Entity State MIB

Status of this Memo

Abstract

  This memo defines a portion of the Management Information Base (MIB)
  for use with network management protocols in the Internet community.
  In particular, it describes extensions to the Entity MIB to
  provide information about the state of physical entities.

Table of Contents

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. Entity State

The goal in adding state objects to the Entity MIB [RFC2737] is to
define a useful subset of the possible state attributes that could
be tracked for a given entity that both fit into the state models
such as those used in the Interfaces MIB [RFC2863] as well as
leverage existing well-deployed models. The entStateTable contains
state objects that are a subset of the popular ISO/OSI states that
are also defined in ITU's X.731 specification [X.731]. Objects are
defined to capture administrative, operational and usage states. In
addition there are further state objects defined to provide
additional information for these three basic states.

Administrative state indicates permission to use or prohibition
against using the entity and is imposed through the management
services.

Operational state indicates whether or not the entity is physically
installed and working. Note that unlike the ifOperStatus [RFC2863],
this operational state is independent of the administrative state.

Usage state indicates whether or not the entity is in use at a
specific instance, and if so, whether or not it currently has spare
capacity to serve additional users. In the context of this MIB, the
user is equivalent to an entity, so this term is substituted. This
state refers to the ability of the entity to service other entities
within its containment hierarchy.

Alarm state indicates whether or not there are any alarms active
against the entity. In addition to those alarm status defined in
X.731 [X.731], warning and indeterminate status are also defined to
provide a more complete mapping to the Alarm MIB [Alarm-MIB].

Standby state indicates whether the entity is currently running as
hot standby, cold standby or is currently providing service.

   The terms state and status are used interchangeably in this memo.

   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].

2.1 Hierarchical State Management

   Physical entities exist within a containment hierarchy. Physical
   containment is defined by the entPhysicalContainedIn
   object[RFC2737]. This raises some interesting issues not addressed
   in existing work on state management [X.731].

   There are two types of state for an entity:

   1) The state of the entity independent of the states of its parents
   and children in its containment hierarchy. This is often referred to
   as raw state.

   2) The state of the entity, as it may be influenced by the state of
   its parents and children. This is often referred to as computed
   state.

   All state objects in this memo are raw state.

2.2 Entity Redundancy

   While this memo is not attempting to address the entire problem
   space around redundancy, the entStateStandby object provides an
   important piece of state information for entities, which helps
   identify which pieces of redundant equipment are currently providing
   service, and which are waiting in either hot or cold standby mode.

3 Relation to other MIBs

3.1 Relationship to the Interfaces MIB

   The Interfaces MIB [RFC2863] defines the ifAdminStatus object, which
   has states of up, down and testing and the ifOperStatus object,
   which has states of up, down, testing, unknown, dormant, notPresent
   and lowerLayerDown.

   An ifAdminStatus of 'up' is equivalent to setting the entStateAdmin
   object to 'unlocked'. An ifAdminStatus of 'down' is equivalent to
   setting the entStateAdmin object to either 'locked' or
   'shuttingDown', depending on a systems interpretation of 'down'.

An ifOperStatus of 'up' is equivalent to an entStateOper value of
   'enabled'. An ifOperStatus of 'down' due to operational failure is

equivalent to an entStateOper value of 'disabled'. An ifOperStatus
of 'down' due to being administratively disabled is equivalent to an
entStateAdmin value of 'locked' and an entStateOper value of either
'enabled' or 'disabled' depending on whether there are any known
issues that would prevent the entity from becoming operational when
its entStateAdmin is set to 'unlocked'. An ifOperStatus of
'unknown' is equivalent to an entStateOper value of 'unavailable'.
The ifOperStatus values of 'testing' and 'dormant' are not
explicitly supported by this MIB, but the state objects will be able
to reflect other aspects of the entities administrative and
operational state. The ifOperStatus values of 'notPresent' and
'lowerLayerDown' are in some ways computed states and so are
therefore not supported in this MIB. They can though be computed by
examining the states of entities within this objects containment
hierarchy and other available related states.

3.2 Relation to Alarm MIB

The entStateAlarm object indicates whether or not there are any
active alarms against this entity. If there are active alarms, then
the alarmActiveTable in the Alarm MIB [Alarm MIB] should be searched
for alarmActiveResourceId that match this entPhysicalIndex.

Alternatively, if the alarmActiveTable is queried first and an
active alarm with a value of alarmActiveResourceId that matches this
entPhysicalIndex is found, then entStateAlarm can be used to quickly
determine if there are additional active alarms against this
physical entity.

3.3 Relation to Bridge MIB

For entities of physical type of 'port' that support the
dot1dStpPortEnable object in the Bridge MIB [RFC1493], a value of
'enabled' is equivalent to setting the entStateAdmin object to
'unlocked'. Setting dot1dStpPortEnable to 'disabled' is equivalent
to setting the entStateAdmin object to 'locked'.

3.4 Relation to the Host Resources MIB

The hrDeviceStatus object in the Host Resources MIB [RFC2790]
provides an operational state for devices. For entities that
logically correspond to the concept of a device, a value of
'unknown' for hrDeviceStatus corresponds to an entStateOper value of
'unavailable'. A value of 'running' corresponds to an entStateOper
value of 'enabled'. A value of 'warning' also corresponds to an
entStateOper value of 'enabled', but with appropriate bits set in
the entStateAlarm object to indicate the alarms corresponding to the

unusual error condition detected. A value of 'testing' or 'down' is
equivalent to an entStateOper value of 'disabled'.

[4](#). Definitions

```
ENTITY-STATE-MIB DEFINITIONS ::= BEGIN

  IMPORTS
      MODULE-IDENTITY, OBJECT-TYPE, NOTIFICATION-TYPE, mib-2
          FROM SNMPv2-SMI
      TEXTUAL-CONVENTION, DateAndTime
          FROM SNMPv2-TC
      MODULE-COMPLIANCE, OBJECT-GROUP, NOTIFICATION-GROUP
           FROM SNMPv2-CONF
      entPhysicalIndex
          FROM ENTITY-MIB;

  entityStateMIB MODULE-IDENTITY
      LAST-UPDATED "200402150000Z"
      ORGANIZATION "IETF Entity MIB Working Group"
      CONTACT-INFO
              " General Discussion: entmib@ietf.org
               To Subscribe:
                 http://www.ietf.org/mailman/listinfo/entmib

               http://www.ietf.org/html.charters/entmib-charter.html

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              "
      DESCRIPTION
              "This MIB defines a state extension to the Entity MIB.

              Copyright (C) The Internet Society 2004.  This version
              of this MIB module is part of RFC yyyy;  see the RFC
              itself for full legal notices."
        -- RFC Ed.: replace yyyy with actual RFC number & remove
        -- this note
      REVISION    "200402150000Z"
      DESCRIPTION
```

```
        "Initial version, published as RFC YYYY."
     -- RFC-Editor assigns yyyy
   ::= { mib-2 XX }  -- to be assigned by IANA
```

-- Textual conventions

 AdminState ::= TEXTUAL-CONVENTION
    STATUS   current
    DESCRIPTION
         " Represents the various possible administrative states.

            A value of 'locked' means the resource is administratively
            prohibited from use. A value of 'shuttingDown' means that
            usage is administratively limited to current instances of
            use. A value of 'unlocked' means the resource is not
            administratively prohibited from use. A value of
             'unavailable' means that this resource is unable to
             report administrative state."
    REFERENCE
          "ITU Recommendation X.731, 'Information Technology - Open
              Systems Interconnection - System Management: State
              Management Function', 1992"
    SYNTAX   INTEGER
              {
              unavailable(1),
              locked(2),
              shuttingDown(3),
              unlocked(4)
              }

 OperState ::= TEXTUAL-CONVENTION
    STATUS   current
    DESCRIPTION
         " Represents the possible values of operational states.

            A value of 'disabled' means the resource is totally
            inoperable. A value of 'enabled' means the resource
            is partially or fully operable. A value of 'testing'
            means the resource is currently being tested
            and cannot there fore report whether it is operational
            or not. A value of 'unavailable' means that this
            resource is unable to report operational state. "
    REFERENCE
          "ITU Recommendation X.731, 'Information Technology - Open
              Systems Interconnection - System Management: State
              Management Function', 1992"
    SYNTAX   INTEGER
              {
              unavailable (1),
              disabled(2),

```
                    enabled(3),
                    testing (4)
                    }
```

   UsageState ::= TEXTUAL-CONVENTION
     STATUS   current
     DESCRIPTION
          " Represents the possible values of usage states.
            A value of 'idle' means the resource is servicing no
            users. A value of 'active' means the resource is
            currently in use and it has sufficient spare capacity
            to provide for additional users. A value of 'busy'
            means the resource is currently in use, but it
            currently has no spare capacity to provide for
            additional users. A value of 'unavailable' means
            that this resource is unable to report usage state."
     REFERENCE
          "ITU Recommendation X.731, 'Information Technology - Open
              Systems Interconnection - System Management: State
              Management Function', 1992"
     SYNTAX   INTEGER
                {
                unavailable (1),
                idle(2),
                active(3),
                busy(4)
                }

   AlarmStatus ::= TEXTUAL-CONVENTION
     STATUS   current
     DESCRIPTION
          "Represents the possible values of alarm status.
           An Alarm [ALARM-MIB] is a persistent indication
           of an error or warning condition.

           When no bits of this attribute are set, then none
           of the value of under repair is set, the resource is
           currently being repaired, which depending on the
           implementation, may make the other values in this bit
           string unreliable.

           When the value of 'critical' is set, one or more critical
           alarms are active against the resource. When the value
           of 'major' is set, one or more major alarms are active
           against the resource. When the value of 'minor' is set,
           one or more minor alarms are active against the resource.
           When the value of 'warning' is set, one or more warning
           alarms are active against the resource. When the value
           of 'indeterminate' is set, one or more alarms whose of
           perceived severity cannot be determined are active
           against this resource.

When the value of 'alarmOutstanding' is set, one or more
alarms is active against the resource. The fault may
or may not be disabling. This bit provides a high-level

        summary that can be used to determine whether or not
        to examine the rest of the values. A value of
        'unavailable' means that this resource is unable to
        report alarm state."
   REFERENCE
         "ITU Recommendation X.731, 'Information Technology - Open
            Systems Interconnection - System Management: State
            Management Function', 1992"
         SYNTAX   BITS
            {
            unavailable (0),
            underRepair(1),
            critical(2),
            major(3),
            minor(4),
            alarmOutstanding(5),
            -- The following are not defined in X.733
            warning (6),
            indeterminate (7)
                          }

 StandbyStatus ::= TEXTUAL-CONVENTION
   STATUS   current
   DESCRIPTION
         " Represents the possible values of standby status.

            A value of 'hotStandby' means the resource is not
            providing service, but it will be immediately able to
            take over the role of the resource to be backed-up,
            without the need for initialization activity, and will
            contain the same information as the resource to be
            backed up. A value of 'coldStandy' means that the
            resource is to back-up another resource, but will not
            be immediately able to take over the role of a resource
            to be backed up, and will require some initialization
            activity. A value of 'providingService' means the
            resource is providing service. A value of
             'unavailable' means that this resource is unable to
             report standby state."
   REFERENCE
         "ITU Recommendation X.731, 'Information Technology - Open
            Systems Interconnection - System Management: State
            Management Function', 1992"
         SYNTAX   INTEGER
            {
            unavailable (1),
            hotStandby(2),

```
            coldStandby(3),
            providingService(4)
            }
```

-- Entity State Objects

entStateObjects OBJECT IDENTIFIER ::= { entityStateMIB 1 }

entStateTable OBJECT-TYPE
 SYNTAX   SEQUENCE OF EntStateEntry
 MAX-ACCESS   not-accessible
 STATUS   current
 DESCRIPTION
      "A table of information about state/status of entities.
       This is a sparse augment of the entPhysicalTable. Entries
       appear in this table for values of
       entPhysicalClass [RFC2737] that in this implementation
       are able to report any of the state or status stored in
       this table.
       "
 ::= { entStateObjects 1 }

  entStateEntry OBJECT-TYPE
     SYNTAX   EntStateEntry
     MAX-ACCESS   not-accessible
     STATUS   current
     DESCRIPTION
         "State information about this physical entity."
     INDEX   { entPhysicalIndex }
     ::= { entStateTable 1 }

  EntStateEntry ::= SEQUENCE {
      entStateLastChanged DateAndTime,
      entStateAdmin   AdminState,
      entStateOper   OperState,
      entStateUsage   UsageState,
      entStateAlarm   AlarmStatus,
      entStateStandby   StandbyStatus
     }

entStateLastChanged OBJECT-TYPE
 SYNTAX   DateAndTime
 MAX-ACCESS   read-only
 STATUS   current
 DESCRIPTION
   "The value of this object is the date and
    time when the value of any of entStateAdmin,
    entStateOper, entStateUsage, entStateAlarm,
    or entStateStandby changed for this entity.

   If there has been no change since

the last re-initialization of the local system,
this object contains the date and time of
local system initialization. If there has been
no change since the entity was added to the

      local system, this object contains the date and
      time of the insertion"
    ::= { entStateEntry 1 }

  entStateAdmin OBJECT-TYPE
          SYNTAX   AdminState
          MAX-ACCESS read-write
          STATUS   current
          DESCRIPTION
              "The administrative state for this entity.
               Setting this object to 'notSupported' will result
               in an 'inconsistentValue' error. For entities that
               do not support administrative state, all set
               operations will result in an 'inconsistentValue'
               error

               Some physical entities exhibit only a subset of the
               remaining administrative state values. Some entities
               cannot be locked, and hence this object exhibits only
               the 'unlocked' state. Other entities can not be shutdown
               gracefully, and hence this object does not exhibit the
               'shuttingDown' state. A value of 'inconsistentValue'
               will be returned if attempts are made to set this
               object to values not supported by its administrative
               model."
          ::= { entStateEntry 2 }

   entStateOper OBJECT-TYPE
          SYNTAX   OperState
          MAX-ACCESS read-only
          STATUS   current
          DESCRIPTION
              "The operational state for this entity.

               Note that unlike the state model used within the
               Interfaces MIB [RFC2863], this object does not follow
               the administrative state. An administrative state of
               down does not predict an operational state
               of disabled.

               A value of 'disabled' means that an entity is totally
               inoperable and unable to provide service both to entities
               within its containment hierarchy, or to other receivers
               of its service as defined in ways outside the scope of
               this MIB.

               A value of 'enabled' means that an entity is fully or
               partially operable and able to provide service both to

entities within its containment hierarchy, or to other
receivers of its service as defined in ways outside the
scope of this MIB.

Note that some implementations may not be able to
accurately report entStateOper while the
entStateAdmin object has a value other than 'unlocked'.
In these cases, this object MUST have a value
of 'unavailable'."
::= { entStateEntry 3 }

entStateUsage OBJECT-TYPE
        SYNTAX   UsageState
        MAX-ACCESS read-only
        STATUS   current
        DESCRIPTION
            "The usage state for this entity.

            Note that in the context of a physical entity, this
            object refers to an entity's ability to service more
            physical entities in a containment hierarchy. A value
            of 'idle' means this entity is able to contain other
            entities but that no other entity is currently
            contained within this entity.

            A value of 'active' means that at least one entity is
            contained within this entity, but that it could handle
            more. A value of 'busy' means that the entity is unable
            to handle any additional entities being contained in it.

            Some entities will exhibit only a subset of the
            usage state values. Entities that are unable to ever
            service any entities within a containment hierarchy will
            always have a usage state of 'busy'. Some entities will
            only ever be able to support one entity within its
            containment hierarchy and will therefore only exhibit
            values of 'idle' and 'busy'."
          ::= { entStateEntry 4 }

entStateAlarm OBJECT-TYPE
        SYNTAX   AlarmStatus
        MAX-ACCESS read-only
        STATUS   current
        DESCRIPTION
            "The alarm status for this entity. It does not include
            the alarms raised on child components within its
            containment hierarchy.

            Note that this differs from 'indeterminate' which
            means that that alarm state is supported and there
            are alarms against this entity, but the severity of
            some of the alarms is not known.

If no bits are set, then this entity supports reporting
of alarms, but there are currently no active alarms
against this entity.

```
                   "
             ::= { entStateEntry 5 }


entStateStandby OBJECT-TYPE
         SYNTAX StandbyStatus
         MAX-ACCESS read-only
         STATUS current
         DESCRIPTION
              "The standby status for this entity.

              Some entities will exhibit only a subset of the
              remaining standby state values. If this entity
              cannot operate in a standby role, the value of this
              object will always be 'providingService'."
     ::= { entStateEntry 6 }


-- Notifications
 entStateNotifications OBJECT IDENTIFIER ::= { entityStateMIB 0 }


entStateOperEnabled NOTIFICATION-TYPE
    OBJECTS { entStateAdmin,
                entStateAlarm
              }
    STATUS               current
    DESCRIPTION
              "An entStateOperEnabled Notification signifies that the
               SNMP entity, acting in an agent role, has detected that
               the entStateOper object for one of its entities has left
               the 'disabled' state and transitioned into the 'enabled'
               state.

               The entity this notification refers can be identified by
               extracting the entPhysicalIndex from one of the
               variable bindings. The entStateAdmin and entStateAlarm
               varbinds may be examined to find out additional
               information on the administrative state at the time of
               the operation state change as well to find out whether
               there were any known alarms against the entity at that
               time that may explain why the physical entity has become
               operationally disabled."
     ::= { entStateNotifications 1 }


entStateOperDisabled NOTIFICATION-TYPE
    OBJECTS { entStateAdmin,
                entStateAlarm }
    STATUS               current
    DESCRIPTION
              "An entStateOperDisabled Notification signifies that the
```

SNMP entity, acting in an agent role, has detected that
the entStateOper object for one of its entities has left
the 'enabled' state and transitioned into the
'disabled' state.

             The entity this notification refers can be identified by
             extracting the entPhysicalIndex from one of the
             variable bindings. The entStateAdmin and entStateAlarm
             varbinds may be examined to find out additional
             information on the administrative state at the time of
             the operation state change as well to find out whether
             there were any known alarms against the entity at that
             time that may have affect on the physical entity's
             ability to stay operationally enabled."
     ::= { entStateNotifications 2 }

-- Conformance and Compliance

entStateConformance OBJECT IDENTIFIER ::= { entityStateMIB 3 }

entStateCompliances OBJECT IDENTIFIER
                 ::= { entStateConformance 1 }

entStateCompliance MODULE-COMPLIANCE
       STATUS current
       DESCRIPTION
           "The compliance statement for systems supporting
           the Entity State MIB."
       MODULE -- this module
           MANDATORY-GROUPS {
            entStateGroup
           }
       GROUP   entStateNotificationsGroup
          DESCRIPTION
              "This group is optional."
       OBJECT entStateAdmin
        MIN-ACCESS read-only
        DESCRIPTION
            "Write access is not required."
    ::= { entStateCompliances 1 }

entStateGroups OBJECT IDENTIFIER ::= { entStateConformance 2 }

entStateGroup OBJECT-GROUP
    OBJECTS {
           entStateLastChanged,
           entStateAdmin,
           entStateOper,
           entStateUsage,
           entStateAlarm,
           entStateStandby
           }

```
     STATUS    current
     DESCRIPTION
          "Standard Entity State group."
     ::= { entStateGroups 1}
```

        entStateNotificationsGroup NOTIFICATION-GROUP
           NOTIFICATIONS {
                   entStateOperEnabled,
                   entStateOperDisabled
                   }
           STATUS   current
           DESCRIPTION
                "Standard Entity State Notification group."
           ::= { entStateGroups 2}

        END

5. Security Considerations

        There is one management object defined in this MIB that has a
        MAX-ACCESS clause of read-write. The object 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.

        The following object is defined with a MAX-ACCESS clause of
        read-write: entStateAdmin.

        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 (entities) that have legitimate
        rights to indeed GET or SET (change/create/delete) them.

        Note that setting the entStateAdmin to 'locked' or 'shuttingDown'
        can cause disruption of services ranging from those running on a
        port to those on an entire device, depending on the type of entity.
        Access to this object should be properly protected.

        Access to the objects defined in this MIB allows one to figure out

what the active and standby resources in a network are. This
information can be used to optimize attacks on networks so even
read-only access to this MIB should be properly protected.

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8. **Acknowledgments**

This document is a product of the Entity MIB Working Group.

9. **References**

9.1 **Normative**

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