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<Green Usage Monitoring Information Base>
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Abstract

This memo defines a portion of the Management Information Base (MIB), the GreenUsage-MIB, for use with network management protocols in the Internet community. In particular, the GreenUsage-MIB can be used to monitor the power-on/power-off status of electrical devices.

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1. 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](#)].

2. Overview

2.1. The GreenUsage monitoring concept

Monitor the power-on/power-off status of electrical devices. If a device is in power-on status beyond business hours, it is wasteful usage of electricity. The GreenUsage concept aims to monitor and reduce this wastage.

This document defines a set of managed objects (MOs) of GreenUsage-MIB that can be used to monitor the power-on/power-off status of electrical devices based on their network activity.

Target devices of the GreenUsage-MIB cover that of the Energy Management Framework [[RFC7326](#)]. Refer to the "Target Devices" section in [[RFC7326](#)] for the definition of target devices.

Since the GreenUsage-MIB has a simple structure, it is easy to use and extend in developing a monitoring system of ALL connected devices.

2.2. Terminology

Electrical device: a device that consumes electricity. Power-on/power-off status indicates whether the device is powered on or not. Often it is not possible to get a direct indication of whether a device is powered on or not. But indirect means may be used to infer the power-on/power-off status of a device. For example, if a device shows some network activity, it can be inferred that the device is powered on. Note that it is difficult to infer that a device is powered off. Also, there may be several states between power-on and power-off e.g. sleep state, power-saving state, etc.

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [BCP 14](#), [RFC 2119](#) [[RFC2119](#)].

3. GreenUsage Monitoring Requirements

Multiple mechanisms may be used to determine whether a device is powered on or not. The mechanisms will depend on the nature of the device. Since the number of devices may be very large, the identification, usage type, and location of devices needs to be addressed with care.

4. MIB Design

The basic principle has been to keep the MIB as simple as possible and at the same time to make it effective enough so that the essential needs of monitoring are met.

The GreenUsage-MIB is composed of the following

- device Table: a list of the devices that will be monitored
- deviceStatus Table: the power-on/power-off status of the devices

5. MIB Definitions

5.1. The GreenUsage-MIB

```
GREENUSAGE-MIB DEFINITIONS ::= BEGIN
    IMPORTS
        MODULE-IDENTITY, mib-2, Unsigned32, OBJECT-TYPE
            FROM SNMPv2-SMI -- RFC 2578
        TimeStamp, MacAddress, TEXTUAL-CONVENTION
            FROM SNMPv2-TC -- RFC 2579
        MODULE-COMPLIANCE, OBJECT-GROUP
            FROM SNMPv2-CONF -- RFC 2580
        SnmpAdminString
            FROM SNMP-FRAMEWORK-MIB
    ;

greenUsageMIB MODULE-IDENTITY
    LAST-UPDATED "201401120000Z" -- 12th January, 2014
    ORGANIZATION "PREDICT Working Group"
    CONTACT-INFO
        "
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Support Group E-mail: xxxxxxxxxxxxxxxx
"

DESCRIPTION

"This MIB module is for monitoring the power-on/power-off status of electrical devices.

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"

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


```
REVISION "201407210000Z"      -- 21th July, 2014
DESCRIPTION
    "added actualMonitoring to GumStatusDetectionMethod"
REVISION "201401120000Z"      -- 11th January, 2014
DESCRIPTION
    "added deviceMonitoring to GumStatusDetectionMethod"
REVISION "201301080000Z"      -- 8th January, 2013
DESCRIPTION
    "added gumDevUsageCreatedTimeStamp to usage table"

REVISION "201207070000Z"      -- 7th July, 2012
DESCRIPTION
    "The initial version, published as draft-suganuma-greenmib-00.txt"

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

 ::= { mib-2 YYY1 }          -- Will be assigned by IANA

-- IANA Reg.: Please assign a value for "YYY1" 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 "YYY1" here with the assigned value and
--     remove this note.

-- -----
-- Textual Conventions
-- -----

GumStatusDetectionMethod ::= TEXTUAL-CONVENTION
    STATUS current
    DESCRIPTION
        "The object specifies the technology which is used
        to detect the power-on/power-off status of a device.
        The enumerated values and the corresponding
        technology are as follows:
        reserved                (0): reserved (Not used)
        arpSensing              (1): arp packets from the
                                device
        neighborDiscoverySensing (2): neighbor discovery
                                packets from the device
        icmpEchoProbing         (3): ICMP echo packets
        switchMonitoring        (4): switch monitoring
        deviceMonitoring        (5): the direct monitoring of
```


device status such as CPU
load and memory usage

actualMonitoring (6): the actual monitoring of power
status of a device by its own
functions

"

SYNTAX INTEGER

{

reserved	(0),
arpSensing	(1),
neighborDiscoverySensing	(2),
icmpEchoProbing	(3),
switchMonitoring	(4),
deviceMonitoring	(5),
actualMonitoring	(6)

}

GumDeviceStatus ::= TEXTUAL-CONVENTION

STATUS current

DESCRIPTION

"The object represents the power-on/power-off
status of a monitored device.

unknown	(0)
powerOn	(1): device is powered on
powerOff	(2): device is powered off
sleepMode	(3): device is in sleep mode
powerSavingMode	(4): device is in powersaving mode

"

SYNTAX INTEGER

{

unknown	(0),
powerOn	(1),
powerOff	(2),
sleepMode	(3),
powerSavingMode	(4)

}

-- The GREENUSAGE-MIB has the following 3 primary groups

gumNotifications	OBJECT IDENTIFIER ::= { greenUsageMIB 0 }
gumObjects	OBJECT IDENTIFIER ::= { greenUsageMIB 1 }
gumConformance	OBJECT IDENTIFIER ::= { greenUsageMIB 2 }

gumDeviceTable OBJECT-TYPE

SYNTAX SEQUENCE OF GumDeviceEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This table models the device list

Entries in this table are required to survive
a reboot of the managed entity.

"

::= { gumObjects 1 }

gumDeviceEntry OBJECT-TYPE

SYNTAX GumDeviceEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This entry represents a conceptual row in the
gumDevice table. It represents a device that
will be monitored for power-on/power-off status.

"

INDEX { gumDeviceID }

::= { gumDeviceTable 1 }

GumDeviceEntry ::=

SEQUENCE {

gumDeviceID	Unsigned32,
gumDeviceName	SnmpAdminString,
gumDeviceMacAddress	MacAddress,
gumDeviceType	SnmpAdminString,
gumDeviceLocation	SnmpAdminString

}

gumDeviceID OBJECT-TYPE

SYNTAX Unsigned32

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A unique arbitrary identifier for this device."

::= { gumDeviceEntry 1 }

gumDeviceName OBJECT-TYPE

SYNTAX SnmpAdminString (SIZE(1..64))

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"Administratively assigned textual name of this
device."

::= { gumDeviceEntry 2 }

gumDeviceMacAddress OBJECT-TYPE

SYNTAX MacAddress


```
MAX-ACCESS    read-only
STATUS        current
DESCRIPTION
    "MAC Address of this device.
     If there is no MAC address, this object will be
     inaccessible."
 ::= { gumDeviceEntry 3 }
```

```
gumDeviceType OBJECT-TYPE
SYNTAX        SnmpAdminString (SIZE(1..64))
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION
    "Administratively assigned textual description about
     usage type of this device."
 ::= { gumDeviceEntry 4 }
```

```
gumDeviceLocation OBJECT-TYPE
SYNTAX        SnmpAdminString (SIZE(1..64))
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION
    "Administratively assigned textual location
     name of this device."
 ::= { gumDeviceEntry 5 }
```

```
gumDevUsageTable OBJECT-TYPE
SYNTAX        SEQUENCE OF GumDevUsageEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
    "This table models the device usage status

     Entries in this table are required to survive
     a reboot of the managed entity.
    "
 ::= { gumObjects 2 }
```

```
gumDevUsageEntry OBJECT-TYPE
SYNTAX        GumDevUsageEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
    "This entry represents a conceptual row in the
     gumDevUsage table. It represents a power-on/power-off
     status of a monitored device.
    "
INDEX { gumDeviceID, gumDevUsageDetID }
```



```
 ::= { gumDevUsageTable 1 }

GumDevUsageEntry ::=
    SEQUENCE {
        gumDevUsageDetID          GumStatusDetectionMethod,
        gumDevUsageDetStatus      GumDeviceStatus,
        gumDevUsageDetTimeStamp   TimeStamp,
        gumDevUsageCreatedTimeStamp TimeStamp
    }

gumDevUsageDetID OBJECT-TYPE
    SYNTAX      GumStatusDetectionMethod
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The detection method by which the usage status is
         computed."
    ::= { gumDevUsageEntry 1 }

gumDevUsageDetStatus OBJECT-TYPE
    SYNTAX      GumDeviceStatus
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "the usage status of the device."
    ::= { gumDevUsageEntry 2 }

gumDevUsageDetTimeStamp OBJECT-TYPE
    SYNTAX      TimeStamp
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "the time at which the usage status of the
         device was computed."
    ::= { gumDevUsageEntry 3 }

gumDevUsageCreatedTimeStamp OBJECT-TYPE
    SYNTAX      TimeStamp
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "the time at which the entry of usage table created."
    ::= { gumDevUsageEntry 4 }

-- Units of conformance
gumGroups          OBJECT IDENTIFIER ::= { gumConformance 1}
gumCompliances     OBJECT IDENTIFIER ::= { gumConformance 2}
```



```
gumObjectsGroup    OBJECT-GROUP
  OBJECTS {
    gumDeviceName,
    gumDeviceMacAddress,
    gumDeviceType,
    gumDeviceLocation,
    gumDevUsageDetStatus,
    gumDevUsageDetTimeStamp,
    gumDevUsageCreatedTimeStamp
  }
  STATUS    current
  DESCRIPTION
    " A collection of objects for basic GreenUsage
      monitoring."
  ::= { gumGroups 1 }

-- Compliance statements
gumCompliance MODULE-COMPLIANCE
  STATUS    current
  DESCRIPTION
    "The compliance statement for SNMP entities
      which implement the GREENUSAGE-MIB
    "
  MODULE -- this module
    MANDATORY-GROUPS { gumObjectsGroup
    }
  ::= { gumCompliances 1 }

END
```


6. Security Considerations

There are no management objects defined in this MIB module with a MAX-ACCESS clause of read-write.

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:

- gumDeviceName,
- gumDeviceMacAddress,
- gumDeviceType,
- gumDeviceLocation,
- gumDevUsageDetStatus,
- gumDevUsageDetTimeStamp,
- gumDevUsageCreatedTimeStamp

The above objects may be used to identify users and their activities. Thus these objects may be considered to be particularly sensitive and/or private.

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.

7. IANA Considerations

IANA should assign

1. a base arc in the 'mib-2' (standards track) OID tree for the 'greenUsageMIB' MODULE-IDENTITY defined in the GREENUSAGE-MIB.

8. References

8.1. Normative References

- [RFC2119] Bradner, S., Key words for use in RFCs to Indicate Requirements Levels, [BCP 14](#), [RFC 2119](#), March 1997.
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- [RFC2863] McCloghrie, K., and Kastenholz., F., The Interfaces Group MIB, [RFC 2863](#), June 2000.

8.2. Informative References

- [RFC3410] Case, J., Mundy, R., Partain, D. and B. Stewart, Introduction and Applicability Statements for Internet-Standard Management Framework, [RFC 3410](#), December 2002.
- [[RFC7326](#)] Parello, J., Claise, B., Schoening, B. and Quittek, J., Energy Management Framework", [RFC 7326](#), September 2014.

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