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K. Korte
J. Schoenwaelder
A. Sehgal
Jacobs University
T. Tsou
Huawei Technologies (USA)
C. Zhou
Huawei Technologies
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Definition of Managed Objects for the IPv6 Routing Protocol for Low
Power and Lossy Networks (RPL)
draft-sehgal-roll-rpl-mib-03

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](#)]. It also provides management access to the Trickle [[RFC6206](#)] parameters as they are used by 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.

RPL-MIB registration tree (generated by smidump 0.4.8)

```

-rplMib(1.3.6.1.2.1.XXX)
+-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)
  | +- rwn Unsigned32 rplActiveDodagTriggerSequence(4)
+-rplOCPTable(3)
  | +-rplOCPEntry(1) [rplOCPCodepoint]

```

```

  | +- --- RplObjectiveCodePoint rplOCPCodepoint(1)
  | +- rwn TruthValue rplOCPEnabled(2)
+-rplRPLInstanceTable(4)
  | +-rplRPLInstanceEntry(1) [rplRPLInstanceID]
  | | +- --- RplInstanceID rplRPLInstanceID(1)
  | | +- rwn RplObjectiveCodePoint rplRPLInstanceOCP(2)
  | | +- rwn RplDISMode rplRPLInstanceDisMode(3)
  | | +- rwn Enumeration rplRPLInstanceDAOAcknowledgement(4)
  | | +- rwn RplModeOfOperation rplRPLInstanceModeOfOperation(5)
+-rplDodagTable(5)
  | +-rplDodagEntry(1) [rplRPLInstanceID,rplDodagRoot]
  | | +- --- InetAddressIPv6 rplDodagRoot(1)
  | | +- r-n RplDodagVersionNumber rplDodagVersion(2)
  | | +- r-n RplRank rplDodagRank(3)
  | | +- r-n Enumeration rplDodagState(4)
  | | +- r-n RplDAODelay rplDodagDAODelay(5)
  | | +- r-n RplDodagPreference rplDodagPreference(6)
  | | +- r-n RplMinHopRankIncrease rplDodagMinHopRankIncrease(7)
  | | +- r-n Unsigned32 rplDodagMaxRankIncrease(8)
  | | +- rwn Unsigned32 rplDodagIntervalDoublings(9)
  | | +- rwn Unsigned32 rplDodagIntervalMin(10)
  | | +- rwn Unsigned32 rplDodagRedundancyConstant(11)
  | | +- r-n RplPathControlSize rplDodagPathControlSize(12)
+-rplDodagParentTable(6)
  | +-rplDodagParentEntry(1) [rplRPLInstanceID,rplDodagRoot,
  | | | rplDodagParentID]
  | | +- --- InetAddressIPv6 rplDodagParentID(1)
  | | +- r-n InterfaceIndex rplDodagParentIf(2)
+-rplDodagChildTable(7)

```

```

|   +-rplDodagChildEntry(1) [rplRPLInstanceID,rplDodagRoot,
|   |                         rplDodagChildID]
|   +- r-n InetAddressIPv6 rplDodagChildID(1)
+-rplDodagPrefixTable(8)
|   +-rplDodagPrefixEntry(1) [rplRPLInstanceID,rplDodagRoot,
|   |                         rplDodagPrefixIpv6Prefix,
|   |                         rplDodagPrefixIpv6PrefixLength]
|   +- r-n InetAddressIPv6      rplDodagPrefixIpv6Prefix(1)
|   +- r-n InetAddressPrefixLength
|   |                         rplDodagPrefixIpv6PrefixLength(2)
+-rplStats(9)
|   +- r-n Counter32 rplMemOverflows(1)
|   +- r-n Counter32 rplParseErrors(2)
|   +- r-n Counter32 rplUnknownMsgTypes(3)
|   +- r-n Counter32 rplSecurityPolicyViolations(4)
|   +- r-n Counter32 rplIntegrityCheckFailures(5)
|   +- r-n Counter32 rplReplayProtectionFailures(6)
|   +- r-n Counter32 rplValidParentFailures(7)
|   +- r-n Counter32 rplNoInstanceIDs(8)

```

```

|   +- r-n Counter32 rplTriggeredLocalRepairs(9)
|   +- r-n Counter32 rplTriggeredGlobalRepairs(10)
|   +- r-n Counter32 rplNoParentSecs(11)
|   +- r-n Counter32 rplActiveNoParentSecs(12)
|   +- r-n Counter32 rpl0BitSetDownwards(13)
|   +- r-n Counter32 rpl0BitClearedUpwards(14)
|   +- r-n Counter32 rplFBitSet(15)
|   +- r-n Counter32 rplRBitSet(16)
|   +- r-n Counter32 rplTrickleTimerResets(17)
+-rplMsgStatsTable(10)
|   +-rplMsgStatsEntry(1) [rplMsgStatsType]
|   |   +- --- RplMessageType rplMsgStatsType(1)
|   |   +- r-n Counter32      rplMsgStatsInMsgs(2)
|   |   +- r-n Counter32      rplMsgStatsOutMsgs(3)

```

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](#)].

The IPv6 routing table should be exposed via the inetCidrRouteTable

defined in the IP-FORWARD-MIB [[RFC4292](#)]. XXX: We need to clarify whether the inetCidrRoutePolicy can / should point to the DODAG instance.

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
```

```
rplMib MODULE-IDENTITY
```

```
    LAST-UPDATED "201110310000Z"
```

```
    ORGANIZATION
```

```
        "Jacobs University Bremen"
```

```
    CONTACT-INFO
```

```
        "Kevin Dominik Korte"
```

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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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REVISION "201110310000Z"

DESCRIPTION

"Initial version, published as RFC XXXX."

-- RFC Ed.: replace XXXX with actual RFC number & remove this note

::= { mib-2 XXXX }

-- XXX: Do we keep all types (textual conventions) defined below or
-- XXX do we inline those that only get used once?

RplMessageType ::= TEXTUAL-CONVENTION

DISPLAY-HINT "d"

STATUS current

DESCRIPTION

"The type of an RPL control message."

REFERENCE

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"RFC YYYY: RPL: IPv6 Routing Protocol for LLNs as defined in [Section 6](#) of RFC YYYY."

SYNTAX Unsigned32 (0..255)

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


```

        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.

Changes to this value may not persist across restarts."

::= { rplGeneral 1 }

-- XXX should be able to configure the number of DIS messages

-- XXX and related timer, see 18.2.1.1.

-- 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. Changes to this value

may not persist across restarts."
 ::= { rplActive 1 }

rplActiveDodag OBJECT-TYPE

SYNTAX InetAddressIPv6

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"The currently active RPL DODAG in the active RPL Instance.

Changes to this value may not persist across restarts."

::= { 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 YYYY."

REFERENCE

"RFC YYYY: 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 YYYY. Changes to
this value may not persist across restarts."

REFERENCE

"RFC YYYY: 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. Changes to
         this value may not persist across restarts."
    ::= { rplOCPEntry 2 }

```

```

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. Changes to
         this value may not persist across restarts."
    ::= { rplRPLInstanceEntry 2 }

```

```

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. Changes to this value may not persist across
         restarts."

```

```
::= { 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. Changes to this value may not persist across restarts."

```
::= { rplRPLInstanceEntry 4 }
```

-- XXX What is this? Kevin?

rplRPLInstanceModeOfOperation OBJECT-TYPE

```
SYNTAX      RplModeOfOperation
```

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"The mode of Operation of the RPL instance. Changes to this

value may not persist across restarts."

```
::= { rplRPLInstanceEntry 5 }
```

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 }

rplDodagIntervalDoublings OBJECT-TYPE

SYNTAX Unsigned32 (0..255)

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"The configured Imax of the DIO trickle timer. This is typically only writable at the root. Changes to this value may not persist across restarts."

REFERENCE

"[RFC 6206](#): The Trickle Algorithm"

DEFVAL { 20 }

::= { rplDodagEntry 9 }

rplDodagIntervalMin OBJECT-TYPE

SYNTAX Unsigned32 (0..255)

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"The configured Imin of the DIO trickle timer. Changes to this

```
        value may not persist across restarts."
REFERENCE
    "RFC 6206: The Trickle Algorithm"
DEFVAL      { 3 }
 ::= { rplDodagEntry 10 }

rplDodagRedundancyConstant OBJECT-TYPE
    SYNTAX      Unsigned32 (0..255)
    MAX-ACCESS   read-write
    STATUS       current
    DESCRIPTION
        "The configured k of the DIO trickle timer. Changes to this
        value may not persist across restarts."
    REFERENCE
        "RFC 6206: The Trickle Algorithm"
    DEFVAL      { 10 }
    ::= { rplDodagEntry 11 }

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
}
```

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```
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 }

rplStats OBJECT IDENTIFIER ::= { rplObjects 9 }

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

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rplParseErrors OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of received malformed messages."
::= { rplStats 2 }

rplUnknownMsgTypes OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of received RPL messages that we dropped because the message type is not recognized by the implementation."
::= { rplStats 3 }

rplSecurityPolicyViolations OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of messages discarded because the described level of security for the message type and originator is unknown or does not meet locally maintained security policies as defined in [Section 10.7.](#) of RFC YYYY."

::= { rplStats 4 }

rplIntegrityCheckFailures OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of messages discarded because the integrity check failed against the received message authentication code (MAC) as defined in [Section 10.7](#). of RFC YYYY."

::= { rplStats 5 }

rplReplayProtectionFailures OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of messages discarded because the received message Counter value is non-zero and less than the maintained incoming Counter watermark or because the received Timestamp Counter value indicates a message transmission time that is earlier than the Current time

less the acceptable packet delay as defined in [Section 10.7](#). of RFC YYYY. This counter is also incremented if the temporal consistency check of the message fails as defined in [Section 10.7.1](#)."

::= { rplStats 6 }

rplValidParentFailures 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 7 }

rplNoInstanceIDs 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 8 }

rplTriggeredLocalRepairs OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of times a local repair procedure was triggered."

::= { rplStats 9 }

rplTriggeredGlobalRepairs OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of times a global repair procedure was triggered."

::= { rplStats 10 }

rplNoParentSecs OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of seconds without a next hop (DODAG parent)."

::= { rplStats 11 }

rplActiveNoParentSecs 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 12 }

rplOBitSetDownwards 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 as defined in [Section 18.3.2](#)
of RFC YYYY."
::= { rplStats 13 }

rplOBitClearedUpwards 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 as defined in [Section 18.3.2](#)
of RFC YYYY."
::= { rplStats 14 }

rplFBitSet OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Number of packets received with the 'F' bit set as
defined in [Section 18.3.2](#) of RFC YYYY."
::= { rplStats 15 }

rplRBitSet OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"Number of packets received with the 'R' bit set as
defined in [Section 18.3.2](#) of RFC YYYY."
::= { rplStats 16 }

rplTrickleTimerResets OBJECT-TYPE

SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of trickle timer resets."


```

 ::= { rplStats 17 }

rplMsgStatsTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF RplMsgStatsEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Basic RPL message statistics by message type."
    ::= { rplObjects 10 }

rplMsgStatsEntry OBJECT-TYPE
    SYNTAX      RplMsgStatsEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Statistics for a specific RPL message type."
    INDEX { rplMsgStatsType }
    ::= { rplMsgStatsTable 1 }

RplMsgStatsEntry ::= SEQUENCE {
    rplMsgStatsType      RplMessageType,
    rplMsgStatsInMsgs    Counter32,
    rplMsgStatsOutMsgs   Counter32
}

rplMsgStatsType OBJECT-TYPE
    SYNTAX      RplMessageType
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The RPL message type being counted by this row."
    ::= { rplMsgStatsEntry 1 }

rplMsgStatsInMsgs OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of RPL messages received of this type."
    ::= { rplMsgStatsEntry 2 }

rplMsgStatsOutMsgs OBJECT-TYPE
    SYNTAX      Counter32

```

```
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
    "The number of RPL messages sent of this type."
 ::= { rplMsgStatsEntry 3 }
```

```
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
}
}
```

```
OBJECT rplDefaultDISMode
MIN-ACCESS  read-only
DESCRIPTION
    "Write access is not required."
```

```
OBJECT rplActiveInstance
MIN-ACCESS  read-only
DESCRIPTION
    "Write access is not required."
```

```
OBJECT rplActiveDodag
MIN-ACCESS  read-only
DESCRIPTION
    "Write access is not required."
```

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OBJECT rplActiveDodagTriggerSequence
MIN-ACCESS read-only
DESCRIPTION

"Write access is not required."

OBJECT rplOCPEnabled
MIN-ACCESS read-only
DESCRIPTION

"Write access is not required."

OBJECT rplRPLInstanceOCP
MIN-ACCESS read-only
DESCRIPTION

"Write access is not required."

OBJECT rplRPLInstanceDisMode
MIN-ACCESS read-only
DESCRIPTION

"Write access is not required."

OBJECT rplRPLInstanceDAOAcknowledgement
MIN-ACCESS read-only
DESCRIPTION

"Write access is not required."

OBJECT rplRPLInstanceModeOfOperation
MIN-ACCESS read-only
DESCRIPTION

"Write access is not required."

OBJECT rplDodagIntervalDoublings
MIN-ACCESS read-only
DESCRIPTION

"Write access is not required."

OBJECT rplDodagIntervalMin
MIN-ACCESS read-only
DESCRIPTION

"Write access is not required."

OBJECT rplDodagRedundancyConstant
MIN-ACCESS read-only

DESCRIPTION

"Write access is not required."

::= { rplCompliances 2 }

rplGeneralGroup OBJECT-GROUP

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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 {

```

```

        rplMemOverflows,
        rplParseErrors,
        rplUnknownMsgTypes,
        rplSecurityPolicyViolations,
        rplIntegrityCheckFailures,
        rplReplayProtectionFailures,
        rplValidParentFailures,
        rplNoInstanceIDs,
        rplTriggeredLocalRepairs,
        rplTriggeredGlobalRepairs,
        rplNoParentSecs,
        rplActiveNoParentSecs,
        rplOBitSetDownwards,
        rplOBitClearedUpwards,
        rplFBitSet,
        rplRBitSet,
        rplTrickleTimerResets,
        -- rplMsgStatsType,
        rplMsgStatsInMsgs,
        rplMsgStatsOutMsgs
    }
    STATUS          current
    DESCRIPTION
        "A collection of objects providing statistics about the
        RPL implementation."
    ::= { rplGroups 3 }

```

END

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:

- o 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 "XXXX" 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 "XXXX" (here and in the MIB module) with the assigned value and to remove this note.

IANA has allocated a number for RPL in the IANAipRouteProtocol textual convention of the IANA-RTPROTO-MIB.

9. Acknowledgements

Thanks to Michael Richardson for helpful comments during the development of this specification.

10. References

10.1. Normative References

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[Appendix A.](#) Open Issues

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

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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 (USA)
2330 Central Expressway
Santa Clara CA 95050
USA

EMail: tina.tsou.zouting@huawei.com

Cathy Zhou
Huawei Technologies
Bantian, Longgang District
Shenzhen 518129
P.R. China

EMail: cathyzhou@huawei.com