Definition of Managed Objects for the Manet Simplified Multicast Framework Relay Set Process
draft-ietf-manet-smf-mib-02

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 Simplified Multicast Forwarding (SMF) process for Mobile Ad-Hoc Networks (MANETs). The SMF-MIB also reports state information, performance metrics, and notifications. In addition to configuration, the additional state and performance information is useful to operators troubleshooting multicast forwarding 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 process implementing Simplified Multicast Forwarding (SMF) [I-D.ietf-manet-smf] for Mobile Ad-Hoc Networks (MANETs). SMF provides multicast Duplicate Packet Detection (DPD) and supports algorithms for constructing an estimate of a MANET Minimum Connected Dominating Set (MCDS) for efficient multicast forwarding. The SMF-MIB also reports state information, performance metrics, and notifications. In addition to configuration, this additional state and performance information is useful to operators troubleshooting multicast forwarding 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

SMF provides methods for implementing DPD-based multicast forwarding with the optional use of Connected Dominating Set (CDS)-based relay sets. The CDS provides a complete connected coverage of the nodes comprising the MANET. The MCDS is the smallest set of MANET nodes (comprising a connected cluster) which cover all the nodes in the cluster with their transmissions. As the density of the MANET nodes increase, the fraction of nodes required in an MCDS decreases. Using the MCDS as a multicast forwarding set then becomes an efficient multicast mechanism for MANETs.
Various algorithms for the construction of estimates of the MCDS exist. The Simplified Multicast Framework [I-D.ietf-manet-smf] describes some of these. It further defines various operational modes for a node which is participating in the collective creation of the MCDS estimates. These modes depend upon the set of related MANET routing and discovery protocols and mechanisms in operation in the specific MANET node.

A SMF router’s MIB contains SMF process configuration parameters (e.g. specific CDS algorithm), state information (e.g., current membership in the CDS), performance counters (e.g., packet counters), and notifications.

4.1. SMF Management Model

This section describes the management model for the SMF node process.

Figure 1 (reproduced from Figure 4 of [I-D.ietf-manet-smf]) shows the relationship between the SMF Relay Set selection algorithm and the related algorithms, processes and protocols running in the MANET nodes. The Relay Set Selection Algorithm (RSSA) can rely upon topology information gotten from the MANET Neighborhood Discovery Protocol (NHDP), from the specific MANET routing protocol running on the node, or from Layer 2 information passed up to the higher layer protocol processes.

RGC Note: update this figure from the latest SMF draft.
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 SMF RS process.

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

- Performance Objects - automatically generated values which help an administrator or automated tool to assess the performance of the CDS multicast process on the router and the overall multicasting performance within the MANET routing domain.

5. Structure of the MIB Module

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

- smfMIBNotifications - defines the notifications associated with the SMF-MIB.
o smfMIBObjects - defines the objects forming the basis for the SMF-MIB. These objects are divided up by function into the following groups:

* Capabilities Group - This group contains the SMF objects that the device uses to advertise its local capabilities with respect to, e.g., the supported RSSAs.

* Configuration Group - This group contains the SMF objects that configure specific options that determine the overall operation of the SMF RSSA and the resulting multicast performance.

* State Group - Contains information describing the current state of the SMF RSSA process such as the Neighbor Table.

* Performance Group - Contains objects which help to characterize the performance of the SMF RSSA process, typically statistics counters.

o smfMIBConformance - defines minimal and full conformance of implementations to this SMF-MIB.

5.1. Textual Conventions

The textual conventions defined within the SMF-MIB are as follows:

o The SmfStatus is defined within the SMF-MIB. This contains the current operational status of the SMF process on an interface.

o The SmfOpModeID represents an index that identifies a specific SMF operational mode.

o The SmfRssaID represents an index that identifies, through reference, a specific RSSA available for operation on the device.

5.2. The Capabilities Group

The SMF device supports a set of capabilities. The list of capabilities which the device can advertise are:

o Operational Mode - topology information from NHDP, CDS-aware unicast routing or Cross-layer from Layer 2.

o SMF RSSA - the specific RSSA operational on the device. Note that configuration, state and performance objects related to a specific RSSA must be defined within another separate MIB.
5.3. The Configuration Group

The SMF device is configured with a set of controls. Some of the prominent configuration controls for the SMF device follow:

- Operational Mode - topology information from NHDP, CDS-aware unicast routing or Cross-layer from Layer 2.
- SMF RSSA - the specific RSSA operational on the device.
- Duplicate Packet detection for IPv4 - Identification-based or Hash-based DPD.
- Duplicate Packet detection for IPv6 - Identification-based or Hash-based DPD.
- SMF Type Message TLV - if NHDP mode is selected, then is the SMF Type Message TLV may be included in the NHDP exchanges.
- SMF Address Block TLV - if NHDP mode is selected, then is the SMF Address Block TLV included in the NHDP exchanges. (Note: is this correct?)

5.4. The State Group

The State Subtree reports current state information, e.g.,

- Node RSS State - is the node currently in or out of the Relay Set.
- Neighbors Table - a table containing current neighbors and their operational RSSA.

5.5. The Performance Group

The Performance subtree reports primarily counters that relate to SMF RSSA performance. The SMF performance counters consists of per node and per interface objects:

- Total multicast packets received.
- Total multicast packets forwarded.
- Total duplicate multicast packets detected.
- Per interface statistics table with the following entries:
* Multicast packets received.
* Multicast packets forwarded.
* Duplicate multicast packets detected.

5.6. The Notifications Group

The Notifications Subtree contains the list of notifications supported within the SMF-MIB and their intended purpose or utility.

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 SMF-MIB does not duplicate those objects.

6.2. MIB modules required for IMPORTS

The textual conventions imported for use in the SMF-MIB are as follows. The MODULE-IDENTITY, OBJECT-TYPE, NOTIFICATION-TYPE, Counter32, Unsigned32, Integer32 and mib-2 textual conventions are imported from RFC 2578 [RFC2578]. The TEXTUAL-CONVENTION, RowStatus and TruthValue textual conventions are imported from RFC 2579 [RFC2579]. The MODULE-COMPLIANCE, OBJECT-GROUP and NOTIFICATION-GROUP textual conventions are imported from RFC 2580 [RFC2580]. The InterfaceIndexOrZero textual convention is imported from RFC 2863 [RFC2863]. The SnmpAdminString textual convention is imported from RFC 3411 [RFC3411]. The InetAddress, InetAddressType and InetAddressPrefixLength textual conventions are imported from RFC 4001 [RFC4001].

6.3. Relationship to the Future RSSA-MIBs

In a sense, the SMF-MIB is a general front-end to a set of, yet to be developed, RSSA-specific MIBs. These RSSA-specific MIBs will define the objects for the configuration, state, performance and
notification objects required for the operation of these specific RSSAs. The SMF-MIB Capabilities Group allows the remote management station the ability to query the router to discover the set of supported RSSAs.

7. Definitions

MANET-SMF-MIB DEFINITIONS ::= BEGIN

IMPORTS

MODULE-IDENTITY, OBJECT-TYPE, NOTIFICATION-TYPE,
Counter32, Unsigned32, Integer32, TimeTicks, mib-2
FROM SNMPv2-SMI -- [RFC2578]

TEXTUAL-CONVENTION, RowStatus, TruthValue
FROM SNMPv2-TC -- [RFC2579]

MODULE-COMPLIANCE, OBJECT-GROUP,
NOTIFICATION-GROUP
FROM SNMPv2-CONF -- [RFC2580]

InterfaceIndexOrZero
FROM IF-MIB -- [RFC2863]

SnmpAdminString
FROM SNMP-FRAMEWORK-MIB -- [RFC3411]

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

;
DESCRIPTION

"This MIB module contains managed object definitions for the Manet SMF RSSA process defined in:


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-- Revision History
REVISION "201101161300Z" -- January 16, 2011
DESCRIPTION
"Updated 5th revision of the draft of this MIB module published as draft-ietf-manet-smf-mib-02.txt. The changes made in this revision include:
- Added the Notification Group and cleaned
up the Conformance section
- Completed the TEXTUAL CONVENTION for the smfOpMode.
- Completed the Description clauses of several objects within the MIB.
- Removed the routerPriority object.
- Added the definition of a smfRouterID object and associated smfRouterIDAddrType object.

" REVISION "200910261300Z" -- October 26, 2009
DESCRIPTION
"Updated draft of this MIB module published as draft-ietf-manet-smf-mib-01.txt. A few changes were made in the development of this draft. Specifically, the following changes were made:
- Updated the textual material, included section on IMPORTS, relationship to other MIBs, etc.

" REVISION "200904211300Z" -- April 21, 2009
DESCRIPTION
"Updated draft of this MIB module published as draft-ietf-manet-smf-mib-00.txt. A few changes were made in the development of this draft. Specifically, the following changes were made:
- Removed the smfGatewayFilterTable from this draft. It is a useful construct, e.g., an IPTABLES-MIB, but might best be handled as a seperate MIB and worked within a security focused working group.
- Removed the smfReportsGroup. This capability is being replaced with a new and more general method for offline reporting. This is being worked as a new MIB module refered to as the REPORT-MIB.
- Rev’d as a new MANET WG document.

" REVISION "200902271300Z" -- February 27, 2009
DESCRIPTION
"Updated draft of this MIB module published as draft-cole-manet-smf-mib-02.txt. Fairly extensive revisions and additions to this MIB were made in this version. Specifically, the following changes were made in development of this version:
- added a Capabilities Group within the Objects Group to allow the device to report supported capabilities, e.g., RSSAs supported.
- added administrative status objects for device and interfaces
- added multicast address forwarding tables, both for configured (within Configuration Group) and discovered (within the State Group).
- added additional Performance counters related to DPD functions.
- Split up the performance counters into IPv4 and IPv6, for both global and per interface statistics.
- Split out the reports capability into a separate Reports Group under the Objects Group.

REVISION    "200811031300Z"   -- November 03, 2008
DESCRIPTION
"Updated draft of this MIB module published as
draft-cole-manet-smf-mib-01.txt. Added gateway filter
table and reports capabilities following rmon."

REVISION    "200807071200Z"   -- July 07, 2008
DESCRIPTION
"Initial draft of this MIB module published as
draft-cole-manet-smf-mib-00.txt."

::= { mib-2 998 }   -- to be assigned by IANA

-- TEXTUAL CONVENTIONS

SmfStatus ::= TEXTUAL-CONVENTION
  STATUS       current
  DESCRIPTION
  "An indication of the operability of a SMF
  function or feature.  For example, the status
  of an interface: ‘enabled’ indicates that
  it is performing SMF functions,
  and ‘disabled’ indicates that it is not."
  SYNTAX  INTEGER {
    enabled (1),
    disabled (2)
  }

SmfOpModeID ::= TEXTUAL-CONVENTION
  STATUS       current
  DESCRIPTION
  "An index that identifies through reference to a specific
SMF operations mode. There are basically three styles of SMF operation with reduced relay sets:

Independent operation - SMF performs its own relay set selection using information from an associated MANET NHDP process.

CDS-aware unicast routing operation - a coexistent unicast routing protocol provides dynamic relay set state based upon its own control plane CDS or neighborhood discovery information.

Cross-layer operation - SMF operates using neighborhood status and triggers from a cross-layer information base for dynamic relay set selection and maintenance.

"SYNTAX  INTEGER {
  independent (1),
  routing (2),
  crossLayer (3)
  -- future (4-255)
}

SmfRssaID ::= TEXTUAL-CONVENTION
STATUS       current
DESCRIPTION   "An index that identifies through reference to a specific RSSA algorithms. Several are currently defined in the appendix of"
"SYNTAX  INTEGER {
  cF(1),
  sMPR(2),
  eCDS(3),
  mprCDS(4)
  -- future(5-127)
  -- noStdAction(128-239)
  -- experimental(240-255)
}

-- Top-Level Object Identifier Assignments
--

smfMIBNotifications OBJECT IDENTIFIER ::= { manetSmFIB 0 }
smfMIBObjects OBJECT IDENTIFIER ::= { manetSmfMIB 1 }
smfMIBConformance OBJECT IDENTIFIER ::= { manetSmfMIB 2 }

--
-- smfMIBObjects Assignments:
--    smfCapabilitiesGroup - 1
--    smfConfigurationGroup - 2
--    smfStateGroup - 3
--    smfPerformanceGroup - 4
--

--

-- smfCapabilitiesGroup
--
-- This group contains the SMF objects that identify specific
-- capabilities within this device related to SMF functions.
--

smfCapabilitiesGroup OBJECT IDENTIFIER ::= { smfMIBObjects 1 }

--

-- SMF Operational Mode Capabilities Table
--

smfOpModeCapabilitiesTable OBJECT-TYPE
SYNTAX      SEQUENCE OF SmfOpModeCapabilitiesEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
    "The smfOpModeCapabilitiesTable identifies the
    resident set of SMF Operational Modes on this
    router."
::= { smfCapabilitiesGroup 1 }

smfOpModeCapabilitiesEntry OBJECT-TYPE
SYNTAX      SmfOpModeCapabilitiesEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
    "Information about a particular operational
    mode."
INDEX       { smfOpModeCapabilitiesID }
::= { smfOpModeCapabilitiesTable 1 }
SmfOpModeCapabilitiesEntry ::= SEQUENCE {
    smfOpModeCapabilitiesID SmfOpModeID,
    smfOpModeCapabilitiesName SnmpAdminString,
    smfOpModeCapabilitiesReference SnmpAdminString
}

smfOpModeCapabilitiesID OBJECT-TYPE
SYNTAX SmfOpModeID
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"The index for this entry. This object identifies
the particular operational mode for this device."
::= { smfOpModeCapabilitiesEntry 1 }

smfOpModeCapabilitiesName OBJECT-TYPE
SYNTAX SnmpAdminString
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The textual name of this operational
mode. Current operational modes include:
Independent Mode, CDS-aware Routing Mode,
and Cross-layer Mode. Others may be defined
in future revisions of [SMF]."
::= { smfOpModeCapabilitiesEntry 2 }

smfOpModeCapabilitiesReference OBJECT-TYPE
SYNTAX SnmpAdminString
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object contains a reference to the document that
defines this operational mode."
::= { smfOpModeCapabilitiesEntry 3 }

--
-- SMF RSSA Capabilities Table
--

smfRssaCapabilitiesTable OBJECT-TYPE
SYNTAX SEQUENCE OF SmfRssaCapabilitiesEntry
MAX-ACCESS not-accessible
STATUS current
"The smfRssaCapabilitiesTable contains reference to the specific set of RSSAs currently supported on this device."

::= { smfCapabilitiesGroup 2 }

smfRssaCapabilitiesEntry OBJECT-TYPE
SYNTAX SmfRssaCapabilitiesEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "Information about a particular RSSA algorithm."
INDEX { smfRssaCapabilitiesID }
::= { smfRssaCapabilitiesTable 1 }

SmfRssaCapabilitiesEntry ::= SEQUENCE {
  smfRssaCapabilitiesID          SmfRssaID,
  smfRssaCapabilitiesName        SnmpAdminString,
  smfRssaCapabilitiesReference   SnmpAdminString
}

smfRssaCapabilitiesID    OBJECT-TYPE
SYNTAX       SmfRssaID
MAX-ACCESS   not-accessible
STATUS       current
DESCRIPTION "The index for this entry. This object identifies the particular RSSA algorithm in this MIB module. Example RSSAs are found in the appendix of [SMF]."
 ::= { smfRssaCapabilitiesEntry 1 }

smfRssaCapabilitiesName OBJECT-TYPE
SYNTAX       SnmpAdminString
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION "The textual name of this RSSA algorithm. Currently defined names are:
Classical Flooding - cF,
Source-based MultiPoint Relay - sMPR,
Essential Connecting Dominating Set - eCDS,
MultiPoint Relay Connected Dominating Set - mprCDS."
::= { smfRssaCapabilitiesEntry 2 }

smfRssaCapabilitiesReference OBJECT-TYPE
SYNTAX SnmpAdminString
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object contains a published reference to the document that defines this algorithm."
 ::= { smfRssaCapabilitiesEntry 3 }

--
-- smfConfigurationGroup
--
-- This group contains the SMF objects that configure specific options that determine the overall performance and operation of the multicast forwarding process for the router device and its interfaces.
--

smfConfigurationGroup OBJECT IDENTIFIER ::= { smfMIBObjects 2 }

smfAdminStatus OBJECT-TYPE
SYNTAX SmfStatus
MAX-ACCESS read-write
STATUS current
DESCRIPTION
"The configured status of the SMF process on this device. Enabled(1) means that SMF is configured to run on this device. Disabled(2) mean that the SMF process is configured off.

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

-- Note: need to better define the algorithm to choose the smfRouterID.

smfRouterIDAddrType OBJECT-TYPE
SYNTAX InetAddressType
MAX-ACCESS   read-write  
STATUS       current  
DESCRIPTION
 "The address type of the address used for
 SMF ID of this router as specified
 in the 'smfRouterID' next.

This can be set by the management station, must
the smfRouterID must be a routable address
assigned to this router. If the management
station does not assign this value, then the
router should choose the highest IP address
assigned to this router.

This object is persistent and when written
the entity SHOULD save the change to
non-volatile storage.
"
 ::= { smfConfigurationGroup 2 }

smfRouterID OBJECT-TYPE
SYNTAX     InetAddress
MAX-ACCESS read-write
STATUS     current
DESCRIPTION
 "The IP address used as the SMF router ID.
 this can be set by the management station.
 If not explicitly set, then the device
 should select a routable IP address
 assigned to this router for use as
 the 'smfRouterID'.

This object is persistent and when written
the entity SHOULD save the change to
non-volatile storage.
"
 ::= { smfConfigurationGroup 3 }

smfConfiguredOpMode OBJECT-TYPE
SYNTAX     INTEGER { 
            withNHDP(1),
            cdsAwareRouting(2),
            crossLayer(3),
            other(4) }

MAX-ACCESS read-write
STATUS     current
DESCRIPTION
"The SMF RSS node operational mode as defined in the TEXTUAL CONVENTION for ‘SmfOpModeID’ and in [SMF].

The value withNHDP(1) indicates Independent Mode of operation.

The value cdsAwareRouting(2) indicates CDS-aware Routing Mode of operation.

The value crossLayer(3) indicates Cross-layer Mode of operation.

This object is persistent and when written the entity SHOULD save the change to non-volatile storage.

::= { smfConfigurationGroup 4 }

smfConfiguredRssa  OBJECT-TYPE
SYNTAX      SmfRssaID
MAX-ACCESS  read-write
STATUS      current
DESCRIPTION
"The SMF RSS currently operational algorithm as defined in the TEXTUAL CONVENTION for ‘SmfRssaID’ and in [SMF].

This object is persistent and when written the entity SHOULD save the change to non-volatile storage.

::= { smfConfigurationGroup 5 }

smfRssaMember  OBJECT-TYPE
SYNTAX      INTEGER {
    potential(1),
    always(2),
    never(3)
}
MAX-ACCESS  read-write
STATUS      current
DESCRIPTION
"The RSSA downselects a set of forwarders for multicast forwarding. Sometimes it is useful to force an agent to be included or excluded from the resulting RSS. This object is a
switch to allow for this behavior.

The value potential(1) allows the selected RSSA to determine if this agent is included or excluded from the RSS.

The value always(1) forces the selected RSSA include this agent in the RSS.

The value never(3) forces the selected RSSA to exclude this agent from the RSS.

This object is persistent and when written the entity SHOULD save the change to non-volatile storage.

```plaintext
::= { smfConfigurationGroup 6 }
```

**smfIpv4Dpd**  OBJECT-TYPE
SYNTAX      INTEGER {
      identificationBased(1),
      hashBased(2)
    }
MAX-ACCESS  read-write
STATUS      current
DESCRIPTION
"The current method for IPv4 duplicate packet detection.

The value identificationBased(1) indicates that the duplicate packet detection relies upon header information in the multicast packets to identify previously received packets.

The value 'hashBased(2) indicates that the routers duplicate packet detection is based upon comparing a hash over the packet fields.

This object is persistent and when written the entity SHOULD save the change to non-volatile storage.

```plaintext
::= { smfConfigurationGroup 7 }
```

**smfIpv6Dpd**  OBJECT-TYPE
SYNTAX      INTEGER {
      identificationBased(1),
```
hashBased(2)
}

MAX-ACCESS read-write
STATUS current

DESCRIPTION
"The current method for IPv6 duplicate packet detection.

The values indicate the type of method used for duplicate packet detection as described in the previous description for the object "smfIpv4Dpd".

This object is persistent and when written the entity SHOULD save the change to non-volatile storage.
"

::= { smfConfigurationGroup 8 }

smfMaxPktLifetime OBJECT-TYPE
SYNTAX Integer32 (0..65535)
UNITS "Seconds"
MAX-ACCESS read-write
STATUS current

DESCRIPTION
"The estimate of the network packet traversal time.

This object is persistent and when written the entity SHOULD save the change to non-volatile storage.
"

DEFVAL { 60 }
::= { smfConfigurationGroup 9 }

smfDpdMaxMemorySize OBJECT-TYPE
SYNTAX Integer32 (0..65535)
UNITS "Kilo-Bytes"
MAX-ACCESS read-write
STATUS current

DESCRIPTION
"The locally reserved memory for storage of cached DPD records for both IPv4 and IPv6 methods.

This object is persistent and when written the entity SHOULD save the change to non-volatile storage.
"
""
DEFVAL { 1024 }
::= { smfConfigurationGroup 10 }

smfDpdEntryMaxLifetime OBJECT-TYPE
SYNTAX      Integer32 (0..65525)
UNITS       "Seconds"
MAX-ACCESS  read-write
STATUS      current
DESCRIPTION
 "The maximum lifetime of a cached DPD
 record in the local device storage.

 This object is persistent and when written
 the entity SHOULD save the change to
 non-volatile storage.
"
DEFVAL { 600 }
::= { smfConfigurationGroup 11 }

--
-- Configuration of messages to be included in
-- NHDP message exchanges in support of SMF
-- operations.
--
-- Note: need to clarify whether this is an option
-- or is required when the smfOpMode is set
-- to 'independent'.
smfNhdpRssaMesgTLVIncluded OBJECT-TYPE
SYNTAX      TruthValue
MAX-ACCESS  read-write
STATUS      current
DESCRIPTION
 "Indicates whether the associated NHDP messages
 include the RSSA Message TLV, or not. This
 is an optional SMF operational setting.
 The value true(1) indicates that this TLV is
 included; the value false(2) indicates that it
 is not included.

 This object is persistent and when written
 the entity SHOULD save the change to
 non-volatile storage.
"
::= { smfConfigurationGroup 12 }
smfNhdpRssaAddrBlockTLVIncluded  OBJECT-TYPE
SYNTAX      TruthValue
MAX-ACCESS  read-write
STATUS      current
DESCRIPTION
"Indicates whether the associated NHDP messages include the RSSA Address Block TLV, or not.
This is an optional SMF operational setting. The value true(1) indicates that this TLV is included; the value false(2) indicates that it is not included.

This object is persistent and when written the entity SHOULD save the change to non-volatile storage.
"
 ::= { smfConfigurationGroup 13 }

--
-- Table identifying configured multicast addresses to be forwarded.
--
smfConfiguredAddrForwardingTable  OBJECT-TYPE
SYNTAX     SEQUENCE OF SmfConfiguredAddrForwardingEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"The (conceptual) table containing information on multicast addresses which are to be forwarded by the SMF process.

Entries in this table are configured. As well, addresses to be forwarded by the SMF device can be dynamically discovered by other means. The corresponding state table, smfDiscoveredAddrForwardingTable, contains these additional, dynamically discovered address for forwarding.

Each row is associated with a range of multicast addresses, and ranges for different rows must be disjoint.

The objects in this table are persistent and when written the entity SHOULD save the change to non-volatile storage.
"
 ::= { smfConfigurationGroup 15 }

smfConfiguredAddrForwardingEntry OBJECT-TYPE
SYNTAX SmfConfiguredAddrForwardingEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "An entry (conceptual row) containing the information on a
particular multicast scope."
INDEX { smfConfiguredAddrForwardingAddrType,
         smfConfiguredAddrForwardingFirstAddr }
 ::= { smfConfiguredAddrForwardingTable 1 }

SmfConfiguredAddrForwardingEntry ::= SEQUENCE {
    smfConfiguredAddrForwardingAddrType InetAddressType,
    smfConfiguredAddrForwardingFirstAddr InetAddress,
    smfConfiguredAddrForwardingLastAddr InetAddress,
    smfConfiguredAddrForwardingStatus RowStatus
}

smfConfiguredAddrForwardingAddrType OBJECT-TYPE
SYNTAX InetAddressType
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "The type of the addresses in the multicast forwarding
range. Legal values correspond to the subset of
address families for which multicast address allocation
is supported."
 ::= { smfConfiguredAddrForwardingEntry 1 }

smfConfiguredAddrForwardingFirstAddr OBJECT-TYPE
SYNTAX InetAddress (SIZE(0..20))
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "The first address in the multicast scope range. The type
of this address is determined by the value of the
smfConfiguredAddrForwardingAddrType object."
 ::= { smfConfiguredAddrForwardingEntry 2 }

smfConfiguredAddrForwardingLastAddr OBJECT-TYPE
SYNTAX InetAddress (SIZE(0..20))
MAX-ACCESS read-create
STATUS current
DESCRIPTION "The last address in the multicast scope range.
The type of this address is determined by the
value of the smfConfiguredAddrForwardingAddrType
object."
::= { smfConfiguredAddrForwardingEntry 3 }

smfConfiguredAddrForwardingStatus OBJECT-TYPE
SYNTAX     RowStatus
MAX-ACCESS read-create
STATUS      current
DESCRIPTION
 "The status of this row, by which new entries may be
created, or old entries deleted from this table. If write
access is supported, the other writable objects in this
table may be modified even while the status is 'active'."
 ::= { smfConfiguredAddrForwardingEntry 4 }

--
-- SMF Interfaces Configuration Table
--

smfInterfaceTable  OBJECT-TYPE
SYNTAX      SEQUENCE OF SmfInterfaceEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
 "The SMF Interface Table describes the SMF
interfaces that are participating in the
SMF packet forwarding process. The ifIndex is
from the interfaces group defined in the
Interfaces Group MIB.

The objects in this table are persistent
and when written the entity SHOULD save
the change to non-volatile storage.
"
REFERENCE
 "RFC 2863 - The Interfaces Group MIB, McCloghrie,
K., and F. Kastenholtz, June 2000."
 ::= { smfConfigurationGroup 16 }

smfInterfaceEntry OBJECT-TYPE
SYNTAX      SmfInterfaceEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
 "The SMF interface entry describes one SMF
interface as indexed by its ifIndex."
INDEX { smfIfIndex }
 ::= { smfInterfaceTable 1 }
SmfInterfaceEntry ::=  
   SEQUENCE {
      smfIfIndex InterfaceIndexOrZero,
      smfIfAdminStatus SmfStatus,
      smfIfRowStatus RowStatus
   }

smfIfIndex OBJECT-TYPE
   SYNTAX InterfaceIndexOrZero
   MAX-ACCESS read-only
   STATUS current
   DESCRIPTION "The ifIndex for this SMF interface."
   ::= { smfInterfaceEntry 1 }

smfIfAdminStatus OBJECT-TYPE
   SYNTAX SmfStatus
   MAX-ACCESS read-create
   STATUS current
   DESCRIPTION "The SMF interface’s administrative status. The value ‘enabled’ denotes that the interface is running the SMF forwarding process. The value ‘disabled’ denotes that the interface is external to the SMF forwarding process."
   ::= { smfInterfaceEntry 2 }

smfIfRowStatus 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."
   ::= { smfInterfaceEntry 3 }

--
-- smfStateGroup
--
-- Contains information describing the current state of the SMF process such as the current inclusion in the RS or not.
smfStateGroup  OBJECT IDENTIFIER ::= { smfMIBObjects 3 }

smfNodeRsStatusIncluded  OBJECT-TYPE
   SYNTAX      TruthValue
   MAX-ACCESS  read-only
   STATUS      current
   DESCRIPTION
       "The current status of the SMF node in the context of
       the MANETs relay set. A value of true(1) indicates
       that the node is currently part of the MANET Relay
       Set. A value of false(2) indicates that the node
       is currently not part of the MANET Relay Set."
   ::= { smfStateGroup 1 }

smfDpdMemoryOverflow  OBJECT-TYPE
   SYNTAX      Counter32
   MAX-ACCESS  read-only
   STATUS      current
   DESCRIPTION
       "The number of times that the memory for caching
       records for DPD overran and records had to be flushed.
       The number of records to be flushed upon a buffer
       overflow is an implementation specific decision.
       "
   ::= { smfStateGroup 2 }

--

-- Dynamically Discovered Multicast Addr Table
--

smfDiscoveredAddrForwardingTable  OBJECT-TYPE
   SYNTAX     SEQUENCE OF SmfDiscoveredAddrForwardingEntry
   MAX-ACCESS not-accessible
   STATUS     current
   DESCRIPTION
       "The (conceptual) table containing information on multicast
       addresses which are to be forwarded by the SMF process.

       Entries in this table are configured. As well, addresses
       to be forwarded by the SMF device can be dynamically
       discovered by other means. The corresponding state
       table, smfDiscoveredAddrForwardingTable contains
       these additional, dynamically discovered address for
       forwarding."
Each row is associated with a range of multicast addresses, and ranges for different rows must be disjoint.

::= { smfStateGroup 3 }

smfDiscoveredAddrForwardingEntry OBJECT-TYPE
SYNTAX SmfDiscoveredAddrForwardingEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "An entry (conceptual row) containing the information on a particular multicast scope."
INDEX { smfDiscoveredAddrForwardingAddrType,
        smfDiscoveredAddrForwardingFirstAddr }
::= { smfDiscoveredAddrForwardingTable 1 }

SmfDiscoveredAddrForwardingEntry ::= SEQUENCE {
    smfDiscoveredAddrForwardingAddrType   InetAddressType,
    smfDiscoveredAddrForwardingFirstAddr  InetAddress,
    smfDiscoveredAddrForwardingLastAddr   InetAddress,
    smfDiscoveredAddrForwardingStatus     RowStatus
}

smfDiscoveredAddrForwardingAddrType OBJECT-TYPE
SYNTAX InetAddressType
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "The type of the addresses in the multicast forwarding range. Legal values correspond to the subset of address families for which multicast address allocation is supported."
::= { smfDiscoveredAddrForwardingEntry 1 }

smfDiscoveredAddrForwardingFirstAddr OBJECT-TYPE
SYNTAX InetAddress (SIZE(0..20))
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "The first address in the multicast scope range. The type of this address is determined by the value of the smfConfiguredAddrForwardingAddrType object."
::= { smfDiscoveredAddrForwardingEntry 2 }

smfDiscoveredAddrForwardingLastAddr OBJECT-TYPE
SYNTAX InetAddress (SIZE(0..20))
MAX-ACCESS read-create
STATUS current
DESCRIPTION "The last address in the multicast scope range. The type of this address is determined by the value of the smfConfiguredAddrForwardingAddrType object."
 ::= { smfDiscoveredAddrForwardingEntry 3 }

smfDiscoveredAddrForwardingStatus OBJECT-TYPE
SYNTAX RowStatus
MAX-ACCESS read-create
STATUS current
DESCRIPTION "The status of this row, by which new entries may be created, or old entries deleted from this table. If write access is supported, the other writable objects in this table may be modified even while the status is ‘active’."
 ::= { smfDiscoveredAddrForwardingEntry 4 }

--
-- SMF Neighbor Table
--

smfNeighborTable OBJECT-TYPE
SYNTAX SEQUENCE OF SmfNeighborEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "The SMF NeighborTable describes the current neighbor nodes, their address and SMF RSSA and the interface on which they can be reached."
REFERENCE "Simplified Multicast Forwarding for MANET (SMF), Macker, J., July 2009. Section 7: SMF Neighborhood Discovery Requirements."
 ::= { smfStateGroup 4 }

smfNeighborEntry OBJECT-TYPE
SYNTAX SmfNeighborEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "The SMF Neighbor Table contains the set of one-hop neighbors, the interface
they are reachable on and the SMF RSSA
they are currently running.
INDEX { smfNeighborIpAddrType,
    smfNeighborIpAddr,
    smfNeighborPrefixLen }
::= { smfNeighborTable 1 }

SmfNeighborEntry ::= 
    SEQUENCE {
        smfNeighborIpAddrType        InetAddressType,
        smfNeighborIpAddr            InetAddress,
        smfNeighborPrefixLen         InetAddressPrefixLength,
        smfNeighborRSSA              SmfRssaID,
        smfNeighborNextHopInterface  InterfaceIndexOrZero
    }

smfNeighborIpAddrType  OBJECT-TYPE
SYNTAX      InetAddressType
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
    "The neighbor IP address type."
::= { smfNeighborEntry 1 }

smfNeighborIpAddr  OBJECT-TYPE
SYNTAX      InetAddress
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
    "The neighbor Inet IPv4 or IPv6 address."
::= { smfNeighborEntry 2 }

smfNeighborPrefixLen  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."
::= { smfNeighborEntry 3 }

smfNeighborRSSA  OBJECT-TYPE
SYNTAX      SmfRssaID
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
"The current RSSA running on the neighbor. The list is identical to that described above for the smfRssa object."
 ::= { smfNeighborEntry 4 }

smfNeighborNextHopInterface OBJECT-TYPE
SYNTAX       InterfaceIndexOrZero
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION   "The interface ifIndex over which the neighbor is reachable in one-hop."
 ::= { smfNeighborEntry 5 }

--
-- SMF Performance Group
--
-- Contains objects which help to characterize the performance of the SMF RSSA process, such as statistics counters. There are two types of SMF RSSA statistics: global counters and per interface counters.
--

smfPerformanceGroup OBJECT IDENTIFIER ::= { smfMIBObjects 4 }

smfGlobalPerfGroup OBJECT IDENTIFIER ::= { smfPerformanceGroup 1 }

--
-- IPv4 packet counters
--

smfIpv4MultiPktsRecvTotal OBJECT-TYPE
SYNTAX       Counter32
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION   "A counter of the total number of multicast IPv4 packets received by the device."
 ::= { smfGlobalPerfGroup 1 }

smfIpv4MultiPktsForwardedTotal OBJECT-TYPE
SYNTAX       Counter32
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION
   "A counter of the total number of multicast IPv4 packets forwarded by the device."
::= { smfGlobalPerfGroup 2 }

smfIpv4DuplMultiPktsDetectedTotal  OBJECT-TYPE
SYNTAX       Counter32
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION
   "A counter of the total number of duplicate multicast IPv4 packets detected by the device."
::= { smfGlobalPerfGroup 3 }

smfIpv4DroppedMultiPktsTTLExceededTotal  OBJECT-TYPE
SYNTAX       Counter32
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION
   "A counter of the total number of dropped multicast IPv4 packets by the device due to TTL exceeded."
::= { smfGlobalPerfGroup 4 }

smfIpv4TTLLargerThanPreviousTotal  OBJECT-TYPE
SYNTAX       Counter32
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION
   "A counter of the total number of IPv4 packets received which have a TTL larger than that of a previously received identical packet.

::= { smfGlobalPerfGroup 5 }

-- IPv6 packet counters
--

smfIpv6MultiPktsRecvTotal  OBJECT-TYPE
SYNTAX       Counter32
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION
   "A counter of the total number of multicast IPv6 packets received by the
smfIpv6MultiPktsForwardedTotal OBJECT-TYPE
SYNTAX      Counter32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
 "A counter of the total number of
 multicast IPv6 packets forwarded by the
device."
::= { smfGlobalPerfGroup 6 }

smfIpv6DuplMultiPktsDetectedTotal OBJECT-TYPE
SYNTAX      Counter32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
 "A counter of the total number of duplicate
 multicast IPv6 packets detected by the
device."
::= { smfGlobalPerfGroup 7 }

smfIpv6DroppedMultiPktsTTLExceededTotal OBJECT-TYPE
SYNTAX      Counter32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
 "A counter of the total number of dropped
 multicast IPv6 packets by the
device due to TTL exceeded."
::= { smfGlobalPerfGroup 8 }

smfIpv6TTL LargerThanPreviousTotal OBJECT-TYPE
SYNTAX      Counter32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
 "A counter of the total number of IPv6 packets
 received which have a TTL larger than that
 of a previously received identical packet."
::= { smfGlobalPerfGroup 9 }

smfIpv6HAVAssistsReqdTotal OBJECT-TYPE
SYNTAX      Counter32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
   "A counter of the total number of IPv6 packets
   received which required the HAV assist for DPD."
::= { smfGlobalPerfGroup 11 }

smfIpv6DpdHeaderInsertionsTotal OBJECT-TYPE
SYNTAX      Counter32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
   "A counter of the total number of IPv6 packets
   received which the device inserted the
   DPD header option."
::= { smfGlobalPerfGroup 12 }

--
-- Per SMF Interface Performance Table
--

smfInterfacePerfGroup OBJECT IDENTIFIER ::= { smfPerformanceGroup 2 }

smfIpv4InterfacePerfTable OBJECT-TYPE
SYNTAX       SEQUENCE OF SmfIpv4InterfacePerfEntry
MAX-ACCESS   not-accessible
STATUS       current
DESCRIPTION
   "The SMF Interface Performance Table
   describes the SMF statistics per
   interface."
::= { smfInterfacePerfGroup 1 }

smfIpv4InterfacePerfEntry OBJECT-TYPE
SYNTAX       SmfIpv4InterfacePerfEntry
MAX-ACCESS   not-accessible
STATUS       current
DESCRIPTION
   "The SMF Interface Performance entry
   describes the statistics for a particular
   node interface."
INDEX { smfIpv4IfPerfIfIndex }
::= { smfIpv4InterfacePerfTable 1 }

SmfIpv4InterfacePerfEntry ::= SEQUENCE {
   smfIpv4IfPerfIfIndex InterfaceIndexOrZero,
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smfIpv4MultiPktsRecvPerIf  Counter32,
smfIpv4MultiPktsForwardedPerIf  Counter32,
smfIpv4DuplMultiPktsDetectedPerIf  Counter32,
smfIpv4DroppedMultiPktsTTLExceededPerIf  Counter32,
smfIpv4TTLLargerThanPreviousPerIf  Counter32

smfIpv4IfPerfIfIndex  OBJECT-TYPE
SYNTAX  InterfaceIndexOrZero
MAX-ACCESS  not-accessible
STATUS  current
DESCRIPTION
"The ifIndex for this node interface
that is collecting this set of
performance management statistics."
::= { smfIpv4InterfacePerfEntry 1 }

smfIpv4MultiPktsRecvPerIf  OBJECT-TYPE
SYNTAX  Counter32
MAX-ACCESS  read-only
STATUS  current
DESCRIPTION
"A counter of the number of
multicast IP packets received by the
device on this interface."
::= { smfIpv4InterfacePerfEntry 2 }

smfIpv4MultiPktsForwardedPerIf  OBJECT-TYPE
SYNTAX  Counter32
MAX-ACCESS  read-only
STATUS  current
DESCRIPTION
"A counter of the number of
multicast IP packets forwarded by the
device on this interface."
::= { smfIpv4InterfacePerfEntry 3 }

smfIpv4DuplMultiPktsDetectedPerIf  OBJECT-TYPE
SYNTAX  Counter32
MAX-ACCESS  read-only
STATUS  current
DESCRIPTION
"A counter of the number of duplicate
multicast IP packets detected by the
device on this interface."
::= { smfIpv4InterfacePerfEntry 4 }

smfIpv4DroppedMultiPktsTTLExceededPerIf  OBJECT-TYPE
SYNTAX       Counter32  
MAX-ACCESS   read-only  
STATUS       current  
DESCRIPTION  
   "A counter of the total number of dropped  
multicast IPv4 packets by the  
device due to TTL exceeded."  
 ::= { smfIpv4InterfacePerfEntry 5 }  

smfIpv4TTLLargerThanPreviousPerIf  OBJECT-TYPE  
SYNTAX       Counter32  
MAX-ACCESS   read-only  
STATUS       current  
DESCRIPTION  
   "A counter of the total number of IPv4 packets  
recieved which have a TTL larger than that  
of a previously recived identical packet.  
   "  
 ::= { smfIpv4InterfacePerfEntry 6 }  

smfIpv6InterfacePerfTable  OBJECT-TYPE  
SYNTAX       SEQUENCE OF SmfIpv6InterfacePerfEntry  
MAX-ACCESS   not-accessible  
STATUS       current  
DESCRIPTION  
   "The SMF Interface Performance Table  
describes the SMF statistics per  
interface."  
 ::= { smfInterfacePerfGroup 2 }  

SmfIpv6InterfacePerfEntry  OBJECT-TYPE  
SYNTAX       SmfIpv6InterfacePerfEntry  
MAX-ACCESS   not-accessible  
STATUS       current  
DESCRIPTION  
   "The SMF Interface Performance entry  
describes the statistics for a particular  
node interface."  
INDEX { smfIpv6IfPerfIfIndex }  
 ::= { smfIpv6InterfacePerfTable 1 }  

SmfIpv6InterfacePerfEntry ::=  
   SEQUENCE {  
   smfIpv6IfPerfIfIndex                    InterfaceIndexOrZero,  
   smfIpv6MultiPktsRecvPerIf               Counter32,  
   smfIpv6MultiPktsForwardedPerIf          Counter32,  
   smfIpv6DuplMultiPktsDetectedPerIf       Counter32,  
   
smfIpv6DroppedMultiPktsTTLExceededPerIf Counter32,
smfIpv6TTLLargerThanPreviousPerIf Counter32,
smfIpv6HAVAssistsReqdPerIf Counter32,
smfIpv6DpdHeaderInsertionsPerIf Counter32

smfIpv6IfPerfIfIndex OBJECT-TYPE
SYNTAX     InterfaceIndexOrZero
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION "The ifIndex for this node interface
that is collecting this set of
performance management statistics.
For packets generated locally at
this node, performance counters
are assigned to the loopback
interface."
::= { smfIpv6InterfacePerfEntry 1 }

smfIpv6MultiPktsRecvPerIf OBJECT-TYPE
SYNTAX     Counter32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION "A counter of the number of
multicast IP packets received by the
device on this interface."
::= { smfIpv6InterfacePerfEntry 2 }

smfIpv6MultiPktsForwardedPerIf OBJECT-TYPE
SYNTAX     Counter32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION "A counter of the number of
multicast IP packets forwarded by the
device on this interface."
::= { smfIpv6InterfacePerfEntry 3 }

smfIpv6DuplMultiPktsDetectedPerIf OBJECT-TYPE
SYNTAX     Counter32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION "A counter of the number of duplicate
multicast IP packets detected by the
device on this interface.

::= { smfIpv6InterfacePerfEntry 4 }

smfIpv6DroppedMultiPktsTTLExceededPerIf  OBJECT-TYPE
SYNTAX      Counter32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
  "A counter of the number of dropped
  multicast IP packets by the
  device on this interface due to TTL
  exceeded."

::= { smfIpv6InterfacePerfEntry 5 }

smfIpv6TTLLargerThanPreviousPerIf  OBJECT-TYPE
SYNTAX      Counter32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
  "A counter of the total number of IPv6 packets
  received which have a TTL larger than that
  of a previously received identical packet.

::= { smfIpv6InterfacePerfEntry 6 }

smfIpv6HAVAssistsReqdPerIf  OBJECT-TYPE
SYNTAX      Counter32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
  "A counter of the total number of IPv6 packets
  received which required the HAV assist for DPD.

::= { smfIpv6InterfacePerfEntry 7 }

smfIpv6DpdHeaderInsertionsPerIf  OBJECT-TYPE
SYNTAX      Counter32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
  "A counter of the total number of IPv6 packets
  received which the device inserted the
  DPD header option.

::= { smfIpv6InterfacePerfEntry 8 }
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--
-- Notifications
--

smfMIBNotifControl OBJECT IDENTIFIER ::= { smfMIBNotifications 1 }
smfMIBNotifObjects OBJECT IDENTIFIER ::= { smfMIBNotifications 2 }
smfMIBNotifStates OBJECT IDENTIFIER ::= { smfMIBNotifications 3 }

-- smfMIBNotifControl
smfSetNotification OBJECT-TYPE
SYNTAX OCTET STRING (SIZE(4))
MAX-ACCESS read-write
STATUS current
DESCRIPTION
"A 4-octet string serving as a bit map for
the notification events defined by the SMF MIB
notifications. This object is used to enable
and disable specific SMF MIB notifications where
a 1 in the bit field represents enabled. The
right-most bit (least significant) represents
notification 0.

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

smfDpdMemoryOverflowThreshold OBJECT-TYPE
SYNTAX Integer32 (0..255)
MAX-ACCESS read-write
STATUS current
DESCRIPTION
"A threshold value for the
'smfDpdMemoryOverflowEvents' object.
If the number of occurrences exceeds
this threshold within the previous
number of seconds
'smfDpdMemoryOverflowWindow',
then the 'smfDpdMemoryOverflowEvent'
notification is sent."
::= { smfMIBNotifControl 2 }

smfDpdMemoryOverflowWindow OBJECT-TYPE
SYNTAX TimeTicks
MAX-ACCESS read-write
A time window value for the
'smfDpdMemoryOverflowEvents' object.
If the number of occurrences exceeds
the 'smfDpdMemoryOverflowThreshold'
within the previous number of seconds
'smfDpdMemoryOverflowWindow',
then the 'smfDpdMemoryOverflowEvent'
notification is sent.

::= { smfMIBNotifControl 3 }

smfIpv4DuplMultiPktsDetectedTotalThreshold

SYNTAX           Integer32 (0..255)
MAX-ACCESS       read-write
STATUS           current
DESCRIPTION      "A threshold value for the
'smfIpv4DuplMultiPktsDetectedTotal'
object. If the number of occurrences
exceeds this threshold within the
previous number of seconds
'smfIpv4DuplMultiPktsDetectedTotalWindow',
then the
'smfIpv4DuplMultiPktsDetectedTotalEvent'
notification is sent.

::= { smfMIBNotifControl 4 }

smfIpv4DuplMultiPktsDetectedTotalWindow

SYNTAX           TimeTicks
MAX-ACCESS       read-write
STATUS           current
DESCRIPTION      "A time window value for the
'smfIpv4DuplMultiPktsDetectedTotalEvents'
object. If the number of occurrences
exceeds the
'smfIpv4DuplMultiPktsDetectedTotalThreshold'
within the previous number of seconds
'smfIpv4DuplMultiPktsDetectedTotalWindow',
then the
'smfIpv4DuplMultiPktsDetectedTotalEvent'
notification is sent.

::= { smfMIBNotifControl 5 }
smfIpv6DuplMultiPktsDetectedTotalThreshold OBJECT-TYPE
SYNTAX Integer32 (0..255)
MAX-ACCESS read-write
STATUS current
DESCRIPTION
"A threshold value for the 'smfIpv6DuplMultiPktsDetectedTotal'
object. If the number of occurrences exceeds this threshold within the
previous number of seconds 'smfIpv6DuplMultiPktsDetectedTotalWindow',
then the 'smfIpv6DuplMultiPktsDetectedTotalEvent' notification is sent.
"
::= { smfMIBNotifControl 6 }

smfIpv6DuplMultiPktsDetectedTotalWindow OBJECT-TYPE
SYNTAX TimeTicks
MAX-ACCESS read-write
STATUS current
DESCRIPTION
"A time window value for the 'smfIpv6DuplMultiPktsDetectedTotalEvents'
object. If the number of occurrences exceeds the 'smfIpv6DuplMultiPktsDetectedTotalThreshold'
within the previous number of seconds 'smfIpv6DuplMultiPktsDetectedTotalWindow',
then the 'smfIpv6DuplMultiPktsDetectedTotalEvent' notification is sent.
"
::= { smfMIBNotifControl 7 }

-- smfMIBNotifObjects

smfAdminStatusChange NOTIFICATION-TYPE
OBJECTS { smfRouterIDAaddrType, -- The originator of
-- the notification.
    smfRouterID, -- The originator of
    smfAdminStatus -- The new status of the
    -- SMF process.
}
STATUS current
DESCRIPTION
"smfAdminStatusChange is a notification sent when a
the 'smfAdminStatus' object changes.
"
::= { smfMIBNotifObjects 1 }

smfConfiguredOpModeChange NOTIFICATION-TYPE
OBJECTS { smfRouterIDAddrType, -- The originator of
-- the notification.
    smfRouterID, -- The originator of
    -- the notification.
    smfConfiguredOpMode -- The new Operations
    -- Mode of the SMF
    -- process.
}
STATUS current
DESCRIPTION
"smfConfiguredOpModeChange is a notification
sent when a the 'smfConfiguredOpMode' object
changes.
"
::= { smfMIBNotifObjects 2 }

smfConfiguredRssaChange NOTIFICATION-TYPE
OBJECTS { smfRouterIDAddrType, -- The originator of
-- the notification.
    smfRouterID, -- The originator of
    -- the notification.
    smfConfiguredRssa -- The new RSSA for
    -- the SMF process.
}
STATUS current
DESCRIPTION
"smfAdminStatusChange is a notification sent when a
the 'smfConfiguredRssa' object changes.
"
::= { smfMIBNotifObjects 3 }

smfIfAdminStatusChange NOTIFICATION-TYPE
OBJECTS { smfRouterIDAddrType, -- The originator of
-- the notification.
    smfRouterID, -- The originator of
    -- the notification.
    smfIfIndex, -- The interface whose
    -- status has changed.
    smfIfAdminStatus -- The new status of the
    -- SMF interface.
}
smfIfAdminStatusChange is a notification sent when a the ‘smfIfAdminStatus’ object changes.

::= { smfMIBNotifObjects 4 }

smfDpdMemoryOverflowEvent NOTIFICATION-TYPE
OBJECTS { smfRouterIDAddrType, -- The originator of
smfRouterID, -- The originator of
smfDpdMemoryOverflow -- The counter of
-- the notification.
-- the notification.
-- the overflows.
}

smfDpdMemoryOverflowEvents is sent when the number of memory overflow events exceeds the ‘smfDpdMemoryOverflowThreshold’ within the previous number of seconds defined by the ‘smfDpdMemoryOverflowWindow’.

::= { smfMIBNotifObjects 5 }

smfIpv4DuplMultiPktsDetectedTotalEvents NOTIFICATION-TYPE
OBJECTS { smfRouterIDAddrType, -- The originator of
smfRouterID, -- The originator of
smfIpv4DuplMultiPktsDetectedTotal -- The
-- counter of detected
-- duplicates.
-- the notification.
-- the notification.
-- the notification.
}

smfIpv4DuplMultiPktsDetectedTotalEvents is a notification sent when the number of IPv4 duplicate packets detected exceeds the ‘smfIpv4DuplMultiPktsDetectedTotalThreshold’ during the previous number of seconds ‘smfIpv4DuplPktsDetectedTotalWindow’.

::= { smfMIBNotifObjects 6 }

smfIpv6DuplMultiPktsDetectedTotalEvents NOTIFICATION-TYPE
OBJECTS { smfRouterIDAddrType, -- The originator of
-- the notification.

smfRouterID,  -- The originator of
     --     the notification.
smfIpv6DuplMultiPktsDetectedTotal -- The
     --     counter of detected
     --     duplicates.

{ smfMIBNotifObjects 7 }

-- smfMIBNotifStates
--     is empty.

-- Compliance Statements
--

smfCompliances OBJECT IDENTIFIER ::= { smfMIBConformance 1 }
smfMIBGroups OBJECT IDENTIFIER ::= { smfMIBConformance 2 }

smfBasicCompliance MODULE-COMPLIANCE
  STATUS current
  DESCRIPTION "The basic implementation requirements for
     managed network entities that implement
     the SMF RSSA process."
  MODULE -- this module
  MANDATORY-GROUPS { smfCapabObjectsGroup,
                    smfConfigObjectsGroup }
::= { smfCompliances 1 }

smfFullCompliance MODULE-COMPLIANCE
  STATUS current
  DESCRIPTION "The full implementation requirements for
     managed network entities that implement
     the SMF RSSA process."
MODULE  -- this module
MANDATORY-GROUPS { smfCapabObjectsGroup,
  smfConfigObjectsGroup,
  smfStateObjectsGroup,
  smfPerfObjectsGroup,
  smfNotifObjectsGroup,
  smfNotificationsGroup

 ::= { smfCompliances 2 }

--
-- Units of Conformance
--

smfCapabObjectsGroup OBJECT-GROUP
OBJECTS {
  smfOpModeCapabilitiesName,
  smfOpModeCapabilitiesReference,
  smfRssaCapabilitiesName,
  smfRssaCapabilitiesReference
}

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

smfConfigObjectsGroup OBJECT-GROUP
OBJECTS {
  smfAdminStatus,
  smfRouterIDAddrType,
  smfRouterID,
  smfIfIndex,
  smfConfiguredOpMode,
  smfConfiguredRssa,
  smfRssaMember,
  smfIpv4Dpd,
  smfIpv6Dpd,
  smfMaxPktLifetime,
  smfDpdMaxMemorySize,
  smfDpdEntryMaxLifetime,
  smfNhdpRssaMesgTLVIncluded,
  smfNhdpRssaAddrBlockTLVIncluded,
  smfConfiguredAddrForwardingLastAddr,
  smfConfiguredAddrForwardingStatus,
smfIfAdminStatus,
smfIfRowStatus
}

DESCRIPTION
"Set of SMF configuration objects implemented
in this module."
::= { smfMIBGroups 2 }

smfStateObjectsGroup  OBJECT-GROUP
OBJECTS {
  smfNodeRsStatusIncluded,
  smfDpdMemoryOverflow,

  smfDiscoveredAddrForwardingLastAddr,
  smfDiscoveredAddrForwardingStatus,

  smfNeighborRSSA,
  smfNeighborNextHopInterface
}

DESCRIPTION
"Set of SMF state objects implemented
in this module."
::= { smfMIBGroups 3 }

smfPerfObjectsGroup  OBJECT-GROUP
OBJECTS {
  smfIpv4MultiPktsRecvTotal,
  smfIpv4MultiPktsForwardedTotal,
  smfIpv4DuplMultiPktsDetectedTotal,
  smfIpv4DroppedMultiPktsTTLExceededTotal,
  smfIpv4TTLLargerThanPreviousTotal,

  smfIpv6MultiPktsRecvTotal,
  smfIpv6MultiPktsForwardedTotal,
  smfIpv6DuplMultiPktsDetectedTotal,
  smfIpv6DroppedMultiPktsTTLExceededTotal,
  smfIpv6TTLLargerThanPreviousTotal,
  smfIpv6HAVAssistsReqdTotal,
  smfIpv6DpdHeaderInsertionsTotal,

  smfIpv4MultiPktsRecvPerIf,
  smfIpv4MultiPktsForwardedPerIf,
  smfIpv4DuplMultiPktsDetectedPerIf,
  smfIpv4DroppedMultiPktsTTLExceededPerIf,
  smfIpv4TTLLargerThanPreviousPerIf,
smfIpv6MultiPktsRecvPerIf,  
smfIpv6MultiPktsForwardedPerIf,  
smfIpv6DuplMultiPktsDetectedPerIf,  
smfIpv6DroppedMultiPktsTTLExceededPerIf,  
smfIpv6TTLLargerThanPreviousPerIf,  
smfIpv6HAVAssistsReqdPerIf,  
smfIpv6DpdHeaderInsertionsPerIf

}  
STATUS current  
DESCRIPTION  
"Set of SMF performance objects implemented in this module by total and per interface."
::= { smfMIBGroups 4 }

smfNotifObjectsGroup OBJECT-GROUP  
OBJECTS {  
smfSetNotification,  
smfDpdMemoryOverflowThreshold,  
smfDpdMemoryOverflowWindow,  
smfIpv4DuplMultiPktsDetectedTotalThreshold,  
smfIpv4DuplMultiPktsDetectedTotalWindow,  
smfIpv6DuplMultiPktsDetectedTotalThreshold,  
smfIpv6DuplMultiPktsDetectedTotalWindow

}  
STATUS current  
DESCRIPTION  
"Set of SMF notification control objects implemented in this module."
::= { smfMIBGroups 5 }

smfNotificationsGroup NOTIFICATION-GROUP  
NOTIFICATIONS {  
smfAdminStatusChange,  
smfConfiguredOpModeChange,  
smfConfiguredRssaChange,  
smfIfAdminStatusChange,  
smfDpdMemoryOverflowEvent,  
smfIpv4DuplMultiPktsDetectedTotalEvents,  
smfIpv6DuplMultiPktsDetectedTotalEvents

}  
STATUS current  
DESCRIPTION  
"Set of SMF notifications implemented in this module."
::= { smfMIBGroups 6 }
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 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

This section tracks the revision history in the development of this SMF-MIB. It will be removed from the final version of this document.

These changes were made from draft-ietf-manet-smf-mib-01 to draft-ietf-manet-smf-mib-02.
1. Added the NotificationGroup to the MIB and updated the ConformanceGroup.

2. Added the definition of an smfRouterID to the MIB. This is later used in the Notifications to indicate the origin of the event to the management station.

3. Removed the Router Priority object as this was used only in the eCDS algorithm and hence should be contained within the future eCDS-MIB.

4. Cleaned up the TEXTUAL CONVENTION for the ‘SmfOpMode’.

5. Filled in some of the missing text in various object descriptions.

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

1. Editorial changes to the textual material. These included the addition of the paragraphs on TEXTUAL-CONVENTIONS defined and imported into this MIB and relationships to other MIBs.

2. Identified those objects in the SMF-MIB requiring non-volatile storage.

3. Changed the name of the TEXTUAL-CONVENTION ‘Status’, defined within this MIB to ‘SmfStatus’.

Appendix B. Open Issues

This section contains the set of open issues related to the development and design of the SMF-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. The SMF draft states that use of the SMF Type Message TLV is optional and is used when the router runs NHDP. But the draft does not clearly state if the use of the SMF Address Block TLV is also optional.

2. Is it useful to track the effectiveness of the coverage of the current RSSA? Is it possible to track this?

3. Complete the security analysis and section.

4. 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-smf-xx.txt. This            *
* need to be replaced with the XXX RFC number.                *
*                                                             *
***************************************************************

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