

Entity MIB Working Group
Internet Draft
Document: [draft-ietf-entmib-state-03.txt](#)
Category: Standards Track
Expiration Date: August 2004

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February 2004

Entity State MIB

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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.

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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. 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
```

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        " General Discussion: entmib@ietf.org
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        To Subscribe:
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            http://www.ietf.org/mailman/listinfo/entmib
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            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 therefore 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 'coldStandby' 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.

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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.

6. Intellectual Property

The IETF takes no position regarding the validity or scope of any intellectual property or other rights that might be claimed to pertain to the implementation or use of the technology described in this document or the extent to which any license under such rights might or might not be available; neither does it represent that it has made any effort to identify any such rights. Information on the IETF's procedures with respect to rights in standards-track and standards-related documentation can be found in [BCP-11](#). Copies of claims of rights made available for publication and any assurances of licenses to be made available, or the result of an attempt made to obtain a general license or permission for the use of such proprietary rights by implementors or users of this specification can be obtained from the IETF Secretariat.

The IETF invites any interested party to bring to its attention any copyrights, patents or patent applications, or other proprietary rights which may cover technology that may be required to practice this standard. Please address the information to the IETF Executive Director.

7. Authors' Addresses

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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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