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6LoWPAN Management Information Base
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Status of This Memo

Abstract

This draft defines a portion of the Management Information Base (MIB), the lowpan MIB for use with network management protocols. In particular it defines objects for managing functions related to a 6LoWPAN entity.

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1. Introduction

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This draft defines a portion of the Management Information Base (MIB), the lowpan MIB for use with network management protocols.In particular it defines objects for managing functions related to a 6LoWPAN entity.

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2. The Internet-Standard Management Framework

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For a detailed overview of the documents that describe the current Internet-Standard Management Framework, please refer to section 7 of RFC 3410 [RFC3410] (Case, J., Mundy, R., Partain, D., and B. Stewart, "Introduction and Applicability Statements for Internet-Standard Management Framework," December 2002.).
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 compliant to the SMIv2, which is described in STD 58, RFC 2578 [RFC2578] (McCloghrie, K., Ed., Perkins, D., Ed., and J. Schoenwaelder, Ed., "Structure of Management Information Version 2 (SMIv2)," April 1999.), STD 58, RFC 2579 [RFC2579] (McCloghrie, K., Ed., Perkins, D., Ed., and J. Schoenwaelder, Ed., "Textual Conventions for SMIv2," April 1999.) and STD 58, RFC 2580 [RFC2580] (McCloghrie, K., Perkins, D., and J. Schoenwaelder, "Conformance Statements for SMIv2," April 1999.).

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3. Conventions

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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] (Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels," March 1997.).

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4. Overview

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4.1. IPv6 over Wireless PAN (6LoWPAN)

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Low-power wireless personal area networks (LoWPANs) comprise devices that conform to the IEEE 802.15.4-2003 standard by the IEEE [IEEE802.15.4]. IEEE 802.15.4 devices are characterized by short range, low bit rate, low power and low cost. Many of the devices employing IEEE 802.15.4 radios will be limited in their computational power, memory, and/or energy availability.

This document defines a set of managed objects (MOs) that can be used to monitor and control 6LoWPAN entities.

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5. Relationship to Other MIB Modules

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Some management objects defined in other MIB modules are applicable to an entity implementing this MIB. In particular, it is assumed that an entity implementing the 6LoWPAN-MIB module will also implement the 'system' group of the SNMPv2-MIB [RFC3418] (Presuhn, R., "Management Information Base (MIB) for the Simple Network Management Protocol (SNMP)," December 2002.) and the 'interfaces' group of the IF-MIB [RFC2863] (McCloghrie, K. and F. Kastenholz, "The Interfaces Group MIB," June 2000.). The description of how certain objects in the IF-MIB are used is TBD.

5.1. Relationship to the SNMPv2-MIB

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The 'system' group in the SNMPv2-MIB [RFC3418] (Presuhn, R., "Management Information Base (MIB) for the Simple Network Management Protocol (SNMP)," December 2002.) 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 6LoWPAN-MIB does not duplicate those objects.

5.2. MIB modules required for IMPORTS

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The following MIB module IMPORTS objects from SNMPv2-SMI [RFC2578] (McCloghrie, K., Ed., Perkins, D., Ed., and J. Schoenwaelder, Ed., "Structure of Management Information Version 2 (SMIv2)," April 1999.), SNMPv2-TC [RFC2579] (McCloghrie, K., Ed., Perkins, D., Ed., and J. Schoenwaelder, Ed., "Textual Conventions for SMIv2," April 1999.) and SNMPv2-CONF [RFC2580] (McCloghrie, K., Perkins, D., and J. Schoenwaelder, "Conformance Statements for SMIv2," April 1999.)

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6. Definitions

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```
LOWPAN-TC-MIB DEFINITIONS ::= BEGIN
       IMPORTS
              TEXTUAL-CONVENTION
                FROM SNMPv2-TC
              MODULE-IDENTITY, mib-2
                FROM SNMPv2-SMI;


        -- definition of textual conventions

    lowpanTCMIB    MODULE-IDENTITY
        LAST-UPDATED    "200909260012Z"
        ORGANIZATION    "IETF 6LoWPAN Working Group"
        CONTACT-INFO    "Ki-Hyung Kim
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Support Group E-mail: 6lowpan@ietf.org"

```
    DESCRIPTION     "A MIB module containing textual conventions
                    for 6LoWPAN data types. This module
                    addresses an immediate need for data types not
                    directly supported in the SMIv2.

                    Copyright (C) The Internet Society 2007.  This
                    version of this MIB module is part of RFC XXXX;
                    see the RFC itself for full legal notices."
  -- RFC Ed.: replace XXXX with actual RFC number & remove this note

    REVISION        "200909260012Z"
    DESCRIPTION        "Initial version, published as RFC XXXX."
-- RFC Ed.: replace XXXX with actual RFC number & remove this note

    ::=  {  mib-2  XXX  } -- will be assigned by IANA

  -- IANA Reg.: Please assign a value for "XXX" under the 'mib-2'
  -- subtree and record the assignment in the SMI Numbers registry.

  -- RFC Ed.: When the above assignment has been made, please
  --     remove the above note
  --     replace "XXX" here with the assigned value and
  --     remove this note.

   LowpanIEEEEUI64Address ::= TEXTUAL-CONVENTION
          DISPLAY-HINT "1x:"
          STATUS        current
          DESCRIPTION
                  "The IEEE defined 64-bit extended unique
                  identifier (EUI-64) is a concatenation of the
                  24-bit company_id value by the IEEE Registration
                  Authority and a 40-bit extension identifier
                  assigned by the organization with that company_id
                  assignment."
          REFERENCE
```

```
                    "IEEE 64-BIT GLOBAL IDENTIFIER (EUI64)"
              SYNTAX  OCTET STRING (SIZE (8))

        LowpanShortAddress ::= TEXTUAL-CONVENTION
             DISPLAY-HINT "1x:"
             STATUS       current
             DESCRIPTION
                     "The 16-bit Short Address used for 802.15.4
                     networks."
             REFERENCE
                     "IEEE Std 802.15.4 specifications"
             SYNTAX       OCTET STRING (SIZE (2))

       END


6LOWPAN-MIB    DEFINITIONS ::= BEGIN
    IMPORTS
        TruthValue
            FROM SNMPv2-TC
        OBJECT-GROUP, MODULE-COMPLIANCE
            FROM SNMPv2-CONF
        MODULE-IDENTITY, OBJECT-TYPE, Unsigned32,mib-2
            FROM SNMPv2-SMI
        LowpanIEEEEUI64Address, LowpanShortAddress
            FROM LOWPAN-TC-MIB;

    6lowpanMIB    MODULE-IDENTITY
        LAST-UPDATED    "200909260012Z"
        ORGANIZATION    "IETF 6LoWPAN Working Group"
        CONTACT-INFO    "Ki-Hyung Kim
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                    Email: soohong.park@samsung.com

                    Support Group E-mail: 6lowpan@ietf.org"

    DESCRIPTION     "The MIB module for monitoring 6LoWPAN
                    entities.

                    Copyright (C) The Internet Society 2007.  This
                    version of this MIB module is part of RFC XXXX;
                    see the RFC itself for full legal notices."
  -- RFC Ed.: replace XXXX with actual RFC number & remove this note

    REVISION        "200909260012Z"
    DESCRIPTION        "Initial version, published as RFC XXXX."
-- RFC Ed.: replace XXXX with actual RFC number & remove this note

    ::=  {  mib-2  YYY  } -- will be assigned by IANA

  -- IANA Reg.: Please assign a value for "YYY" under the 'mib-2'
  -- subtree and record the assignment in the SMI Numbers registry.

  -- RFC Ed.: When the above assignment has been made, please
  --     remove the above note
```

```
  --     replace "YYY" here with the assigned value and
  --     remove this note.

   -- The major groups

   lowpanNotifications        OBJECT IDENTIFIER ::= { lowpanMIB 0 }
   lowpanObjects              OBJECT IDENTIFIER ::= { lowpanMIB 1 }
   lowpanConformance          OBJECT IDENTIFIER ::= { lowpanMIB 2 }

lowpanDeviceRole    OBJECT-TYPE
    SYNTAX           INTEGER  { PAN Coordinator ( 0 ) , 6LoWPAN
                    Router ( 1 ) , 6LoWPAN Mesh Node ( 3 ),
                    6LoWPAN Host ( 2 ) }

    MAX-ACCESS       read-only
    STATUS           current
    DESCRIPTION     "The device in 6LoWPAN can play four roles.
                    coordinator(0) indicates that the device is a
                    PAN Coordinator which is the primary controller
                    of the PAN. It MAY initiate the synchronization
                    of the entire 6LoWPAN by transmitting beacons.
                    6LoWPAN Router(1)  A LoWPAN node that forwards
                    datagrams between arbitrary source- destination
                    pairs using a single 6LoWPAN interface
                    performing IP routing on that interface.
                    6LoWPAN Mesh Node (2) A LoWPAN node that
                    forwards data between arbitrary source-
                    destination pairs using link addresses (and
                    thus only exist in Mesh Under LoWPANs).
                    6LoWPAN Host(3) indicates a node that only
                    sources or sinks IPv6 datagrams.
    ::=  {  lowpanObjects  1  }

lowpanDeviceCapabilities    OBJECT-TYPE
    SYNTAX           BITS  { alternatePANcoordinator ( 0 ) ,
                    deviceType ( 1 ) , powerSource ( 2 ) ,
                    recieverOnWhenIdle ( 3 ) , securityCapability
                    ( 6 ) , allocateAddress ( 7 ) }
    MAX-ACCESS       read-only
    STATUS           current
    DESCRIPTION     "alternatePANcoordinator(0)- The alternate PAN
                    coordinator subfield shall be set to 1 if the
                    device is capable of becoming a PAN
                    coordinator. Otherwise, the alternate PAN
                    coordinator subfield shall be set to 0.

                    deviceType(1) -The device type subfield shall
                    be set to 1 if the device is an FFD.
                    Otherwise, the device type subfield shall be
```

```
                    set to 0 to indicate an RFD.

                    powerSource(2)- The power source subfield
                    shall be set to 1 if the device is receiving
                    power from the alternating current mains.
                    Otherwise, the power source subfield shall
                    be set to 0.

                    recieverOnWhenIdle(3) - The receiver on when
                    idle shall be set to 1 if the device does not
                    disable its receiver to conserve power
                    during idle periods. Otherwise, the receiver
                    on when idle subfield shall be set to 0.

                    securityCapability(6)- The security capability
                    subfield shall be set to 1 if the device is
                    capable of sending and receiving MAC frames
                    secured using the security suite. Otherwise
                    the security capability subfield shall be
                    set to 0.

                    allocateAddress(7)- The allocate address
                    subfield shall be set to 1 if the device
                    wishes the coordinator to allocate a short
                    address as a result of the association
                    procedure. If this subfield is set to 0, the
                    special short address of 0 x fffe shall be
                    allocated to the device and returned through
                    the association response command. In this
                    case, the device shall communicate on the
                    PAN using only its 64 bit extended address.

                    BITS 4-5 are reserved"
    REFERENCE       "IEEE Std 802.15.4 specifications section
                    7.3.1.1.2"
    ::=  {  lowpanObjects  2  }

lowpanRoutingProtocol    OBJECT-TYPE
    SYNTAX            INTEGER  { RPL ( 0 ), DADR ( 1 ), DV ( 2 ),
                    dymoLow ( 3 ), hiLow ( 4 ) , load ( 5 ), Other
                    Other ( 6 ) }
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION     "6LoWPAN Router Over and Mesh Under currently
                    have three protocols each.
                    RPL(0) - Routing Protocol for Low Power and
                    Lossy Networks
                    DADR (1)- Distributed Autonomous Depth-first
                    Routing Protocol in LLN
```

```
                    DV (2)- A Distance Vector Protocol for Routing
                    Over Low Power and Lossy Networks
                    dymoLow(3) - Dynamic MANET On-demand routing
                    for 6LoWPAN
                    hiLow(4) - Hierarchical Routing over 6LoWPAN
                    load(5) -Ad Hoc On-Demand Distance Vector
                    Routing for 6LoWPAN"
    REFERENCE       "draft-ietf-roll-rpl (Work in progress),
                    draft-iwao-roll-dadr (Work in progress),
                    draft-goyal-roll-dv (Work in progress),
                    draft-daniel-6lowpan-load-adhoc-routing
                    (Work in progress),
                    draft-montenegro-6lowpan-dymo-low-routing
                    (Work in progress),
                    draft-daniel-6lowpan-hilow-hierarchical-routing
                    (Work in progress)"
    ::=  {  lowpanObjects  3  }

lowpanRoutingTable  OBJECT-TYPE
    SYNTAX          SEQUENCE  OF  LowpanRoutingEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION     "The routing table entries of a device"
    ::=  { lowpanObjects  4 }

lowpanRoutingEntry  OBJECT-TYPE
    SYNTAX          LowpanRoutingEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION     "This entry represents a conceptual row in the
                    routing table.  It represents a single routing
                    entry."
    INDEX        {  lowpanRouteDestAddress  }
    ::=  { lowpanRoutingTable 1 }

LowpanRoutingEntry  ::=  SEQUENCE {
    lowpanRouteDestAddress  LowpanShortAddress,
    lowpanRouteNextHopAddress  LowpanShortAddress,
    }


lowpanRouteDestAddress    OBJECT-TYPE
    SYNTAX          LowpanShortAddress
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION     "The 16-bit short address of destination of this
                    route"
    ::=  {  lowpanRoutingEntry  1  }
```

```
lowpanRouteNextHopAddress    OBJECT-TYPE
    SYNTAX          LowpanShortAddress
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION     "The short address of the next hop which leads
                    to the destination"
    ::=  {  lowpanRoutingEntry  2  }


lowpanNeighborTable   OBJECT-TYPE
    SYNTAX            SEQUENCE  OF  LowpanNeighborEntry
    MAX-ACCESS        not-accessible
    STATUS            current
    DESCRIPTION       "The neighbor table entries of a device"
    ::=  { lowpanObjects  5 }

lowpanNeighborEntry   OBJECT-TYPE
    SYNTAX            LowpanNeighborEntry
    MAX-ACCESS        not-accessible
    STATUS            current
    DESCRIPTION       "This entry represents a conceptual row in the
                      neighbor table.  It represents a single
                      neighbor table entry."
    INDEX        {  lowpanNeighborEUI64Address  }
    ::=  { lowpanNeighborTable 1 }

LowpanNeighborEntry  ::=  SEQUENCE {
    lowpanNeighborPanID  Unsigned32,
    lowpanNeighborEUI64Address  LowpanIEEEEUI64Address,
    lowpanNeighborShortAddress  LowpanShortAddress,
    lowpanNeighborDeviceType  INTEGER,
    lowpanNeighborIsParent  TruthValue
    }

lowpanNeighborPanID    OBJECT-TYPE
    SYNTAX            Unsigned32 (0..65536)
    MAX-ACCESS        read-only
    STATUS            current
    DESCRIPTION       "The Personal area network Identifier
                      (PanID) of the neighbor entry"
    ::=  {  lowpanNeighborEntry  1  }


lowpanNeighborEUI64Address    OBJECT-TYPE
    SYNTAX            LowpanIEEEEUI64Address
    MAX-ACCESS        not-accessible
    STATUS            current
    DESCRIPTION        "The EUI64 bit address of the neighbor
                       entry."
```

```
    ::=  {  lowpanNeighborEntry  2  }


lowpanNeighborShortAddress    OBJECT-TYPE
    SYNTAX            LowpanShortAddress
    MAX-ACCESS        read-only
    STATUS            current
    DESCRIPTION       "The 16-bit short address of the neighbor
                      entry."
    ::=  {  lowpanNeighborEntry  3  }


lowpanNeighborDeviceType    OBJECT-TYPE
    SYNTAX            INTEGER  { coordinator ( 0 ) , router ( 1 ) ,
                      endDevice ( 2 )}
    MAX-ACCESS        read-only
    STATUS            current
    DESCRIPTION        "The device type of the neighbor entry."
    ::=  {  lowpanNeighborEntry  4  }


lowpanNeighborIsParent    OBJECT-TYPE
    SYNTAX            TruthValue
    MAX-ACCESS        read-only
    STATUS            current
    DESCRIPTION       "The value 'true(1)' indicates that the
                      neighbor is a topological parent of the
                      device."
    ::=  {  lowpanNeighborEntry  5  }


lowpanUseHierarchicalRouting    OBJECT-TYPE
    SYNTAX            TruthValue
    MAX-ACCESS        read-only
    STATUS            current
    DESCRIPTION       "The value 'true(1)' indicates that the
                      entity uses tree based routing. 'false(2)'
                      indicates that entity is not using
                      tree based routing."
    ::=  {  lowpanObjects  6  }

lowpanBroadcastSequenceNumber    OBJECT-TYPE
    SYNTAX            Unsigned32 (0..65536)
    MAX-ACCESS        read-only
    STATUS            current
    DESCRIPTION       "The last value of the sequence number
                      that was added to the 6LoWPAN broadcast or
                      multicast frame."
    REFERENCE         "RFC4944"
    ::=  {  lowpanObjects  7  }
```

```
lowpanAckTimeout    OBJECT-TYPE
    SYNTAX            Unsigned32
    UNITS             "milli-seconds"
    MAX-ACCESS        read-write
    STATUS            current
    DESCRIPTION       "The maximum time allowed for retransmission
                       of a broadcast message"
    ::=  {  lowpanObjects  8  }

lowpanBroadcastRetries    OBJECT-TYPE
    SYNTAX            Unsigned32
    MAX-ACCESS        read-write
    STATUS            current
    DESCRIPTION       "The maximum number of retries allowed for a
                       broadcast message."
    ::=  {  lowpanObjects  9  }

   -- Conformance information
  lowpanGroups      OBJECT IDENTIFIER ::= { lowpanConformance 1 }
  lowpanCompliances OBJECT IDENTIFIER ::= { lowpanConformance 2 }

lowpanGeneralGroup    OBJECT-GROUP
    OBJECTS         { lowpanDeviceCapabilities,
                      lowpanRouteNextHopAddress,
                      lowpanRouteNextHopAddress,
                      lowpanRoutingProtocol}
    STATUS          current
    DESCRIPTION     "A collection of objects for basic 6LoWPAN
                      monitoring"
    ::=  {  lowpanGroups  1  }

lowpanCoreCompliance    MODULE-COMPLIANCE
    STATUS            current
    DESCRIPTION
                    "The compliance statement for SNMP entities
                    which implement the LOWPAN-MIB."
    MODULE  -- this module
           MANDATORY-GROUPS { lowpanGeneralGroup }

    ::=  {  lowpanCompliances  1  }

 lowpanCoreReadOnlyCompliance MODULE-COMPLIANCE
       STATUS  current
       DESCRIPTION
              "The compliance statement for SNMP entities
               which implement the LOWPAN-MIB without support
               for read-write (i.e. in read-only mode) .
              "
```

```
                MODULE  -- this module
                    MANDATORY-GROUPS { lowpanGeneralGroup }

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

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

                ::= { lowpanCompliances  2 }


     END
```

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7. Security Considerations

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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 objects and their sensitivity/vulnerability:

- *The vulnerabilities for lowpanAckTimeout object will be discussed in the next version of the draft

- *The vulnerabilities for lowpanBroadcastRetries object will be discussed in the next version of the draft

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. The vulnerabilities will be discussed in next versions on this draft
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] (Case, J., Mundy, R., Partain, D., and B. Stewart, "Introduction and Applicability Statements for Internet-Standard Management Framework," December 2002.), 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.

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8. IANA Considerations

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The MIB module in this document uses the following IANA-assigned OBJECT IDENTIFIER values recorded in the SMI Numbers registry:

Descriptor	OBJECT IDENTIFIER value
lowpanTCMIB	{ mib-2 XXX }
lowpanMIB	{ mib-2 YYY }

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9. Contributors

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Thanks to the contribution from 6LoWPAN WG MIB Doctor, Juergen Schoenwaelder for the review and useful discussion for writing this document

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10. Acknowledgements

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Thanks to Ali Hammad Akbar, Shafique Ahmed Choadry, Chae-Seong Lim, Seong-Soon Joo, and Geoff Mulligan for their useful discussion and support for writing this document and to Glenn M. Keeni for reviewing the MIB module.

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11. References

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11.1. Normative References

TOC

[RFC2119]	Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels," BCP 14, RFC 2119, March 1997 (TXT, HTML, XML).
[RFC2578]	McCloghrie, K., Ed., Perkins, D., Ed., and J. Schoenwaelder, Ed., "Structure of Management Information Version 2 (SMIv2)," STD 58, RFC 2578, April 1999 (TXT).
[RFC2579]	McCloghrie, K., Ed., Perkins, D., Ed., and J. Schoenwaelder, Ed., "Textual Conventions for SMIv2," STD 58, RFC 2579, April 1999 (TXT).
[RFC2580]	McCloghrie, K., Perkins, D., and J. Schoenwaelder, "Conformance Statements for SMIv2," STD 58, RFC 2580, April 1999 (TXT).
[RFC3418]	Presuhn, R., "Management Information Base (MIB) for the Simple Network Management Protocol (SNMP)," STD 62, RFC 3418, December 2002 (TXT).
[RFC2863]	McCloghrie, K. and F. Kastenholz, "The Interfaces Group MIB," RFC 2863, June 2000 (TXT).
[RFC4944]	Montenegro, G., Kushalnagar, N., Hui, J., and D. Culler, "Transmission of IPv6 Packets over IEEE 802.15.4 Networks," RFC 4944, September 2007 (TXT).
[IEEE802.15.4]	802.15.4-2003, IEEE Standard., "Wireless medium access control and physical layer specifications for low-rate wireless personal area networks.," May 2003.

11.2. Informative References

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[RFC3410]	Case, J., Mundy, R., Partain, D., and B. Stewart, "Introduction and Applicability Statements for Internet-Standard Management Framework," RFC 3410, December 2002 (TXT).
[RFC4919]	Kushalnagar, N., Montenegro, G., and C. Schumacher, "IPv6 over Low-Power Wireless Personal Area Networks (6LoWPANs): Overview, Assumptions, Problem Statement, and Goals," RFC 4919, August 2007 (TXT).
[EUI64]	

	802.15.4-2003, IEEE Standard., “GUIDELINES FOR 64-BIT GLOBAL IDENTIFIER (EUI-64) REGISTRATION AUTHORITY.”
[I-D.draft-ietf-roll-rpl]	Winter, T., Thubert, P., and ROLL. Design Team, “RPL: Routing Protocol for Low Power and Lossy Networks,” (Work in progress), October 2009.
[I-D.draft-iwao-roll-dadr]	Iwao, T., “Distributed Autonomous Depth-first Routing Protocol in LLN,” (Work in progress), July 2009.
[I-D.draft-goyal-roll-dv]	Goyal, M., “A Distance Vector Protocol for Routing Over Low Power and Lossy Networks,” (Work in progress), July 2009.
[I-D.montenegro-6lowpan-dymo-low-routing]	Kim, K., Montenegro, G., Daniel Park, S., Chakeres, I., and S. Yoo, “Dynamic MANET On-demand for 6LoWPAN (DYMO-low) Routing,” (Work in progress), December 2007.
[I-D.daniel-6lowpan-hilow-hierarchical-routing]	Kim, K., Yoo, S., Park, J., Daniel Park, S., and J. Lee, “Hierarchical Routing over 6LoWPAN (HiLow),” (Work in progress), December 2007.
[I-D.daniel-6lowpan-load-adhoc-routing]	Kim, K., Daniel Park, S., Montenegro, G., Yoo, S., and Kushalnagar. N., “6LoWPAN Ad Hoc On-Demand Distance Vector Routing (LOAD),” (Work in progress), December 2007.

Appendix A. Open Issues

TOC

SNMP based access to 802.15.4 PHY/MAC PIBs should also be provided by assigning them object identifiers.

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TOC

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