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Definitions of Managed Objects
for Monitoring and Controlling the
Frame Relay/ATM PVC Service Interworking Function

Status of this Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

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Abstract

This memo defines a Management Information Base (MIB) to configure, monitor, and control a service interworking function (IWF) for Permanent Virtual Connections (PVC) between Frame Relay and Asynchronous Transfer Mode (ATM) technologies.

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1. The SNMP Management Framework

The SNMP Management Framework presently consists of five major components:

- o An overall architecture, described in RFC 2571 [1].
- o Mechanisms for describing and naming objects and events for the purpose of management. The first version of this Structure of Management Information (SMI) is called SMIV1 and described in STD 16, RFC 1155 [2], STD 16, RFC 1212 [3] and RFC 1215 [4]. The second version, called SMIV2, is described in STD 58, RFC 2578 [5], STD 58, RFC 2579 [6] and STD 58, RFC 2580 [7].
- o Message protocols for transferring management information. The first version of the SNMP message protocol is called SNMPv1 and described in STD 15, RFC 1157 [8]. A second version of the SNMP message protocol, which is not an Internet standards track protocol, is called SNMPv2c and described in RFC 1901 [9] and RFC 1906 [10]. The third version of the message protocol is called SNMPv3 and described in RFC 1906 [10], RFC 2572 [11] and RFC 2574 [12].

- o Protocol operations for accessing management information. The first set of protocol operations and associated PDU formats is described in STD 15, RFC 1157 [8]. A second set of protocol operations and associated PDU formats is described in RFC 1905 [13].
- o A set of fundamental applications described in RFC 2573 [14] and the view-based access control mechanism described in RFC 2575 [15].

A more detailed introduction to the current SNMP Management Framework can be found in RFC 2570 [16].

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. Objects in the MIB are defined using the mechanisms defined in the SMI.

This memo specifies a MIB module that is compliant to the SMIV2. A MIB conforming to the SMIV1 can be produced through the appropriate translations. The resulting translated MIB must be semantically equivalent, except where objects or events are omitted because no translation is possible (use of Counter64). Some machine readable information in SMIV2 will be converted into textual descriptions in SMIV1 during the translation process. However, this loss of machine readable information is not considered to change the semantics of the MIB.

2. Conventions

The keywords MUST, MUST NOT, REQUIRED, SHALL, SHALL NOT, SHOULD, SHOULD NOT, RECOMMENDED, NOT RECOMMENDED, MAY, and OPTIONAL, when they appear in this document, are to be interpreted as described in RFC 2119 [23].

3. Overview

This document defines a Management Information Base (MIB) for monitoring and controlling a service interworking function (IWF) for Permanent Virtual Connections (PVC) between Frame Relay and Asynchronous Transfer Mode (ATM) technologies. The agreements on which this MIB is based were reached jointly by the Frame Relay Forum and the ATM Forum and are documented in the Frame Relay Forum Document FRF.8 [17].

3.1. Frame Relay/ATM Service Interworking Background

Frame relay to ATM interworking is a function that exchanges Protocol Data Units (PDU) between a frame relay service user and an ATM service user. Two types of interworking functions are specified for frame relay and ATM permanent virtual connection (PVC) service users: network interworking and service interworking.

Network interworking provides PDU forwarding between frame relay service users inter-connected by an ATM service. Both endpoints are frame relay PVCs. Frame Relay to ATM PVC Network Interworking is defined in [20].

Service interworking provides PDU forwarding so that the ATM service user performs no frame relaying service-specific functions and the frame relay service user performs no ATM service-specific functions. Optionally, the service IWF translates particular higher layer protocols to satisfy the requirements of end-systems. Frame Relay to ATM PVC Service Interworking is defined in [17].

This MIB describes management objects used to provision, monitor, and control a Frame Relay/ATM PVC Service IWF.

FRF.8 [17] does not address point-to-multipoint applications of the IWF. Implementations MAY provide support for point-to-multipoint capability using this MIB.

Consult FRF.8 [17] for more details on the operation of a Frame Relay/ATM PVC Service IWF.

3.2. Structure of the MIB

The Frame Relay/ATM PVC Service IWF managed objects are organized as follows:

- (1) FR/ATM PVC Service IWF cross-connect table,
- (2) Connection description table, and
- (3) Notification object

The IWF cross-connect table contains one or more rows for each inter-worked connection. Each inter-worked connection is uniquely identified by the frAtmIwfConnIndex object. In the case of point-to-point, a single row is present. In the case of point-to-multipoint, one row exists for each multipoint destination. Index objects for the ATM port, VPI, VCI, frame relay port, and frame relay DLCI distinguish the constituent rows used in a point-to-multipoint case.

Each inter-worked connection has attributes governing behavior of the IWF. These attributes describe how the IWF should transform a PDU during the forwarding process and provide rules for:

- (1) Mapping the ATM CLP bit to frame relay DE bit
- (2) Mapping the ATM congestion notification bit to frame relay congestion bits
- (3) Mapping higher protocol encapsulations between ATM and frame relay
- (4) Performing fragmentation and reassembly
- (5) Performing ARP translation between ATM and frame relay

Typically, most connections share the same attributes. The attributes are represented in this MIB by the connection description table. Each row of the connection description table contains the attribute settings common to one or more inter-worked connections. One example would be full mapping and translation. All cross-connect table entries that require full mapping and translation services set the frAtmIwfConnectionDescriptor object to the index value for the connection description table row that contains objects set to values that provide full mapping and translation services.

A notification object provides cross-connect status change alerts.

3.3. Relationship to Other MIBs

The Frame Relay/ATM PVC Service IWF MIB describes the cross-connections between frame relay and ATM service users. Each PVC endpoint is provisioned and managed with a technology-specific MIB as described below.

Each technology-specific MIB has a table of PVC endpoints (indexed by ifIndex and logical link address such as the DLCI or VPI/VCI). In the absence of interworking, two endpoints are cross-connected via a technology-specific cross connect table (e.g., the atmVcCrossConnectTable in the ATM MIB). However, a connection between a frame relay endpoint and an ATM endpoint requires a cross-connect in the ATM IWF MIB.

The following sections describe the relationship between the technology-specific MIBs and the FR/ATM PVC Service IWF MIB.

3.3.1. Frame Relay Service MIB

Frame relay PVC endpoints are provisioned as rows in the Frame Relay Services MIB [19] endpoint table.

Each frame relay PVC endpoint is described in the frPVCEndptTable. A connection between two frame relay endpoints is described by an entry in the frame relay PVC cross-connect table frPVCConnectTable. The frPVCEndptConnectIdentifier object of each endpoint points to the frPVCConnectTable cross-connect table row for the connection.

In the case of an inter-worked connection, the frPVCEndptConnectIdentifier object is set to zero. Instead, the frPVCEndptAtmIwfConnIndex object is set to the index of the FR/ATM IWF cross-connect table row.

The frame relay PVC cross-connect table (frPVCConnectTable) does not contain an entry for the FR/ATM inter-worked connection.

Note that the frPVCEndptConnectIdentifier and frPVCEndptAtmIwfConnIndex objects are set by the system as a side-effect of cross-connect establishment. Consequently, these objects are read-only.

3.3.2. Frame Relay DTE MIB

The Frame Relay DTE MIB described in [24] has no relevance to the FR/ATM PVC Service IWF MIB.

3.3.3. ATM MIB

ATM PVC endpoints are provisioned as rows in the ATM MIB [21] virtual connection link table.

Each ATM connection endpoint is described in the atmVclTable. A connection between two ATM endpoints is described by an entry in the ATM VCL cross-connect table atmVcCrossConnectTable. The atmVclCrossConnectIdentifier object of each endpoint points to the atmVcCrossConnectTable row for the connection.

In the case of an inter-worked connection, the atmVclCrossConnectIdentifier object is set to zero. Instead, the frAtmIwfVclCrossConnectIdentifier object in the frAtmIwfVclEntry is set to the index of the applicable FR/ATM IWF cross-connect table row.

Note that the `frAtmIwfVclCrossConnectIdentifier` object is defined not in the ATM MIB but in Section 5 of this MIB. Specifically, the object is defined as a column object in a table that AUGMENTS the ATM MIB VCL table.

The ATM VCL cross-connect table (`atmVcCrossConnectTable`) does not contain an entry for the inter-worked connection.

Note that the `atmVclCrossConnectIdentifier` and `frAtmIwfVclCrossConnectIdentifier` objects are set by the system as a side-effect of cross-connect establishment. Consequently, these objects are read-only.

3.3.4. IF MIB

The `ifIndex` defined in the IF MIB [22] identifies the specific frame relay and ATM endpoint interfaces. The values `frAtmIwfConnAtmPort` and `frAtmIwfConnFrPort` are used in this MIB as components in the index list for the `frAtmIwfConnectionTable` rows.

3.4. Point to Multipoint Considerations

This MIB supports IWF implementations providing point-to-multipoint functionality. All rows of the cross-connect table indexed by the same `frAtmIwfConnIndex` MUST utilize the same `frAtmIwfConnectionDescriptor` value.

A group of cross-connect table entries indexed by the same `frAtmIwfConnIndex` value MUST agree on which service the multipoint operation is offered. Two cases are possible:

- (1) Many frame relay PVCs cross-connected to one ATM PVC, or
- (2) One frame relay PVC cross-connected to many ATM PVCs

3.5. Theory of Operation

3.5.1. Creation Process

Multiple steps are required to create a frame relay to ATM cross-connection. First, rows must be created in the following tables:

- (1) The Frame Relay Service MIB `frPVCEndptTable`
- (2) The ATM MIB `atmVclTable`
- (3) The FR/ATM Service IWF MIB `frAtmIwfConnectionDescriptorTable`

- b) A new row is created in atmVclTable and frAtmIwfVclTable (the AUGMENT to the atmVclTable) as follows:
- atmVclCrossConnectIdentifier initialized to zero
 - frAtmIwfVclCrossConnectIdentifier initialized to zero
 - atmVclConnKind initialized to pvc(1)
 - remaining row objects initialized as needed for VPI.VCI Q.R on ifIndex S

Step 3 - Create the FR/ATM connection descriptor

- a) If an existing connection descriptor is appropriate for the new connection, go to Step 4 using the selected connection descriptor index value L
- b) Manager requests a new connection descriptor index value by reading frAtmIwfConnectionDescriptorIndexNext from the agent
- c) Agent receives GET request for frAtmIwfConnectionDescriptorIndexNext and responds with the next available value L
- d) Manager requests a new connection descriptor row entry using the value L as the index
- e) Agent receives SET request to create the frAtmIwfConnectionDescriptorTable row entry causes the system to create a row in the table.

Step 4 - Create the FR/ATM cross-connect

- a) Manager requests a new cross-connect index value by reading frAtmIwfConnIndexNext from the agent
- b) Agent receives GET request for frAtmIwfConnIndexNext and responds with the next available value K
- c) Manager requests a new cross-connect row entry using the value K as the index
- d) Agent receives SET request to create the frAtmIwfConnectionTable row entry (note: the frame relay and ATM PVC endpoints MUST exist and be specified as part of the index fields for the row 'K.S.Q.R.Y.X')

e) System creates a row in frAtmIwfConnectionTable for the following indices:

- frAtmIwfConnIndex of K
- frAtmIwfConnAtmPort of S
- frAtmIwfConnVpi of Q
- frAtmIwfConnVci of R
- frAtmIwfConnFrPort of Y
- frAtmIwfConnDlci of X
- frAtmIwfConnectionDescriptor of L

Step 5 - The system sets the frame relay PVC endpoint and ATM VCL endpoint to point to the FR/ATM cross-connect row (as a side-effect of Step 4).

a) System sets frPVCEndptAtmIwfConnIndex to K

b) System sets frAtmIwfVclCrossConnectIdentifier to K

Step 6 - Manager signals activation by issuing a SET for the frAtmIwfConnAdminStatus object using the value of 'up(1)'

Step 7 - Agent receives SET request for frAtmIwfConnAdminStatus and executes internal system mechanisms to activate each PVC segment and the IWF cross-connect. The successful activation permits the agent to respond with 'up(1)' when a GET request is received for the following fields:

- frAtmIwfConnAtm2FrOperStatus
- frAtmIwfConnFr2AtmOperStatus
- atmVclOperStatus (Note: there is no comparable FRS MIB object)

3.5.2. Destruction Process

Destruction of the frame relay to ATM cross-connection is initiated by the network management system. The agent's processing of the request stimulates implementation-specific system clean-up actions. Following removal of the row in the cross-connection table, the frAtmIwfVclCrossConnectIdentifier in the frAtmIwfVclTable (AUGMENT of

the ATM MIB endpoint table) and frPVCEndptAtmIwfConnIndex in the Frame Relay Service MIB endpoint table are both re-initialized to zero.

A step-by-step example is provided to illustrate the destruction process.

Step 1 - Manager requests destruction of an existing row in the frAtmIwfConnectionTable by setting frAtmIwfConnRowStatus to destroy(6)

Step 2 - Agent receives the SET request and performs implementation-specific system clean-up actions for the cross-connection row

Step 3 - System updates the relevant cross connect information for the frame relay PVC endpoint by setting frPVCEndptAtmIwfConnIndex to 0

Step 4 - System updates the relevant cross connect information for the ATM PVC endpoint as follows:

- a) System sets frAtmIwfVclCrossConnectIdentifier to 0
- b) System sets atmVclOperStatus to 'down(2)' (Note: there is no comparable FRS MIB object)

Following the destruction of the FR/ATM cross-connection entry, the manager MAY set the frPVCConnectRowStatus and/or atmVclRowStatus to destroy(6) the associated endpoint entries.

3.5.3. Modification Process

At the discretion of the agent, a FR/ATM cross-connect may be reconfigured by adding and/or deleting leafs to/from the IWF topology as per the FR/ATM IWF cross-connect creation/destruction procedures. Reconfiguration of traffic/service category parameter values requires release of the FR/ATM IWF cross-connect before those parameter values may be changed for individual frame relay or ATM endpoint segments.

4. Object Definitions

FR-ATM-PVC-SERVICE-IWF-MIB DEFINITIONS ::= BEGIN

IMPORTS

MODULE-IDENTITY, OBJECT-TYPE,
NOTIFICATION-TYPE,
mib-2, Integer32, Counter32

FROM SNMPv2-SMI

RowStatus, TimeStamp	FROM SNMPv2-TC
MODULE-COMPLIANCE, OBJECT-GROUP, NOTIFICATION-GROUP	FROM SNMPv2-CONF
AtmVpIdentifier, AtmVcIdentifier	FROM ATM-TC-MIB
atmVclEntry	FROM ATM-MIB
InterfaceIndex	FROM IF-MIB;

frAtmIwfmib MODULE-IDENTITY

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DESCRIPTION

"The MIB module for monitoring and controlling the
Frame Relay/ATM PVC Service Interworking
Function."

--

-- Revision History

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```

REVISION "200009280000Z"
DESCRIPTION
    "Published as RFC 2955"

 ::= { mib-2 86 }

--
-- Object Identifiers
--
frAtmIwfMIBObjects      OBJECT IDENTIFIER
                        ::= { frAtmIwfMIB 1 }

frAtmIwfTraps           OBJECT IDENTIFIER
                        ::= { frAtmIwfMIB 2 }
frAtmIwfTrapsPrefix     OBJECT IDENTIFIER
                        ::= { frAtmIwfTraps 0 }

frAtmIwfConformance     OBJECT IDENTIFIER
                        ::= { frAtmIwfMIB 3 }
frAtmIwfGroups           OBJECT IDENTIFIER
                        ::= { frAtmIwfConformance 1 }
frAtmIwfCompliances     OBJECT IDENTIFIER
                        ::= { frAtmIwfConformance 2 }

--
-- The FR/ATM PVC Service IWF Group
--
-- The Frame Relay/ATM PVC Service Interworking Function
-- Connection Table contains all connections utilizing
-- the interworking function.
--

frAtmIwfConnIndexNext OBJECT-TYPE
    SYNTAX      Integer32 (0..2147483647)
    MAX-ACCESS   read-only
    STATUS      current
    DESCRIPTION
        "This object contains an appropriate value to be
        used for frAtmIwfConnIndex when creating entries
        in the frAtmIwfConnectionTable. The value 0
        indicates that no unassigned entries are
        available. To obtain the frAtmIwfConnIndexNext
        value for a new entry, the manager issues a
        management protocol retrieval operation to obtain
        the current value of this object. After each
        retrieval, the agent should modify the value to
        the next unassigned index."
    ::= { frAtmIwfMIBObjects 1 }

```

frAtmIwfConnectionTable OBJECT-TYPE

SYNTAX SEQUENCE OF FrAtmIwfConnectionEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A table in which each row represents a Frame Relay/ATM interworking connection."

::= { frAtmIwfMIBObjects 2 }

frAtmIwfConnectionEntry OBJECT-TYPE

SYNTAX FrAtmIwfConnectionEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The FrAtmIwfConnectionEntry provides an entry for an interworking connection between a frame relay PVC and one or more ATM PVCs, or an ATM PVC and one or more frame relay PVCs. A single frame relay PVC connected to a single ATM PVC is referred to as a 'point-to-point' connection and is represented by a single row in the FR/ATM IWF Connection Table. The case of a single frame relay PVC connected to multiple ATM PVCs (or single ATM PVC connected to multiple frame relay PVCs) is referred to as a 'point-to-multipoint' connection and is represented by multiple rows in the FR/ATM IWF Connection Table.

The object frAtmIwfConnIndex uniquely identifies each point-to-point or point-to-multipoint connection. The manager obtains the frAtmIwfConnIndex value by reading the frAtmIwfConnIndexNext object.

After a frAtmIwfConnIndex is assigned for the connection, the manager creates one or more rows in the Cross Connect Table; one for each cross-connection between the frame relay PVC and an ATM PVC. In the case of 'point-to-multipoint' connections, all rows are indexed by the same frAtmIwfConnIndex value and MUST refer to the same frame relay PVC or ATM PVC respectively. An entry can be created only when at least one pair of frame relay and ATM PVCs exist.

A row can be established by one-step set-request with all required parameter values and frAtmIwfConnRowStatus set to createAndGo(4). The

Agent should perform all error checking as needed. A pair of cross-connected PVCs, as identified by a particular value of the indexes, is released by setting frAtmIwfConnRowStatus to destroy(6). The Agent may release all associated resources. The manager may remove the related PVCs thereafter. Indexes are persistent across reboots of the system."

```
INDEX { frAtmIwfConnIndex,
        frAtmIwfConnAtmPort,
        frAtmIwfConnVpi,
        frAtmIwfConnVci,
        frAtmIwfConnFrPort,
        frAtmIwfConnDlci
      }
 ::= { frAtmIwfConnectionTable 1 }
```

FrAtmIwfConnectionEntry ::=

```
SEQUENCE {
    frAtmIwfConnIndex          Integer32,
    frAtmIwfConnAtmPort       InterfaceIndex,
    frAtmIwfConnVpi           AtmVpIdentifier,
    frAtmIwfConnVci           AtmVcIdentifier,
    frAtmIwfConnFrPort        InterfaceIndex,
    frAtmIwfConnDlci          Integer32,
    frAtmIwfConnRowStatus      RowStatus,
    frAtmIwfConnAdminStatus    INTEGER,
    frAtmIwfConnAtm2FrOperStatus INTEGER,
    frAtmIwfConnAtm2FrLastChange Timestamp,
    frAtmIwfConnFr2AtmOperStatus INTEGER,
    frAtmIwfConnFr2AtmLastChange Timestamp,
    frAtmIwfConnectionDescriptor Integer32,
    frAtmIwfConnFailedFrameTranslate Counter32,
    frAtmIwfConnOverSizedFrames Counter32,
    frAtmIwfConnFailedAal5PduTranslate Counter32,
    frAtmIwfConnOverSizedSDUs Counter32,
    frAtmIwfConnCrcErrors      Counter32,
    frAtmIwfConnSarTimeOuts    Counter32
}
```

frAtmIwfConnIndex OBJECT-TYPE

SYNTAX Integer32 (1..2147483647)

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A unique value for each point-to-point or point-to-multipoint connection. The manager obtains the frAtmIwfConnIndex value by reading the

frAtmIwfConnIndexNext object. A point-to-multipoint connection will be represented in the frAtmIwfConnectionTable with multiple entries that share the same frAtmIwfConnIndex value."

::= { frAtmIwfConnectionEntry 1 }

frAtmIwfConnAtmPort OBJECT-TYPE
SYNTAX InterfaceIndex
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"The index in the ifTable that identifies the ATM port for this interworking connection."
::= { frAtmIwfConnectionEntry 2 }

frAtmIwfConnVpi OBJECT-TYPE
SYNTAX AtmVpIdentifier
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"The VPI of the ATM PVC end point for this interworking connection."
::= { frAtmIwfConnectionEntry 3 }

frAtmIwfConnVci OBJECT-TYPE
SYNTAX AtmVcIdentifier
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"The VCI of the ATM PVC end point for this interworking connection."
::= { frAtmIwfConnectionEntry 4 }

frAtmIwfConnFrPort OBJECT-TYPE
SYNTAX InterfaceIndex
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"The index in the ifTable that identifies the frame relay port for this interworking connection."
::= { frAtmIwfConnectionEntry 5 }

frAtmIwfConnDlci OBJECT-TYPE
SYNTAX Integer32 (16..4194303)
MAX-ACCESS not-accessible
STATUS current

DESCRIPTION

"The DLCI that identifies the frame relay PVC end point for this interworking connection."

::= { frAtmIwfConnectionEntry 6 }

frAtmIwfConnRowStatus OBJECT-TYPE

SYNTAX RowStatus
MAX-ACCESS read-create
STATUS current

DESCRIPTION

"The table row may be created with 'createAndWait(5)' or 'createAndGo(4)'. To activate a connection entry, a valid connection descriptor MUST be established in the frAtmIwfConnectionDescriptor object.

This object is set to 'destroy(6)' to delete the table row. Before the table row is destroyed, the OperStatus/AdminStatus of the corresponding endpoints MUST be 'down(2)'. The deactivation of the ATM endpoint MAY occur as a side-effect of deleting the FR/ATM IWF cross-connection table row. Otherwise, 'destroy(6)' operation MUST fail (error code 'inconsistentValue')."

::= { frAtmIwfConnectionEntry 7 }

frAtmIwfConnAdminStatus OBJECT-TYPE

SYNTAX INTEGER { up(1), down(2) }
MAX-ACCESS read-create
STATUS current

DESCRIPTION

"The desired operational state for this FR/ATM interworked connection.

up(1) = Activate the connection. Before the activation can be completed, the OperStatus/AdminStatus of the corresponding endpoints MUST be 'up(1)'. The activation of the corresponding endpoints MAY occur as a side-effect of activating the FR/ATM IWF cross-connection.

down(2) = Deactivate the connection. Before the deactivation can be completed, the atmVclAdminStatus of the corresponding ATM endpoint MUST be 'down(2)'. The deactivation of the

ATM endpoint MAY occur as a side-effect of deactivating the FR/ATM IWF cross-connection."

::= { frAtmIwfConnectionEntry 8 }

frAtmIwfConnAtm2FrOperStatus OBJECT-TYPE

SYNTAX INTEGER { up(1), down(2) }

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The current operational state of this interworking connection in the ATM to frame relay direction."

::= { frAtmIwfConnectionEntry 9 }

frAtmIwfConnAtm2FrLastChange OBJECT-TYPE

SYNTAX TimeStamp

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of sysUpTime at the time this interworking connection entered its current operational state in the ATM to FR direction. If the current state was entered prior to the last re-initialization of the local network management subsystem, then this object contains a zero value."

::= { frAtmIwfConnectionEntry 10 }

frAtmIwfConnFr2AtmOperStatus OBJECT-TYPE

SYNTAX INTEGER { up(1), down(2) }

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The current operational state of this interworking connection in the frame relay to ATM direction."

::= { frAtmIwfConnectionEntry 11 }

frAtmIwfConnFr2AtmLastChange OBJECT-TYPE

SYNTAX TimeStamp

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of sysUpTime at the time this interworking connection entered its current operational state in the FR to ATM direction. If the current state was entered prior to the last

re-initialization of the local network management subsystem, then this object contains a zero value."

::= { frAtmIwfConnectionEntry 12 }

frAtmIwfConnectionDescriptor OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The value represents a pointer to the relevant descriptor in the IWF descriptor table. An attempt to set this value to an inactive or non-existent row in the Connection Descriptor Table MUST fail (error code 'inconsistentValue')."

::= { frAtmIwfConnectionEntry 13 }

frAtmIwfConnFailedFrameTranslate OBJECT-TYPE

SYNTAX Counter32

UNITS "Frames"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object counts the number of frames discarded by the IWF because, while operating in Translation Mode, the IWF is unable to decode the incoming frame payload header according to the mapping rules. (i.e., payload header not recognized by the IWF).

Frame relay frames are received in the frame relay to ATM direction of the PVC.

When operating in Transparent Mode, the IWF MUST return noSuchInstance."

REFERENCE

"FRF.8 [17], Section 5.3.1"

::= { frAtmIwfConnectionEntry 14 }

frAtmIwfConnOverSizedFrames OBJECT-TYPE

SYNTAX Counter32

UNITS "Frames"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Count of frames discarded by the IWF because the frame is too large to be processed by the AAL5 segmentation procedure. Specifically, the frame

does not conform to the size specified in the atmVccAal5CpcsTransmitSduSize object associated with the atmVclEntry at the ATM endpoint. Frame relay frames are received in the frame relay to ATM direction of the PVC."

REFERENCE

"ATM MIB [21], atmVclTable
FRF.8 [17], 5.3.1.4"

::= { frAtmIwfConnectionEntry 15 }

frAtmIwfConnFailedAal5PduTranslate OBJECT-TYPE

SYNTAX Counter32

UNITS "PDUs"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This attribute counts the number of AAL5 PDUs discarded by the IWF because, while operating in Translation Mode, the IWF is unable to decode the incoming AAL5 PDU payload header according to the mapping rules. (i.e., payload header not recognized by the IWF)."

AAL5 PDUs are received in the ATM to frame relay direction of the PVC.

When operating in Transparent Mode, the IWF MUST return noSuchInstance."

REFERENCE

"FRF.8 [17], Section 5.3.1"

::= { frAtmIwfConnectionEntry 16 }

frAtmIwfConnOverSizedSDUs OBJECT-TYPE

SYNTAX Counter32

UNITS "SDUs"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Count of AAL5 SDUs discarded by the IWF because the SDU is too large to be forwarded on the frame relay segment of the connection. Specifically, the frame does not conform to the size specified in the frLportFragSize object of the FRS MIB [19]."

AAL5 PDUs are received in the ATM to frame relay direction of the PVC."

REFERENCE

"FRS MIB [19], frLportTable"

```

        FRF.8 [17], 5.3.1.4"
    ::= { frAtmIwfConnectionEntry 17 }

```

frAtmIwfConnCrcErrors OBJECT-TYPE

```

    SYNTAX      Counter32
    UNITS       "PDUs"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of AAL5 CPCS PDUs received with CRC-32
        errors on this AAL5 VCC at the IWF.

        AAL5 PDUs are received in the ATM to frame relay
        direction of the PVC."
    REFERENCE
        "ATM MIB [21], atmVclTable"
    ::= { frAtmIwfConnectionEntry 18 }

```

frAtmIwfConnSarTimeOuts OBJECT-TYPE

```

    SYNTAX      Counter32
    UNITS       "PDUs"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of partially re-assembled AAL5 CPCS
        PDUs which were discarded on this AAL5 VCC at the
        IWF because they were not fully re-assembled
        within the required time period.  If the re-
        assembly timer is not supported, then this object
        contains a zero value.

        AAL5 PDUs are received in the ATM to frame relay
        direction of the PVC."
    REFERENCE
        "ATM MIB [21], atmVclTable"
    ::= { frAtmIwfConnectionEntry 19 }

```

```

--
-- The FR/ATM PVC Service IWF Connection Descriptor Group
--
-- The Frame Relay/ATM PVC Service Interworking Function
-- Connection Descriptor table.  A descriptor provides the
-- attributes for a type of interworked connection.
--

```

frAtmIwfConnectionDescriptorIndexNext OBJECT-TYPE

```

    SYNTAX      Integer32 (0..2147483647)
    MAX-ACCESS  read-only

```

STATUS current

DESCRIPTION

"This object contains an appropriate value to be used for frAtmIwfConnectionDescriptorIndex when creating entries in the frAtmIwfConnectionDescriptorTable. The value 0 indicates that no unassigned entries are available. To obtain the frAtmIwfConnectionDescriptorIndexNext value for a new entry, the manager issues a management protocol retrieval operation to obtain the current value of this object. After each retrieval, the agent should modify the value to the next unassigned index."

::= { frAtmIwfMIBObjects 3 }

frAtmIwfConnectionDescriptorTable OBJECT-TYPE

SYNTAX SEQUENCE OF FrAtmIwfConnectionDescriptorEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A table in which each row represents a descriptor for one type of Frame Relay/ATM interworking connection. A descriptor may be assigned to zero or more FR/ATM PVC service IWF connections."

::= { frAtmIwfMIBObjects 4 }

frAtmIwfConnectionDescriptorEntry OBJECT-TYPE

SYNTAX FrAtmIwfConnectionDescriptorEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry for a descriptor in an interworking connection between a frame relay PVC and an ATM PVC."

INDEX { frAtmIwfConnectionDescriptorIndex }

::= { frAtmIwfConnectionDescriptorTable 1 }

FrAtmIwfConnectionDescriptorEntry ::=

SEQUENCE {

frAtmIwfConnectionDescriptorIndex	Integer32,
frAtmIwfConnDescriptorRowStatus	RowStatus,
frAtmIwfConnDeToClpMappingMode	INTEGER,
frAtmIwfConnClpToDeMappingMode	INTEGER,
frAtmIwfConnCongestionMappingMode	INTEGER,
frAtmIwfConnEncapsulationMappingMode	INTEGER,
frAtmIwfConnEncapsulationMappings	BITS,
frAtmIwfConnFragAndReassEnabled	INTEGER,

```

        frAtmIwfConnArpTranslationEnabled      INTEGER
    }

frAtmIwfConnectionDescriptorIndex OBJECT-TYPE
    SYNTAX      Integer32 (1..2147483647)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A unique value to identify a descriptor in the
        table "
    ::= { frAtmIwfConnectionDescriptorEntry 1 }

frAtmIwfConnDescriptorRowStatus OBJECT-TYPE
    SYNTAX      RowStatus
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "The status of this table row.  This object is
        used to create or delete an entry in the
        descriptor table.

        Creation of the row requires a row index (see
        frAtmIwfConnectionDescriptorIndexNext).  If not
        explicitly set or in existence, all other columns
        of the row will be created and initialized to the
        default value.  During creation, this object MAY
        be set to 'createAndGo(4)' or 'createAndWait(5)'.
        The object MUST contain the value 'active(1)'
        before any connection table entry references the
        row.

        To destroy a row in this table, this object is set
        to the 'destroy(6)' action.  Row destruction MUST
        fail (error code 'inconsistentValue') if any
        connection references the row."
    ::= { frAtmIwfConnectionDescriptorEntry 2 }

frAtmIwfConnDeToClpMappingMode OBJECT-TYPE
    SYNTAX      INTEGER {
                    model(1),
                    mode2Const0(2),
                    mode2Const1(3)
                }
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "This object describes which mode of translation
        is in use for loss priority mapping in the frame

```

relay to ATM direction.

model(1) = the DE field in the Q.922 core frame shall be mapped to the ATM CLP field of every cell generated by the segmentation process of the AAL5 PDU containing the information of that frame.

mode2Const0(2) = the ATM CLP field of every cell generated by the segmentation process of the AAL5 PDU containing the information of that frame shall be set to constant 0.

mode2Const1(3) = the ATM CLP field of every cell generated by the segmentation process of the AAL5 PDU containing the information of that frame shall be set to constant 1."

REFERENCE

"FRF.8 [17], Section 4.2.1"

DEFVAL { model }

::= { frAtmIwfConnectionDescriptorEntry 3 }

frAtmIwfConnClpToDeMappingMode OBJECT-TYPE

SYNTAX INTEGER {
 model(1),
 mode2Const0(2),
 mode2Const1(3)
}

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This object describes which mode of translation is in use for loss priority mapping in the ATM to frame relay direction.

model(1) = if one or more cells in a frame has its CLP field set, the DE field of the Q.922 core frame should be set.

mode2Const0(2) = the DE field of the Q.922 core frame should be set to the

constant 0.

mode2Const1(3) = the DE field of the Q.922 core
frame should be set to the
constant 1."

REFERENCE

"FRF.8 [17], Section 4.2.2"

DEFVAL { model }

::= { frAtmIwfConnectionDescriptorEntry 4 }

frAtmIwfConnCongestionMappingMode OBJECT-TYPE

SYNTAX INTEGER {
model(1),
mode2(2)
}

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This object describes which mode of translation
is in use for forward congestion indication
mapping in the frame relay to ATM direction.

model(1) = The FECN field in the Q.922 core frame
shall be mapped to the ATM EFCI field
of every cell generated by the
segmentation process of the AAL5 PDU
containing the information of that
frame.

mode2(2) = The FECN field in the Q.922 core frame
shall not be mapped to the ATM EFCI
field of cells generated by the
segmentation process of the AAL5 PDU
containing the information of that
frame. The EFCI field is always set to
'congestion not experienced'.

In both of the modes above, if there is congestion
in the forward direction in the ATM layer within
the IWF, then the IWF can set the EFCI field to
'congestion experienced'."

REFERENCE

"FRF.8 [17], Section 4.3.1.1"

DEFVAL { model }

::= { frAtmIwfConnectionDescriptorEntry 5 }

frAtmIwfConnEncapsulationMappingMode OBJECT-TYPE

SYNTAX INTEGER {

```

        transparentMode(1),
        translationMode(2),
        translationModeAll(3)
    }
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION
    "This object indicates whether the mapping of
    upper layer protocol encapsulation is enabled on
    this interworking connection.

    transparentMode(1) = Forward the encapsulations
                        unaltered.

    translationMode(2) = Perform mapping between the
                        two encapsulations due to the
                        incompatibilities of the two
                        methods. Mapping is provided
                        for a subset of the potential
                        encapsulations as itemized in
                        frAtmIwfConnEncapsulationMappp
                        ings.

    translationModeAll(3) = Perform mapping between
                        the two encapsulations due to
                        the incompatibilities of the
                        two methods. All
                        encapsulations are
                        translated."

REFERENCE
    "FRF.8 [17], Section 5.3"
DEFVAL        { transparentMode }
::= { frAtmIwfConnectionDescriptorEntry 6 }

frAtmIwfConnEncapsulationMappings OBJECT-TYPE
    SYNTAX     BITS {
        none (0),
        bridgedPdus(1),
        bridged802dot6(2),
        bPdus(3),
        routedIp(4),
        routedOsi(5),
        otherRouted(6),
        x25Iso8202(7),
        q933q2931(8) }
    MAX-ACCESS    read-create
    STATUS        current
    DESCRIPTION

```

"If upper layer protocol encapsulation mapping is enabled on this interworking connection, then this attribute enumerates which of the encapsulation mappings are supported.

```

none(0)           = Transparent mode operation
bridgedPdus(1)    = PID: 0x00-01,-07,-02 or -08
bridged802dot6(2) = PID: 0x00-0B
bPdus(3)          = PID: 0x00-0E or -0F
routedIp(4)       = NLPID: 0xCC
routedOsi(5)      = NLPID: 0x81, 0x82 or 0x83
otherRouted(6)    = Other routed protocols
x25Iso8202(7)     = X25
q933q2931(8)     = Q.933 and Q.2931"

```

REFERENCE

"FRF.8 [17], Section 5.3.1"

DEFVAL { { none } }

::= { frAtmIwfConnectionDescriptorEntry 7 }

frAtmIwfConnFragAndReassEnabled OBJECT-TYPE

SYNTAX INTEGER { enabled(1), disabled(2) }

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The attribute indicates whether fragmentation and reassembly is enabled for this connection."

REFERENCE

"FRF.8 [17], Section 5.3.1.4"

DEFVAL { disabled }

::= { frAtmIwfConnectionDescriptorEntry 8 }

frAtmIwfConnArpTranslationEnabled OBJECT-TYPE

SYNTAX INTEGER { enabled(1), disabled(2) }

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The attribute indicates whether ARP translation is enabled for this connection."

REFERENCE

"FRF.8 [17], Section 5.4"

DEFVAL { disabled }

::= { frAtmIwfConnectionDescriptorEntry 9 }

--

-- Augmentation of ATM MIB VCL Endpoint Table (atmVclTable)

--

frAtmIwfVclTable OBJECT-TYPE

SYNTAX SEQUENCE OF FrAtmIwfVclEntry

```

MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
    "The FR/ATM IWF VCL Table augments the ATM MIB VCL
    Endpoint table."
 ::= { frAtmIwfMIBObjects 5 }

frAtmIwfVclEntry OBJECT-TYPE
    SYNTAX      FrAtmIwfVclEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Entries in this table are created only by the
        agent. One entry exists for each ATM VCL managed
        by the agent."
    AUGMENTS    { atmVclEntry }
    ::= { frAtmIwfVclTable 1 }

FrAtmIwfVclEntry ::= SEQUENCE {
    frAtmIwfVclCrossConnectIdentifier    Integer32
}

frAtmIwfVclCrossConnectIdentifier OBJECT-TYPE
    SYNTAX      Integer32 (1..2147483647)
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "This object contains the index value of the
        FR/ATM cross-connect table entry used to link the
        ATM VCL with a frame relay PVC.

        Each row of the atmVclTable that is not cross-
        connected with a frame relay PVC MUST return the
        value zero when this object is read.

        In the case of (frame relay) point to (ATM)
        multipoint, multiple ATM VCLs will have the same
        value of this object, and all their cross-
        connections are identified by entries that are
        indexed by the same value of
        frAtmIwfVclCrossConnectIdentifier in the
        frAtmIwfConnectionTable of this MIB module.

        The value of this object is initialized by the
        agent after the associated entries in the
        frAtmIwfConnectionTable have been created."
    ::= { frAtmIwfVclEntry 1 }

```

```
--
-- Frame Relay/ATM PVC Service Interworking NOTIFICATION
--

frAtmIwfConnStatusChange NOTIFICATION-TYPE
    OBJECTS {      frAtmIwfConnAdminStatus,
                    frAtmIwfConnAtm2FrOperStatus,
                    frAtmIwfConnFr2AtmOperStatus
                  }
    STATUS          current
    DESCRIPTION
        "An indication that the status of this
        interworking connection has changed."
    ::= { frAtmIwfTrapsPrefix 1 }

--
-- Conformance Information
--

--
-- Compliance Statement For Equipment
--

frAtmIwfEquipmentCompliance MODULE-COMPLIANCE
    STATUS          current
    DESCRIPTION
        "The compliance statement for equipment that
        implements the FR/ATM Interworking MIB."

    MODULE -- this module
        MANDATORY-GROUPS { frAtmIwfBasicGroup,
                             frAtmIwfConnectionDescriptorGroup,
                             frAtmIwfAtmVclTableAugmentGroup,
                             frAtmIwfNotificationsGroup }

        OBJECT      frAtmIwfConnDeToClpMappingMode
        SYNTAX       INTEGER { model(1) }
        DESCRIPTION
            "Only support for Mode 1 is REQUIRED."

        OBJECT      frAtmIwfConnClpToDeMappingMode
        SYNTAX       INTEGER { model(1) }
        DESCRIPTION
            "Only support for Mode 1 is REQUIRED."

        OBJECT      frAtmIwfConnCongestionMappingMode
        SYNTAX       INTEGER { model(1) }
        DESCRIPTION
```

"Only support for Mode 1 is REQUIRED."

OBJECT frAtmIwfConnEncapsulationMappingMode
 SYNTAX INTEGER { transparentMode(1) }
 DESCRIPTION
 "Support for Translation Mode is OPTIONAL."

OBJECT frAtmIwfConnEncapsulationMappings
 SYNTAX BITS { none(0) }
 DESCRIPTION
 "The IWF may provide one, some or none of the
 encapsulation translations defined in section
 5.3.1 of FRF.8 [17]."

OBJECT frAtmIwfConnFragAndReassEnabled
 SYNTAX INTEGER { disabled(2) }
 DESCRIPTION
 "Only support for Mode 1 is REQUIRED."

OBJECT frAtmIwfConnArpTranslationEnabled
 SYNTAX INTEGER { disabled(2) }
 DESCRIPTION
 "Support for ARP Translation is NOT REQUIRED."

::= { frAtmIwfCompliances 1 }

--

-- Compliance Statement For Service (CNM Interface)

--

frAtmIwfServiceCompliance MODULE-COMPLIANCE

STATUS current

DESCRIPTION

"The compliance statement for a CNM interface that
 implements the FR/ATM Interworking MIB."

MODULE -- this module

MANDATORY-GROUPS { frAtmIwfBasicGroup,
 frAtmIwfConnectionDescriptorGroup,
 frAtmIwfAtmVclTableAugmentGroup,
 frAtmIwfNotificationsGroup }

--

-- Exceptions for each object type implemented for a
 -- CNM view of the FR/ATM Interworking MIB

--

OBJECT frAtmIwfConnAdminStatus
 MIN-ACCESS read-only

DESCRIPTION

"Write access is not REQUIRED."

OBJECT frAtmIwfConnDeToClpMappingMode

SYNTAX INTEGER { model(1) }

MIN-ACCESS read-only

DESCRIPTION

"Support for Mode 1 is REQUIRED. Other modes are OPTIONAL. Write access is NOT REQUIRED."

OBJECT frAtmIwfConnClpToDeMappingMode

SYNTAX INTEGER { model(1) }

MIN-ACCESS read-only

DESCRIPTION

"Support for Mode 1 is REQUIRED. Other modes are OPTIONAL. Write access is NOT REQUIRED."

OBJECT frAtmIwfConnCongestionMappingMode

SYNTAX INTEGER { model(1) }

MIN-ACCESS read-only

DESCRIPTION

"Support for Mode 1 is REQUIRED. Other modes are OPTIONAL. Write access is NOT REQUIRED."

OBJECT frAtmIwfConnEncapsulationMappingMode

SYNTAX INTEGER { transparentMode(1) }

MIN-ACCESS read-only

DESCRIPTION

"Support for Transparent Mode is REQUIRED.
Translation Mode is OPTIONAL. Write access is not required."

OBJECT frAtmIwfConnEncapsulationMappings

SYNTAX BITS { none(0) }

MIN-ACCESS read-only

DESCRIPTION

"The IWF may provide one, some or none of the encapsulation translations defined in section 5.3.1 of FRF.8 [17]. Write access is not required."

OBJECT frAtmIwfConnFragAndReassEnabled

SYNTAX INTEGER { disabled(2) }

MIN-ACCESS read-only

DESCRIPTION

"Support for Fragmentation and Reassembly is NOT REQUIRED. Write access is not required."

```

OBJECT      frAtmIwfConnArpTranslationEnabled
SYNTAX      INTEGER { disabled(2) }
MIN-ACCESS   read-only
DESCRIPTION
    "Support for ARP Translation is not required.
    Write access is not required."

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

 ::= { frAtmIwfCompliances 2 }

--
-- Units of Conformance
--

--
-- Basic FR/ATM IWF PVC Connection Group
--
frAtmIwfBasicGroup      OBJECT-GROUP
    OBJECTS { frAtmIwfConnIndexNext,
               frAtmIwfConnAdminStatus,
               frAtmIwfConnAtm2FrOperStatus,
               frAtmIwfConnAtm2FrLastChange,
               frAtmIwfConnFr2AtmOperStatus,
               frAtmIwfConnFr2AtmLastChange,
               frAtmIwfConnectionDescriptor,
               frAtmIwfConnFailedFrameTranslate,
               frAtmIwfConnOverSizedFrames,
               frAtmIwfConnFailedAal5PduTranslate,
               frAtmIwfConnOverSizedSDUs,
               frAtmIwfConnCrcErrors,
               frAtmIwfConnSarTimeOuts,
               frAtmIwfConnRowStatus }
    STATUS      current
    DESCRIPTION
        "The collection of basic objects for configuration
        and control of FR/ATM interworking connections."
    ::= { frAtmIwfGroups 1 }

--
-- FR/ATM IWF PVC Connection Descriptor Group
--

frAtmIwfConnectionDescriptorGroup      OBJECT-GROUP
    OBJECTS {
```

```

        frAtmIwfConnectionDescriptorIndexNext,
        frAtmIwfConnDeToClpMappingMode,
        frAtmIwfConnClpToDeMappingMode,
        frAtmIwfConnCongestionMappingMode,
        frAtmIwfConnEncapsulationMappingMode,
        frAtmIwfConnEncapsulationMappings,
        frAtmIwfConnFragAndReassEnabled,
        frAtmIwfConnArpTranslationEnabled,
        frAtmIwfConnDescriptorRowStatus
    }
    STATUS current
    DESCRIPTION
        "The collection of basic objects for specification
        of FR/ATM interworking connection descriptors."
    ::= { frAtmIwfGroups 2 }

--
-- ATM MIB VCL Endpoint Table Augmentation Group
--

frAtmIwfAtmVclTableAugmentGroup OBJECT-GROUP
    OBJECTS {
        frAtmIwfVclCrossConnectIdentifier
    }
    STATUS current
    DESCRIPTION
        "The ATM MIB VCL Endpoint Table AUGMENT object
        contained in the FR/ATM PVC Service Interworking
        MIB."
    ::= { frAtmIwfGroups 3 }

--
-- Notification Group
--

frAtmIwfNotificationsGroup NOTIFICATION-GROUP
    NOTIFICATIONS { frAtmIwfConnStatusChange }
    STATUS current
    DESCRIPTION
        "The notification for FR/ATM interworking status
        change."
    ::= { frAtmIwfGroups 4 }
END

```

8. Acknowledgments

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10. Security Considerations

There are a number of management objects defined in this MIB that have 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.

No managed objects in this MIB contain sensitive information.

SNMPv1 by itself is not a secure environment. 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.

It is recommended that the implementers consider the security features as provided by the SNMPv3 framework. Specifically, the use of the User-based Security Model RFC 2574 [12] and the View-based Access Control Model RFC 2575 [15] is recommended.

It is then a customer/user responsibility to ensure that the SNMP entity giving access to an instance of this MIB, 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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