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:

o

* 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:
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]

manetSmfMIB MODULE-IDENTITY
LAST-UPDATED "201101161300Z" -- January 16, 2011
ORGANIZATION "IETF MANET Working Group"
CONTACT-INFO
"WG E-Mail: manet@ietf.org
WG Chairs: ian.chakeres@gmail.com
jmacker@nrl.navy.mil

Editors: Robert G. Cole
US Army CERDEC
Space and Terrestrial Communications

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

Simplified Multicast Forwarding draft-ietf-manet-smf-10,
March 06, 2010.

Copyright (C) The IETF Trust (2008). This version
of this MIB module is part of RFC xxxx; see the RFC
itself for full legal notices."

-- 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."
-- RFC-Editor assigns XXXX
::= { 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 ::= { manetSmfMIB 0 }

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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
DESCRIPTION
"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 to 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.

" ::= { 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.

":= { 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 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.

":= { smfConfigurationGroup 7 }
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'.

smfNhdpRssaMsgTLVIncluded 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 }
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
}

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 }

The first address in the multicast scope range. The type of this address is determined by the value of the smfConfiguredAddrForwardingAddrType object.

 ::= { smfConfiguredAddrForwardingEntry 2 }

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
A counter of the total number of multicast IPv6 packets forwarded by the device.

A counter of the total number of duplicate multicast IPv6 packets detected by the device.

A counter of the total number of dropped multicast IPv6 packets by the device due to TTL exceeded.

A counter of the total number of IPv6 packets recceived which have a TTL larger than that of a previously received identical packet.

A counter of the total number of IPv6 packets recceived which have a TTL larger than that of a previously received identical packet.

A counter of the total number of IPv6 packets recceived which have a TTL larger than that of a previously received identical packet.
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 INTEGER (1...65535) }
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."
 ::= { smipv4InterfacePerfEntry 1 }

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."
 ::= { smipv4InterfacePerfEntry 2 }

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."
 ::= { smipv4InterfacePerfEntry 4 }

smfIpv4DroppedMultiPktsTTLExceededPerIf OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION "A counter of the number of multicast IP packets with TTL exceeded by the device on this interface."
 ::= { smipv4InterfacePerfEntry 3 }
SMF Interface Performance Table

SYNTAX       SEQUENCE OF SmfIpv6InterfacePerfEntry
MAX-ACCESS   not-accessible
STATUS       current
DESCRIPTION   "The SMF Interface Performance Table describes the SMF statistics per interface."
 ::= { smfIpv6InterfacePerfGroup 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,
   . . .
}
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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 }

--
-- 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
STATUS current
DESCRIPTION
"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 OBJECT-TYPE
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 OBJECT-TYPE
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 }

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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 { smfRouterIDAddrType, -- The originator of
          -- the notification.
            smfRouterID, -- The originator of
            -- the notification.
            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.
}

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

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

smfIpv6DuplMultiPktsDetectedTotalEvents NOTIFICATION-TYPE
OBJECTS { smfRouterIDAddrType, -- The originator of
         smfRouterID,     -- The originator of

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

}  

STATUS       current  
DESCRIPTION
"smfIpv6DuplMultiPktsDetectedTotal is a
notification sent when the number of
IPv6 duplicate packets detected exceeds the
'smfIpv6DuplMultiPktsDetectedTotalThreshold'
during the previous number of seconds
'smfIpv6DuplPktsDetectedTotalWindow'.
"

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

smfStateObjectsGroup OBJECT-GROUP
OBJECTS {
  smfNodeRsStatusIncluded,
  smfDpdMemoryOverflow,

  smfDiscoveredAddrForwardingLastAddr,
  smfDiscoveredAddrForwardingStatus,

  smfNeighborRSSA,
  smfNeighborNextHopInterface
}
STATUS current
DESCRIPTION "Set of SMF state objects implemented in this module."
::= { smfMIBGroups 3 }

smfPerfObjectsGroup OBJECT-GROUP
OBJECTS {
  smfIpv4MultiPktsRecvTotal,
  smfIpv4MultiPktsForwardedTotal,
  smfIpv4Dup1MultiPktsDetectedTotal,
  smfIpv4DroppedMultiPktsTTLExceededTotal,
  smfIpv4TTLLargerThanPreviousTotal,

  smfIpv6MultiPktsRecvTotal,
  smfIpv6MultiPktsForwardedTotal,
  smfIpv6Dup1MultiPktsDetectedTotal,
  smfIpv6DroppedMultiPktsTTLExceededTotal,
  smfIpv6TTLLargerThanPreviousTotal,
  smfIpv6HAVAssistsReqdTotal,
  smfIpv6DpdHeaderInsertionsTotal,

  smfIpv4MultiPktsRecvPerIf,
  smfIpv4MultiPktsForwardedPerIf,
  smfIpv4Dup1MultiPktsDetectedPerIf,
  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

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

Architecture for Describing Simple Network

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 RFCXXXX2 throughout this document point *
* to the current draft-ietf-manet-smf-xx.txt. This            *
* need to be replaced with the XXX RFC number.                *
*                                                          *
******************************************************

Authors’ Addresses

Robert G. Cole
US Army CERDEC
328 Hopkins Road, Bldg 245
Aberdeen Proving Ground, Maryland 21005
USA

Phone: +1 410 278 6779
EMail: robert.g.cole@us.army.mil
URI: http://www.cs.jhu.edu/~rgcole/

Joseph Macker
Naval Research Laboratory
Washington, D.C. 20375
USA

EMail: macker@itd.nrl.navy.mil

Brian Adamson
Naval Research Laboratory
Washington, D.C. 20375
USA

EMail: adamson@itd.nrl.navy.mil