Definition of Managed Objects for the IPv6 Routing Protocol for Low Power and Lossy Networks (RPL)
draft-sehgal-roll-rpl-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 defines objects for managing the IPv6 Routing Protocol for Low Power and Lossy Networks (RPL).

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1. Introduction

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols. In particular it defines objects for managing the IPv6 Routing Protocol for Low Power and Lossy Networks (RPL) ([I-D.ietf-roll-rpl]).

2. The Internet-Standard Management Framework

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

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

3. Conventions

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

4. Overview

The MIB module is organized into a group of scalars and tables.

```
| rplMib(1.3.6.1.2.1.8888) |
| +- rplNotifications(0) |
| +- rplObjects(1) |
| | +- rplGeneral(1) |
| | | | +- rwn RplDISMode rplDefaultDISMode(1) |
| | | +- rplActive(2) |
| | | | | +- rwn RplInstanceID rplActiveInstance(1) |
| | | | | +- rwn InetAddressIPv6 rplActiveDodag(2) |
| | | | | +- r-n Unsigned32 rplActiveDodagDAOSequence(3) |
| | | | | +- r-wn Unsigned32 rplActiveDodagTriggerSequence(4) |
```
5. Relationship to Other MIB Modules

The MIB module IMPORTS definitions from SNMPv2-SMI [RFC2578], SNMPv2-TC [RFC2579], SNMPv2-CONF [RFC2580], IF-MIB [RFC2863] and the INET-ADDRESS-MIB [RFC4001].

6. Definitions

RPL-MIB DEFINITIONS ::= BEGIN

IMPORTS
    MODULE-IDENTITY, OBJECT-TYPE, Unsigned32, Counter32, mib-2
    FROM SNMPv2-SMI -- RFC 2578
    TEXTUAL-CONVENTION, TruthValue
    FROM SNMPv2-TC -- RFC 2579
    OBJECT-GROUP, MODULE-COMPLIANCE
    FROM SNMPv2-CONF -- RFC 2580
    InterfaceIndex
    FROM IF-MIB -- RFC 2863
    InetAddressIPv6, InetAddressPrefixLength
    FROM INET-ADDRESS-MIB; -- RFC 4001
    -- XXX Are we sure RPL will never ever support a different
-- XXX version of IP?

rplMib MODULE-IDENTITY
  LAST-UPDATED "201110310000Z"
  ORGANIZATION
    "Jacobs University Bremen"
  CONTACT-INFO
    "Kevin Dominik Korte
       Jacobs University Bremen
       Email: k.korte@jacobs-university.de"
    Anuj Sehgal
       Jacobs University Bremen
       Email: s.anuj@jacobs-university.de
    Juergen Schoenwaelder
       Jacobs University Bremen
       Email: j.schoenwaelder@jacobs-university.de
    Tina Tsou
       Huawei Technologies
       Email: tena@huawei.com
    Cathy Zhou
       Huawei Technologies
       Email: cathyzhou@huawei.com"
  DESCRIPTION
    "The MIB module for monitoring nodes implementing the IPv6
     routing protocol for low power and lossy networks (RPL).

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     License set forth in Section 4.c of the IETF Trust's
     Legal Provisions Relating to IETF Documents
     (http://trustee.ietf.org/license-info)."
  REVISION "201110310000Z"
  DESCRIPTION
    "Initial version, published as RFC XXXX."
    -- RFC Ed.: replace XXXX with actual RFC number & remove this note

 ::= { mib-2 XXXX }

RplInstanceID ::= TEXTUAL-CONVENTION
DISPLAY-HINT "d"
STATUS current
DESCRIPTION "A global or local RPLInstanceID as defined in Section 5.1 of RFC YYYY."
REFERENCE "RFC YYYY: RPL: IPv6 Routing Protocol for LLNs"
SYNTAX Unsigned32 (0..255)

RplDodagVersionNumber ::= TEXTUAL-CONVENTION
DISPLAY-HINT "d"
STATUS current
DESCRIPTION "The version number of a DODAG as defined in Section 6.3 of RFC YYYY."
REFERENCE "RFC YYYY: RPL: IPv6 Routing Protocol for LLNs"
SYNTAX Unsigned32 (0..255)

RplRank ::= TEXTUAL-CONVENTION
DISPLAY-HINT "d"
STATUS current
DESCRIPTION "The rank of a node within a DODAG as defined in Section 6.3 of RFC YYYY."
REFERENCE "RFC YYYY: RPL: IPv6 Routing Protocol for LLNs"
SYNTAX Unsigned32 (0..65535)

RplObjectiveCodePoint ::= TEXTUAL-CONVENTION
DISPLAY-HINT "d"
STATUS current
DESCRIPTION "The Objective Code Point of a DODAG as defined in Section 6.7.6 of RFC YYYY."
REFERENCE "RFC YYYY: RPL: IPv6 Routing Protocol for LLNs"
SYNTAX Unsigned32 (0..65535)

RplDISMode ::= TEXTUAL-CONVENTION
STATUS current
DESCRIPTION "Determines whether a DIS message is send upon boot-up or not as defined in Section 17.2.1.1 of RFC YYYY:

silent(1) do not send DIS messages
send(2) send DIS messages"
REFERENCE
"RFC YYYY: RPL: IPv6 Routing Protocol for LLNs"
SYNTAX INTEGER { silent(1), send(2) }

RplModeOfOperation ::= TEXTUAL-CONVENTION
STATUS current
DESCRIPTION "Determines the mode of operation."
REFERENCE "RFC YYYY: RPL: IPv6 Routing Protocol for LLNs"
SYNTAX INTEGER { noDownwardRoutes(0), nonStoringMode(1), storingWithoutMulticastSupport(2), storingWithMulticastSupport(3) }

RplDAODelay ::= TEXTUAL-CONVENTION
DISPLAY-HINT "d"
STATUS current
DESCRIPTION "The delay time used for aggregation before a DAO message is send."
REFERENCE "RFC YYYY: RPL: IPv6 Routing Protocol for LLNs"
SYNTAX Unsigned32

RplDodagPreference ::= TEXTUAL-CONVENTION
DISPLAY-HINT "d"
STATUS current
DESCRIPTION "The preference of a DODAG compared to another DODAG of the same instance as defined in Section 6.3 of RFC YYYY."
REFERENCE "RFC YYYY: RPL: IPv6 Routing Protocol for LLNs"
SYNTAX Unsigned32 (0..7)

RplMinHopRankIncrease ::= TEXTUAL-CONVENTION
DISPLAY-HINT "d"
STATUS current
DESCRIPTION "The minimal incerease of a rank within a single hop as defined in Section 6.7.6 of RFC YYYY."
REFERENCE "RFC YYYY: RPL: IPv6 Routing Protocol for LLNs"
SYNTAX Unsigned32 (0..131071)
RplPathControlSize ::= TEXTUAL-CONVENTION
  DISPLAY-HINT "d"
  STATUS current
  DESCRIPTION
  "The Path Control Size within a DODAG as defined in
  Section 6.7.6 of RFC YYYY."
  REFERENCE
  "RFC YYYY: RPL: IPv6 Routing Protocol for LLNs"
  SYNTAX Unsigned32 (0..7)

-- object definitions

rplNotifications OBJECT IDENTIFIER ::= { rplMib 0 }
rplObjects OBJECT IDENTIFIER ::= { rplMib 1 }
rplConformance OBJECT IDENTIFIER ::= { rplMib 2 }

rplGeneral OBJECT IDENTIFIER ::= { rplObjects 1 }

rplDefaultDISMode OBJECT-TYPE
  SYNTAX RplDISMode
  MAX-ACCESS read-write
  STATUS current
  DESCRIPTION
  "Determines whether a DIS message is send upon boot-up."
  ::= { rplGeneral 1 }
  -- XXX should be able to configure the number of DIS messages
  -- XXX and related timer, see 17.2.1.1.
  -- XXX need to say something about persistence across reboots
  -- XXX Should there be more objects to configure default timers
  -- XXX etc that are applied to all DODAGs etc?

rplActive OBJECT IDENTIFIER ::= { rplObjects 2 }

rplActiveInstance OBJECT-TYPE
  SYNTAX RplInstanceID
  MAX-ACCESS read-write
  STATUS current
  DESCRIPTION
  "The currently active RPL Instance."
  ::= { rplActive 1 }
  -- XXX need to say something about persistence across reboots

rplActiveDodag OBJECT-TYPE
  SYNTAX InetAddressIPv6
  MAX-ACCESS read-write
  STATUS current
  DESCRIPTION
"The currently active RPL DODAG in the active RPL Instance."
::= { rplActive 2 }

rplActiveDodagDAOSequence OBJECT-TYPE
SYNTAX       Unsigned32 (0..255)
MAX-ACCESS   read-only
STATUS       current
DESCRIPTION   
"The DAO message sequence number (DAOSequence) of the active
DODAG as defined in Section 6.5.1 of RFC YYY."
REFERENCE    "RFC YYY: RPL: IPv6 Routing Protocol for LLNs"
::= { rplActive 3 }

rplActiveDodagTriggerSequence OBJECT-TYPE
SYNTAX       Unsigned32 (0..255)
MAX-ACCESS   read-write
STATUS       current
DESCRIPTION   
"The DAO Trigger Sequence Number (DTSN) of the active
DODAG as defined in Section 6.3.1 of RFC YYY."
REFERENCE    "RFC YYY: RPL: IPv6 Routing Protocol for LLNs"
::= { rplActive 4 }

rplOCPTable OBJECT-TYPE
SYNTAX       SEQUENCE OF RplOCPEntry
MAX-ACCESS   not-accessible
STATUS       current
DESCRIPTION   
"The table of all supported Objective Code Points (OCPs)."
::= { rplObjects 3 }

RplOCPEntry OBJECT-TYPE
SYNTAX       RplOCPEntry
MAX-ACCESS   not-accessible
STATUS       current
DESCRIPTION   
"An entry representing a supported Objective Code Point."
INDEX { rplOCPCodepoint }
::= { rplOCPTable 1 }

RplOCPEntry ::= SEQUENCE {
  rplOCPCodepoint  RplObjectiveCodePoint,
  rplOCPEnabled    TruthValue
}

rplOCPCodepoint OBJECT-TYPE
SYNTAX       RplObjectiveCodePoint
MAX-ACCESS   not-accessible
STATUS       current
DESCRIPTION  "A supported Objective Code Point."
::= { rplOCPEntry 1 }

rplOCPEnabled OBJECT-TYPE
SYNTAX       TruthValue
MAX-ACCESS   read-write
STATUS       current
DESCRIPTION  "Enables the usage of this Objective Code Point."
::= { rplOCPEntry 2 }
-- XXX need to say something about persistence across reboots

rplRPLInstanceTable OBJECT-TYPE
SYNTAX       SEQUENCE OF RplRPLInstanceEntry
MAX-ACCESS   not-accessible
STATUS       current
DESCRIPTION  "The table represents information about all known RPL Instances."
::= { rplObjects 4 }

rplRPLInstanceEntry OBJECT-TYPE
SYNTAX       RplRPLInstanceEntry
MAX-ACCESS   not-accessible
STATUS       current
DESCRIPTION  "An entry representing information about a RPL Instance."
INDEX { rplRPLInstanceID }
::= { rplRPLInstanceTable 1 }
-- XXX This should likely be a read-create table.

RplRPLInstanceEntry ::= SEQUENCE {
  rplRPLInstanceID                 RplInstanceID,
  rplRPLInstanceOCP                RplObjectiveCodePoint,
  rplRPLInstanceDisMode            RplDISMode,
  rplRPLInstanceDAOAcknowledgement INTEGER,
  rplRPLInstanceModeOfOperation    RplModeOfOperation
}

rplRPLInstanceID OBJECT-TYPE
SYNTAX       RplInstanceID
MAX-ACCESS   not-accessible
STATUS       current
DESCRIPTION
"The InstanceID of this RPL Instance."
::= { rplRPLInstanceEntry 1 }

rplRPLInstanceOCP OBJECT-TYPE
SYNTAX      RplObjectiveCodePoint
MAX-ACCESS  read-write
STATUS      current
DESCRIPTION
"The Objective Code Point of this RPL Instance."
::= { rplRPLInstanceEntry 2 }
-- XXX If this is read-write, what is the persistence?
-- XXX Support provisioning of table entries on border routers?
-- XXX If so, use StorageType and RowStatus?

rplRPLInstanceDisMode OBJECT-TYPE
SYNTAX      RplDISMode
MAX-ACCESS  read-write
STATUS      current
DESCRIPTION
"Determines whether a DIS message is send for this instance
upon boot-up."
::= { rplRPLInstanceEntry 3 }
-- XXX Check how this works together with the global toggle.
-- XXX should we allow per instance parameters such as the number
-- XXX of DIS messages and related timer, see 17.2.1.1?

rplRPLInstanceDAOAcknowledgement OBJECT-TYPE
SYNTAX      INTEGER {
    nope(1)
}
MAX-ACCESS  read-write
STATUS      current
DESCRIPTION
"The mode of Operation of the RPL instance."
::= { rplRPLInstanceEntry 4 }
-- XXX What is this? Kevin?
-- XXX persistence?

rplRPLInstanceModeOfOperation OBJECT-TYPE
SYNTAX      RplModeOfOperation
MAX-ACCESS  read-write
STATUS      current
DESCRIPTION
"The mode of Operation of the RPL instance."
::= { rplRPLInstanceEntry 5 }
-- XXX persistence?

rplDodagTable OBJECT-TYPE

SYNTAX     SEQUENCE OF RplDodagEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
  "The table represents information about all locally known DODAGs."
 ::= { rplObjects 5 }
-- XXX The root needs a bit(?) config, where does that go?

rplDodagEntry OBJECT-TYPE
SYNTAX     RplDodagEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
  "An entry representing information about a DODAG."
INDEX      { rplRPLInstanceID, rplDodagRoot }
 ::= { rplDodagTable 1 }

RplDodagEntry ::= SEQUENCE {
  rplDodagRoot                InetAddressIPv6,
  rplDodagVersion             RplDodagVersionNumber,
  rplDodagRank                RplRank,
  rplDodagState               INTEGER,
  rplDodagDAODelay            RplDAODelay,
  rplDodagPreference          RplDodagPreference,
  rplDodagMinHopRankIncrease  RplMinHopRankIncrease,
  rplDodagMaxRankIncrease     Unsigned32,
  rplDodagIntervalDoublings   Unsigned32,
  rplDodagIntervalMin         Unsigned32,
  rplDodagRedundancyConstant  Unsigned32,
  rplDodagPathControlSize     RplPathControlSize
}

rplDodagRoot OBJECT-TYPE
SYNTAX     InetAddressIPv6
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
  "The identifier of a DODAG root (DODAGID) of this RPL instance. The root of the DODAG reports its own IPv6 address as the DODAG root."
 ::= { rplDodagEntry 1 }

rplDodagVersion OBJECT-TYPE
SYNTAX     RplDodagVersionNumber
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The version of the DODAG in this RPL instance."
::= { rplDodagEntry 2 }

rplDodagRank OBJECT-TYPE
SYNTAX      RplRank
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION  "The rank of the node within the DODAG."
::= { rplDodagEntry 3 }

rplDodagState OBJECT-TYPE
SYNTAX      INTEGER {
             other(0),
             associated(1),
             grounded(2),
             floating(3)
          }  
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION  "The status of the DODAG:

other(0)    An unknown state.
associated(1) A node is associated with the RPL instance.
grounded(2)  The DODAG is grounded.
floating(3)  The DODAG is floating (not grounded).
"
::= { rplDodagEntry 4 }

rplDodagDAODelay OBJECT-TYPE
SYNTAX      RplDAODelay
UNITS       "milliseconds"
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION  "The delay for aggregations before a DAO is send."
::= { rplDodagEntry 5 }
-- XXX should this be configuration? If so we should add a default
-- clause to define the default value to be 1 second.

rplDodagPreference OBJECT-TYPE
SYNTAX      RplDodagPreference
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
"How preferred this DODAG is compared to other DODAGs
within the same instance."
 ::= { rplDodagEntry 6 }

rplDodagMinHopRankIncrease OBJECT-TYPE
SYNTAX RplMinHopRankIncrease
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The minimum increase of the rank in a single hop."
 ::= { rplDodagEntry 7 }
-- XXX should this be writable at the root? If so we should add a
-- defval clause to define the default value to be 256.

rplDodagMaxRankIncrease OBJECT-TYPE
SYNTAX Unsigned32 (0..65535)
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The maximum allowable increase in rank in support of local
repair. If DAGMaxRankIncrease is 0 then this mechanism is
disabled."
 ::= { rplDodagEntry 8 }
-- XXX should this be writable at the root? If so we should add a
-- defval clause to define the default value of 256.

rplDodagIntervalDoublings OBJECT-TYPE
SYNTAX Unsigned32 (0..255)
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The configured Imax of the DIO trickle timer."
 ::= { rplDodagEntry 9 }
-- XXX should this be writable at the root? If so we should add a
-- defval clause to define the default value of 20.

rplDodagIntervalMin OBJECT-TYPE
SYNTAX Unsigned32 (0..255)
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The configured Imin of the DIO trickle timer."
 ::= { rplDodagEntry 10 }
-- XXX should this be writable at the root? If so we should add a
-- defval clause to define the default value of 3.
rplDodagPathControlSize OBJECT-TYPE
SYNTAX RplPathControlSize
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The Path Control Size of this DODAG."
 ::= { rplDodagEntry 12 }

rplDodagParentTable OBJECT-TYPE
SYNTAX SEQUENCE OF RplDodagParentEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"The list of parents for a DODAG."
 ::= { rplObjects 6 }

rplDodagParentEntry OBJECT-TYPE
SYNTAX RplDodagParentEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Information about a known DODAG parent."
INDEX { rplRPLInstanceID, rplDodagRoot, rplDodagParentID }
 ::= { rplDodagParentTable 1 }

RplDodagParentEntry ::= SEQUENCE {
   rplDodagParentID InetAddressIPv6,
   rplDodagParentIf InterfaceIndex
}

rplDodagParentID OBJECT-TYPE
SYNTAX InetAddressIPv6
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"An RPL parent associated with this DODAG."
 ::= { rplDodagParentEntry 1 }

rplDodagParentIf OBJECT-TYPE
SYNTAX InterfaceIndex
MAX-ACCESS read-only
STATUS  current
DESCRIPTION
"The interface over which the parent can be reached."
::= { rplDodagParentEntry 2 }

rplDodagChildTable OBJECT-TYPE
SYNTAX  SEQUENCE OF RplDodagChildEntry
MAX-ACCESS  not-accessible
STATUS  current
DESCRIPTION
"The list of children for a DODAG."
::= { rplObjects 7 }

rplDodagChildEntry OBJECT-TYPE
SYNTAX  RplDodagChildEntry
MAX-ACCESS  not-accessible
STATUS  current
DESCRIPTION
"Information about a known DODAG child."
INDEX { rplRPLInstanceID, rplDodagRoot, rplDodagChildID }
::= { rplDodagChildTable 1 }

RplDodagChildEntry ::= SEQUENCE {
    rplDodagChildID InetAddressIPv6
}

rplDodagChildID OBJECT-TYPE
SYNTAX  InetAddressIPv6
MAX-ACCESS  read-only
STATUS  current
DESCRIPTION
"An RPL child associated with this DODAG."
::= { rplDodagChildEntry 1 }

rplDodagPrefixTable OBJECT-TYPE
SYNTAX  SEQUENCE OF RplDodagPrefixEntry
MAX-ACCESS  not-accessible
STATUS  current
DESCRIPTION
"List of prefixes associated with a DODAG."
::= { rplObjects 8 }
-- XXX Explain how this relates to the ipAddressPrefixTable in
-- XXX the IP-MIB

rplDodagPrefixEntry OBJECT-TYPE
SYNTAX  RplDodagPrefixEntry
MAX-ACCESS  not-accessible
STATUS  current
DESCRIPTION
"Information about a prefix associated with a DODAG."

INDEX { rplRPLInstanceID, rplDodagRoot,
        rplDodagPrefixIpv6Prefix, rplDodagPrefixIpv6PrefixLength }
 ::= { rplDodagPrefixTable 1 }

RplDodagPrefixEntry ::= SEQUENCE {
    rplDodagPrefixIpv6Prefix InetAddressIPv6,
    rplDodagPrefixIpv6PrefixLength InetAddressPrefixLength
}

rplDodagPrefixIpv6Prefix OBJECT-TYPE
SYNTAX InetAddressIPv6
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The IPv6 address forming the IPv6 prefix."
 ::= { rplDodagPrefixEntry 1 }

rplDodagPrefixIpv6PrefixLength OBJECT-TYPE
SYNTAX InetAddressPrefixLength
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The length of the IPv6 prefix."
 ::= { rplDodagPrefixEntry 2 }

-- XXX The routing table should be exposed via the inetCidrRouteTable
-- XXX defines in the IP-FORWARD-MIB (RFC 4292). We need to clarify
-- XXX whether the inetCidrRoutePolicy can / should point to the DODAG
-- XXX instance. Furthermore, this document should request that IANA
-- XXX allocates a number for RPL in the IANAipRouteProtocol TC.

rplStats OBJECT IDENTIFIER ::= { rplObjects 9 }

rplStatsMemOverflows OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of memory allocation failures (e.g., routing table
overflows)."
 ::= { rplStats 1 }

rplStatsValidParentFailures OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of times a packet could not be sent to a DODAG parent flagged as valid."
 ::= { rplStats 2 }

rplStatsNoInstanceIDs OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of times a packet could not be sent because of a missing RPLInstanceID."
 ::= { rplStats 3 }

rplStatsTriggeredLocalRepairs OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of times a local repair procedure was triggered."
 ::= { rplStats 4 }

rplStatsTriggeredGlobalRepairs OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of times a global repair procedure was triggered."
 ::= { rplStats 5 }

rplStatsParseErrors OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of received malformed messages."
 ::= { rplStats 6 }

rplStatsNoParentSecs OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of seconds without a next hop (DODAG parent)."
 ::= { rplStats 7 }

rplStatsActiveNoParentSecs OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION  "The number of seconds with packets to forward without a
              next hop (DODAG parent)."
 ::= { rplStats 8 }

rplStatsOBitSetDownwards OBJECT-TYPE
SYNTAX      Counter32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION  "Number of packets received with the 'O' bit set from
              a node with a higher rank."
 ::= { rplStats 9 }

rplStatsOBitClearedUpwards OBJECT-TYPE
SYNTAX      Counter32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION  "Number of packets received with the 'O' bit cleared
              from a node with a lower rank."
 ::= { rplStats 10 }

rplStatsFBitSet OBJECT-TYPE
SYNTAX      Counter32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION  "Number of packets received with the 'F' bit set."
 ::= { rplStats 11 }

rplStatsRBitSet OBJECT-TYPE
SYNTAX      Counter32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION  "Number of packets received with the 'R' bit set."
 ::= { rplStats 12 }

-- XXX There seem to be additional local error events to count, see
-- XXX for example Section 11.2. (rank errors, forwarding errors, ...)

-- XXX RPL security has not been looked at.

rplGroups      OBJECT IDENTIFIER ::= { rplConformance 1 }
rplCompliances OBJECT IDENTIFIER ::= { rplConformance 2 }
rplFullCompliance MODULE-COMPLIANCE
STATUS current
DESCRIPTION "Compliance statement for implementations supporting read/write access, according to the object definitions."
MODULE -- this module
MANDATORY-GROUPS {
   rplGeneralGroup,
   rplInstanceGroup,
   rplStatsGroup
}
::= { rplCompliances 1 }

rplReadOnlyCompliance MODULE-COMPLIANCE
STATUS current
DESCRIPTION "Compliance statement for implementations supporting only readonly access."
MODULE -- this module
MANDATORY-GROUPS {
   rplGeneralGroup,
   rplInstanceGroup,
   rplStatsGroup
}
::= { rplCompliances 2 }
-- XXX Need to list all writable objects to declare them
-- XXX readonly.

rplGeneralGroup OBJECT-GROUP
OBJECTS {
   rplDefaultDISMode,
   rplActiveInstance,
   rplActiveDodag,
   rplActiveDodagDAOSequence,
   rplActiveDodagTriggerSequence,
   -- rplOCPCodepoint,
   rplOCPEnabled
}
STATUS current
DESCRIPTION "A collection of objects providing general information about the RPL implementation."
::= { rplGroups 1 }

rplInstanceGroup OBJECT-GROUP
OBJECTS {
   -- rplRPLInstanceID,
   rplRPLInstanceOCP,
rplRPLInstanceDisMode,
rplRPLInstanceDAOAcknowledgement,
rplRPLInstanceModeOfOperation,
-- rplDodagRoot,
rplDodagVersion,
rplDodagRank,
rplDodagState,
rplDodagDAODelay,
rplDodagPreference,
rplDodagMinHopRankIncrease,
rplDodagMaxRankIncrease,
rplDodagIntervalDoublings,
rplDodagIntervalMin,
rplDodagRedundancyConstant,
rplDodagPathControlSize,
-- rplDodagParentID,
rplDodagParentIf,
rplDodagChildID,
rplDodagPrefixIpv6Prefix,
rplDodagPrefixIpv6PrefixLength
}
STATUS current
DESCRIPTION
"A collection of objects providing insight into the RPL
Instances and the DODAGs."
::= { rplGroups 2 }

rplStatsGroup OBJECT-GROUP
OBJECTS {
  rplStatsMemOverflows,
rplStatsValidParentFailures,
rplStatsNoInstanceIDs,
rplStatsTriggeredLocalRepairs,
rplStatsTriggeredGlobalRepairs,
rplStatsParseErrors,
rplStatsNoParentSecs,
rplStatsActiveNoParentSecs,
rplStatsOBitSetDownwards,
rplStatsOBitClearedUpwards,
rplStatsFBitSet,
rplStatsRBitSet
}
STATUS current
DESCRIPTION
"A collection of objects providing statistics about the
RPL implementation."
::= { rplGroups 3 }
7. Security Considerations

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:

- rplActiveInstance: [TBD] explain sensitivity

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: Need to describe vulnerabilities here.]

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.

8. IANA Considerations

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.

9. References

9.1. Normative References


9.2. Informative References

Appendix A. Open Issues

Should there be basic DIS/DIO/DAO/DAO-ACK message counters?

Should we reveal the internal trickle variables? Right now, we only allow to read the configured trickle parameters.

Should we model objective functions, e.g. by introducing a table that includes things such as MinHopRankIncrease and MaxRankIncrease?

Should we report the mode (storing mode, non-storing mode)?

Check the various issues marked with XXX in the RPL-MIB itself.

Authors’ Addresses

Kevin Korte
Jacobs University
Campus Ring 1
Bremen 28759
Germany

EMail: k.korte@jacobs-university.de

Juergen Schoenwaelder
Jacobs University
Campus Ring 1
Bremen 28759
Germany

EMail: j.schoenwaelder@jacobs-university.de

Anuj Sehgal
Jacobs University
Campus Ring 1
Bremen 28759
Germany

EMail: s.anuj@jacobs-university.de
Tina Tsou  
Huawei Technologies  
Bantian, Longgang District  
Shenzhen  518129  
P.R. China  
EMail: tena@huawei.com

Cathy Zhou  
Huawei Technologies  
Bantian, Longgang District  
Shenzhen  518129  
P.R. China  
EMail: cathyzhou@huawei.com