
     "Dynamic MANET On-demand (DYMO) Routing, Chakeres, I., and C. Perkins, April 2008. Table 3 Important Settings."
::= { dymoRoutingEntry 1 }

dymoRoutingIpAddr  OBJECT-TYPE
   SYNTAX      InetAddress
   MAX-ACCESS  not-accessible
   STATUS      current
   DESCRIPTION
     "The routing table Inet IPv4 or IPv6 address."
   REFERENCE
     "Dynamic MANET On-demand (DYMO) Routing, Chakeres, I., and C. Perkins, April 2008. Table 3 Important Settings."
::= { dymoRoutingEntry 2 }

dymoRoutingPrefixLen  OBJECT-TYPE
   SYNTAX      InetAddressPrefixLength
   MAX-ACCESS  not-accessible
   STATUS      current
   DESCRIPTION
     "The prefix length. This is a decimal value that
indicates the number of contiguous, higher-order bits of the address that make up the network portion of the address."

REFERENCE
"Dynamic MANET On-demand (DYMO) Routing, Chakeres, I., and C. Perkins, April 2008. Table 3 Important Settings."

::= { dymoRoutingEntry 3 }

dymoRoutingSeqNum OBJECT-TYPE
SYNTAX Unsigned32 (1..65535)
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The interface sequence number. This is the DYMO SeqNum associated with this routing information."

::= { dymoRoutingEntry 4 }

dymoRoutingNextHopIpAddrType OBJECT-TYPE
SYNTAX InetAddressType
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The IP address type of the next hop."

::= { dymoRoutingEntry 5 }

dymoRoutingNextHopIpAddress OBJECT-TYPE
SYNTAX InetAddress
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The IP address of the next hop."

::= { dymoRoutingEntry 6 }

dymoRoutingNextHopInterface OBJECT-TYPE
SYNTAX InterfaceIndex
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The interface ifIndex for sending packets toward the destination route address."

::= { dymoRoutingEntry 7 }

dymoRoutingDist OBJECT-TYPE
SYNTAX Unsigned32 (1..65535)
UNITS "hops"
MAX-ACCESS  read-only
STATUS       current
DESCRIPTION
 "The distance to the destination address’s
 DYO router. This is a metric of the
distance a message or piece of information
has traversed. The minimum value of distance
is the number of IP hops traversed. The
maximum value is 65,535."
REFERENCE
 "Dynamic MANET On-demand (DYMO) Routing,
 Chakeres, I., and C. Perkins, April
 2008. Section 3 Terminology."
 ::= { dymoRoutingEntry 8 }

--
-- DYMO Statistics Group (Performance Management)
--
-- Contains objects which help to characterize the
-- performance of the DYMO process, typically statistics
-- counters. There are two types of DYMO statistics:
-- global counters and per interface counters.
--
dymoStatisticsGroup OBJECT IDENTIFIER ::= { dymoMIBObjects 3 }
dymoGlobalStatsGroup OBJECT IDENTIFIER ::= { dymoStatisticsGroup 1 }
dymoRreqOriginated OBJECT-TYPE
   SYNTAX      Counter32
   MAX-ACCESS  read-only
   STATUS      current
   DESCRIPTION
   "A counter of the number of
   RREQ messages that this DYMO
   device has initiated."
 ::= { dymoGlobalStatsGroup 1 }
dymoRreqForwarded OBJECT-TYPE
   SYNTAX      Counter32
   MAX-ACCESS  read-only
   STATUS      current
   DESCRIPTION
   "A counter of the number of
   RREQ messages that this DYMO
   device has forwarded, i.e., this
   device neither originated or
terminated the RREQ message."
::= { dymoGlobalStatsGroup 2 }

dymoRreqReceived OBJECT-TYPE
SYNTAX     Counter32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"A counter of the number of
RREQ messages that this DYMO
device has received as the
target of the message."
::= { dymoGlobalStatsGroup 3 }

dymoRrepOriginated OBJECT-TYPE
SYNTAX     Counter32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"A counter of the number of
RREP messages that this DYMO
device has initiated."
::= { dymoGlobalStatsGroup 4 }

dymoRrepForwarded OBJECT-TYPE
SYNTAX     Counter32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"A counter of the number of
RREP messages that this DYMO
device has forwarded, i.e, this
device neither originated or
terminated the RREP message."
::= { dymoGlobalStatsGroup 5 }

dymoRrepReceived OBJECT-TYPE
SYNTAX     Counter32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"A counter of the number of
RREP messages that this DYMO
device has received as the
target of the message."
::= { dymoGlobalStatsGroup 6 }

dymoRrerOriginated OBJECT-TYPE
SYNTAX     Counter32
dymoRrerForwarded  OBJECT-TYPE
SYNTAX   Counter32
MAX-ACCESS read-only
STATUS   current
DESCRIPTION
"A counter of the number of RRER messages that this DYMO device has forwarded, i.e., this device neither originated or terminated the RRER message."
::= { dymoGlobalStatsGroup 8 }

dymoRrerReceived  OBJECT-TYPE
SYNTAX   Counter32
MAX-ACCESS read-only
STATUS   current
DESCRIPTION
"A counter of the number of RRER messages that this DYMO device has received as the target of the message."
::= { dymoGlobalStatsGroup 9 }

--
-- Per DYMO Interface Statistics Table
--
dymoInterfaceStatsGroup OBJECT IDENTIFIER ::= {dymoStatisticsGroup 2}

dymoInterfaceStatsTable OBJECT-TYPE
SYNTAX   SEQUENCE OF DymoInterfaceStatsEntry
MAX-ACCESS not-accessible
STATUS   current
DESCRIPTION
"The DYMO Interface Statistics Table describes the DYMO statistics per interface."
::= { dymoInterfaceStatsGroup 1 }

dymoInterfaceStatsEntry OBJECT-TYPE
SYNTAX       DymoInterfaceStatsEntry
MAX-ACCESS   not-accessible
STATUS       current
DESCRIPTION  
"The DYM0 Interface Statistics entry 
describes the statistics for a particular  
DYM0 interface."
INDEX { dymoIfStatsIfIndex }
::= { dymoInterfaceStatsTable 1 }

DymoInterfaceStatsEntry ::= SEQUENCE {
  dymoIfStatsIfIndex  
    InterfaceIndex,
  dymoIfRreqOriginated  
    Counter32,
  dymoIfRreqForwarded  
    Counter32,
  dymoIfRreqReceived  
    Counter32,
  dymoIfRrepOriginated  
    Counter32,
  dymoIfRrepForwarded  
    Counter32,
  dymoIfRrepReceived  
    Counter32,
  dymoIfRrerOriginated  
    Counter32,
  dymoIfRrerForwarded  
    Counter32,
  dymoIfRrerReceived  
    Counter32
}

dymoIfStatsIfIndex  OBJECT-TYPE
SYNTAX       InterfaceIndex
MAX-ACCESS   not-accessible
STATUS       current
DESCRIPTION  
"The ifIndex for this DYM0 interface 
that is collecting this set of  
performance management statistics."
::= { dymoInterfaceStatsEntry 1 }

dymoIfRreqOriginated  OBJECT-TYPE
SYNTAX       Counter32
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION
"A counter of the number of
RREQ messages that this DYMO
interface has initiated."
::= { dymoInterfaceStatsEntry 2 }

dymoIfRreqForwarded  OBJECT-TYPE
SYNTAX       Counter32
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION
"A counter of the number of
RREQ messages that this DYMO
interface has forwarded, i.e., this
interface neither originated nor
terminated the RREQ message."
::= { dymoInterfaceStatsEntry 3 }

dymoIfRreqReceived  OBJECT-TYPE
SYNTAX       Counter32
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION
"A counter of the number of
RREQ messages that this DYMO
interface has received as the
target of the message."
::= { dymoInterfaceStatsEntry 4 }

dymoIfRrepOriginated  OBJECT-TYPE
SYNTAX       Counter32
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION
"A counter of the number of
RREP messages that this DYMO
interface has initiated."
::= { dymoInterfaceStatsEntry 5 }

dymoIfRrepForwarded  OBJECT-TYPE
SYNTAX       Counter32
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION
"A counter of the number of
RREP messages that this DYMO
interface has forwarded, i.e., this
interface neither originated nor
terminated the RREP message.

::= { dymoInterfaceStatsEntry 6 }

dymoIfRrepReceived OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"A counter of the number of RREP messages that this DYMO interface has received as the target of the message."

::= { dymoInterfaceStatsEntry 7 }

dymoIfRrerOriginated OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"A counter of the number of RRER messages that this DYMO interface has initiated."

::= { dymoInterfaceStatsEntry 8 }

dymoIfRrerForwarded OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"A counter of the number of RRER messages that this DYMO interface has forwarded, i.e., this interface neither originated nor terminated the RRER message."

::= { dymoInterfaceStatsEntry 9 }

dymoIfRrerReceived OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"A counter of the number of RRER messages that this DYMO interface has received as the target of the message."

::= { dymoInterfaceStatsEntry 10 }

--

-- Notifications
--

dymoInterfaceOperStatusChange NOTIFICATION-TYPE
  OBJECTS     { dymoIfOperStatus }
  STATUS      current
  DESCRIPTION
    "This notification is generated when the
     operational status of a DYMO interface changes."
  ::= { dymoMIBNotifications 1 }

dymoResponsibleAddrEntryChange NOTIFICATION-TYPE
  OBJECTS     { dymoResponsibleAddrRowStatus }
  STATUS      current
  DESCRIPTION
    "This notification is generated when the status
     of an entry in the DYMO Responsible Address
     Table changes. This includes the creation or
     deletion of a row."
  ::= { dymoMIBNotifications 2 }

--
-- Compliance Statements
--

dymoCompliances OBJECT IDENTIFIER ::= { dymoMIBConformance 1 }
dymoMIBGroups OBJECT IDENTIFIER ::= { dymoMIBConformance 2 }

dymoBasicCompliance MODULE-COMPLIANCE
  STATUS current
  DESCRIPTION "The basic implementation requirements for
               managed network entities that implement
               the DYMO routing protocol."
  MODULE  -- this module
  MANDATORY-GROUPS { dymoConfigObjectsGroup }
  ::= { dymoCompliances 1 }

dymoFullCompliance MODULE-COMPLIANCE
  STATUS current
  DESCRIPTION "The full implementation requirements for managed
              network entities that implement the DYMO routing
              protocol."
  MODULE  -- this module
  MANDATORY-GROUPS { dymoConfigObjectsGroup,
                    dymoStateObjectsGroup,
                    dymoStatsObjectsGroup,
                    dymoNotifObjectsGroup }
  ::= { dymoCompliances 2 }
dymoConfigObjectsGroup OBJECT-GROUP
   OBJECTS {
      dymoMaxHopLimit,
      dymoRouteTimeout,
      dymoRouteAgeMinTimeout,
      dymoRouteAgeMaxTimeout,
      dymoRouteUsedTimeout,
      dymoRouteDeleteTimeout,
      dymoRouteRREQWaitTime,
      dymoRREQTries,
      dymoUnicastMsgSentTimeout,
      dymoIfOperStatus,
      dymoResponsibleAddrRowStatus
   }
   STATUS  current
   DESCRIPTION
      "Set of DYMO configuration objects implemented in this module."
   ::= { dymoMIBGroups 1 }

dymoStateObjectsGroup OBJECT-GROUP
   OBJECTS {
      dymoCurrentSeqNum,
      dymoRoutingSeqNum,
      dymoRoutingNextHopIpAddrType,
      dymoRoutingNextHopIpAddress,
      dymoRoutingNextHopInterface,
      dymoRoutingDist
   }
   STATUS  current
   DESCRIPTION
      "Set of DYMO state objects implemented in this module."
   ::= { dymoMIBGroups 2 }

dymoStatsObjectsGroup OBJECT-GROUP
   OBJECTS {
      dymoRreqOriginated,
      dymoRreqForwarded,
      dymoRreqReceived,
      dymoRrepOriginated,
      dymoRrepForwarded,
      dymoRrepReceived,
      dymoRrerOriginated,
8.  Security Considerations

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

9. IANA Considerations

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

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

Option #1:

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

<table>
<thead>
<tr>
<th>Descriptor</th>
<th>OBJECT IDENTIFIER value</th>
</tr>
</thead>
<tbody>
<tr>
<td>sampleMIB</td>
<td>{ mib-2 XXX }</td>
</tr>
</tbody>
</table>

Option #2:

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

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

Option #3:

This memo includes no request to IANA.

10. Contributors

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

11. Acknowledgements

12. References

12.1. Normative References


12.2.  Informative References


Appendix A.  Change Log

The following changes have been made from draft-ietf-manet-dymo-mib-00.

Not applicable to draft 00

1.

Appendix B.  Open Issues

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

1. Agree on set of configuration options to be supported, e.g., Gateway config, local hosts, responsible addresses, etc.

2. Will DYMO require an MANET_ID (Instance ID) for running multiple DYMO processes over the same interfaces?

3. Incorporate MIB-II IfGroup interworking with DymoIfTable.

4. Incorporate MIB-II IpGroup interworking with DymoIfTable.

5. Incorporate MIB-II IpForwardingGroup interworking with DymoRoutingTable.

6. What performance objects are of interest and utility?

7. What notifications are of interest and utility?

8. Work on the Security Section. This MIB does have settable objects, but not sensitive objects (true?).
9. Work on the relationship to other MIBs, IF-MIB, NHDP-MIB.

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

11. Incorporate parameter relationship conditions into their DESCRIPTION clauses.

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

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

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