Definition of Managed Objects for the DYMO Manet Routing Protocol
draft-ietf-manet-dymo-mib-02

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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.

The MIB is comprised of four Groups, i.e., Notifications, Configuration, State and Statistics. The configuration of the managed devices is controlled by the objects in the Configuration Group. These are divided into Nodal and Interface objects. The bulk of the DYMO configuration is in the Nodal objects which control protocol behavior. The Interface objects merely identify/configure interfaces to enable DYMO routing over their interface. The Nodal objects are further divided into routing (or protocol) objects and Gateway objects. Gateway objects define other routing prefixes for which the node acts as a routing proxy on behalf of these non-local prefixes.

The Configuration Objects drive the information in the remaining groups, i.e., State, Statistics and Notifications. The State objects primarily address the resulting routing table objects. The Statistics group primarily is comprised of counters for monitoring the number of DYMO routing messages received locally. The Notifications group only contains two objects which monitor changes to the interface configuration and the gateway prefixes configuration.

See the below diagram outlining the DYMO-MIB device management model.
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:

- dyomoMIBNotifications - defines the notifications associated with the DYMO MIB. These are currently limited to notifications of interface state changes and gateway prefix 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 and TruthValue textual conventions are 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 primarily contained in the 'Routing'
Table.

5.3.1. 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 and
various flags indicating the viability of the routing 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
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 two notification objects, one related to status changes in DYMO interfaces and one related to changes in the gateway prefixes table.

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 someplace within the narrative sections. If there are imported items in the MIB module, such as Textual Conventions, that are not already cited, they can be cited in text here. Since relationships to other MIB modules should be described in the narrative text, this section is typically used to cite modules from which Textual Conventions are imported.

The following 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, TruthValue
FROM SNMPv2-TC -- [RFC2579]

MODULE-COMPLIANCE, OBJECT-GROUP,

Harnedy, et al. Expires August 28, 2009
NOTIFICATION-GROUP
FROM SNMPv2-CONF -- [RFC2580]

InetAddress, InetAddressType, InetAddressPrefixLength
FROM INET-ADDRESS-MIB -- [RFC4001]

InterfaceIndexOrZero
FROM IF-MIB -- [RFC2863]
;

manetDymoMIB MODULE-IDENTITY
LAST-UPDATED "200902241200Z" -- February 24, 2009
ORGANIZATION "IETF MANET Working Group"
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DESCRIPTION
"This MIB module contains managed object definitions for
the Dynamic MANET On-demand (DYMO) routing protocol as

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-- Revision History
REVISION "200902241200Z" -- February 24, 2009
DESCRIPTION
"Third draft of this MIB module published as draft-ietf-manet-dymo-mib-02.txt.
- Minor changes to dymoInterfacesTable and dymoResponsibleAddrTable.
- Added global dymoAdminStatus and interface specific dymoIfAdminStatus.
- Imported InterfaceIndexOrZero type from IF-MIB."
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

--
-- TEXTUAL CONVENTIONS
--

Status ::= TEXTUAL-CONVENTION
STATUS current
DESCRIPTION
"An indication of the operability of a DYMO function or feature. For example, the status of an interface: 'enabled' indicates that it is willing to communicate with other DYMO routers, and 'disabled' indicates that it is not."
SYNTAX INTEGER { enabled (1), disabled (2) }

--
-- Top-Level Object Identifier Assignments
--

dymoMIBNotifications OBJECT IDENTIFIER ::= { manetDymoMIB 0 }
dymoMIBObjects OBJECTION 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}

dymoAdminStatus OBJECT-TYPE
SYNTAX Status
MAX-ACCESS read-write
STATUS current
DESCRIPTION "The administrative status of DYMO in the
router. The value ‘enabled’ denotes that the
DYMO Process is active on at least one interface;
‘disabled’ disables it on all interfaces.

This object is persistent and when written
the entity SHOULD save the change to non-volatile storage."
::= { dymoRouterConfigGroup 1 }

dymoMaxHopLimit OBJECT-TYPE
SYNTAX Unsigned32 (0..255)
UNITS "hops"
MAX-ACCESS read-write
STATUS current
DESCRIPTION "The maximum number of hops. The suggested value
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 2 }

dymoRouteTimeout OBJECT-TYPE
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 3 }

dymoRouteAgeMinTimeout OBJECT-TYPE
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 4 }

dymoRouteAgeMaxTimeout OBJECT-TYPE
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 5 }

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 6 }

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 7 }

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 8 }

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 9 }

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 10 }

--
-- 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 InterfaceIndexOrZero,
  dymoIfAdminStatus Status,
  dymoIfRowStatus RowStatus
}

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

dymoIfAdminStatus OBJECT-TYPE
SYNTAX Status
MAX-ACCESS read-create
STATUS current
DESCRIPTION "The DYMO interface’s administrative status. The value ‘enabled’ denotes that the interface is running the DYMO routing protocol. The value ‘disabled’ denotes that the interface is external to DYMO."
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-create
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-create
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,
::= { dymoResponsibleAddrEntry 3 }

**dymoResponsibleAddrPrefixLen**  OBJECT-TYPE
SYNTAX        InetAddressPrefixLength
MAX-ACCESS    read-create
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 dymoResonsibleAddr
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).

::= { dymoStateGroup 1 }

--

-- 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 INTEGER
}
dymoRoutingPrefixLen
   InetAddressPrefixLength,
dymoRoutingSeqNum
   Unsigned32,
dymoRoutingNextHopIpAddrType
   InetAddressType,
dymoRoutingNextHopIpAddress
   InetAddress,
dymoRoutingNextHopInterface
   InterfaceIndexOrZero,
dymoRoutingForwardingFlag
   TruthValue,
dymoRoutingBrokenFlag
   TruthValue,
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 InterfaceIndexOrZero
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The interface ifIndex for sending
packets toward the destination route
address."

::= { dymoRoutingEntry 7 }

dymoRoutingForwardingFlag OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-only
The Forwarding Flag indicates whether this route can be used for forwarding data packets. A value ‘true(1)’ indicates that this route is being used for forwarding of data packets, while a value ‘false(2)’ indicates that it is not being used for forwarding.

::= { dymoRoutingEntry 8 }

dymoRoutingBrokenFlag OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The Broken Flag indicates whether this Route is broken. This flag is set if the next-hop becomes unreachable or in response to processing a RERR. A value ‘true(1)’ indicates that this route is broken, while a value ‘false(2)’ indicates that it is not broken."

::= { dymoRoutingEntry 9 }

dymoRoutingDist OBJECT-TYPE
SYNTAX Unsigned32 (1..65535)
UNITS "hops"
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The distance to the destination address’s DYMO 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

::= { dymoRoutingEntry 10 }

--
-- 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
   MAX-ACCESS read-only
   STATUS current
   DESCRIPTION
   "A counter of the number of
   RRER messages that this DYMO
device has initiated."
::= { dymoGlobalStatsGroup 7 }
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 DYMO Interface Statistics entry
 describes the statistics for a particular
 DYMO interface."
 INDEX { dymoIfStatsIfIndex }
 ::= { dymoInterfaceStatsTable 1 }

DymoInterfaceStatsEntry ::=  
 SEQUENCE {
   dymoIfStatsIfIndex
   InterfaceIndexOrZero,
   dymoIfRreqOriginated
   Counter32,

dymoIfRreqForwarded  
   OBJECT-TYPE  
   SYNNTAX      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 2 }

dymoIfRreqOriginated  OBJECT-TYPE  
   SYNNTAX      Counter32  
   MAX-ACCESS  read-only  
   STATUS      current  
   DESCRIPTION  
      "A counter of the number of 
      RREQ messages that this DYMO 
      interface has initiated."
::= { dymoInterfaceStatsEntry 1 }

::= { 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
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
--

dymoAdminStatusChange  NOTIFICATION-TYPE
OBJECTS     { dymoAdminStatus }
STATUS      current
DESCRIPTION
 "This notification is generated when the
 administrative status of a DYMO router changes."
::= { dymoMIBNotifications 1 }

dymoInterfaceAdminStatusChange  NOTIFICATION-TYPE
OBJECTS     { dymoIfAdminStatus }
STATUS      current
DESCRIPTION
 "This notification is generated when the

administrative status of a DYMO interface changes."
::= { dymoMIBNotifications 2 }

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 3 }

--
-- 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 }

--
-- Units of Conformance
--

dymoConfigObjectsGroup OBJECT-GROUP
  OBJECTS {
    dymoAdminStatus,
dymoMaxHopLimit,
dymoRouteTimeout,
dymoRouteAgeMinTimeout,
dymoRouteAgeMaxTimeout,
dymoRouteUsedTimeout,
dymoRouteDeleteTimeout,
dymoRouteRreqWaitTime,
dymoRreqTries,
dymoUnicastErrMsgSentTimeout,
dymoIfAdminStatus,
dymoIfRowStatus,
dymoResponsibleAddrType,
dymoResponsibleAddr,
dymoResponsibleAddrPrefixLen,
dymoResponsibleAddrRowStatus

} STATUS current
DESCRIPTION "Set of DYMO configuration objects implemented in this module."
::= { dymoMIBGroups 1 }

dymoStateObjectsGroup OBJECT-GROUP
OBJECTS {
dymoCurrentSeqNum,
dymoRoutingSeqNum,
dymoRoutingNextHopIpAddrType,
dymoRoutingNextHopIpAddress,
dymoRoutingNextHopInterface,
dymoRoutingForwardingFlag,
dymoRoutingBrokenFlag,
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,
dymoRrerForwarded,
dymoRrerReceived,
dymoIfRreqOriginated,
dymoIfRreqForwarded,
dymoIfRreqReceived,
dymoIfRrepOriginated,
dymoIfRrepForwarded,
dymoIfRrepReceived,
dymoIfRrerOriginated,
dymoIfRrerForwarded,
dymoIfRrerReceived
}

STATUS current
DESCRIPTION
"Set of DYMO statistic objects implemented
in this module for performance management."
::= { dymoMIBGroups 3 }

dymoNotifObjectsGroup NOTIFICATION-GROUP
NOTIFICATIONS {
 dymoAdminStatusChange,
 dymoInterfaceAdminStatusChange,
 dymoResponsibleAddrEntryChange
}

STATUS current
DESCRIPTION
"Set of DYMO notifications implemented in this
module."
::= { dymoMIBGroups 4 }

END

8. Security Considerations

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

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

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

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

- [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 place-holders (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

[RFC2863] McCloghrie, K. and F. Kastenholz, "The

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

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

Information Version 2 (SMIv2)", STD 58,
RFC 2578, April 1999.

Schoenwaelder, Ed., "Textual Conventions for
SMIv2", STD 58, RFC 2579, April 1999.

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


Appendix A. Change Log

This section identifies the changes that have been made from draft-ietf-manet-dymo-mib-00.

These changes were made from draft-ietf-manet-dymo-mib-00 to draft-ietf-manet-dymo-mib-01.

1. Only minor changes of a typographic nature, e.g., read-only to read-write on MAX_ACCESS clauses of a few configuration objects.

These changes were made from draft-ietf-manet-dymo-mib-01 to draft-ietf-manet-dymo-mib-02.

1. Added the ForwardingFlag and BrokenFlag objects to the DYMO Routing Table.
2. Added the TruthValue Textual Convention to handle the new Routing Table objects.
3. Added the DYMO device management model to the introductory sections of this draft.
4. General clean up of the introductory sections of this draft.

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. Will DYMO require an MANET_ID (Instance ID) for running multiple DYMO processes over the same interfaces?
2. Incorporate MIB-II IpGroup interworking with DymoIfTable. (Note: We have looked into the current IpForwarding Table and it is not clear how this table can be extended through a ‘delta’ table within this MIB. Hence, we currently have a full DYMO forwarding table in this MIB.)

3. What notifications are of interest and utility?

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

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

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

7. Add DEFAULT clauses to the appropriate Configuration Objects.

8. Incorporate parameter relationship conditions into their DESCRIPTION clauses.

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

Appendix C.

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