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SNMP Alarms and MIB Module
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Abstract

This document defines the model for alarms in the SNMP framework and defines a Management Information Base (MIB) module that defines a list of outstanding alarms and log of alarms that have occurred and have been cleared.

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1. The SNMP Management Framework

- An overall architecture, described in RFC 2571 [RFC2571].

- 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 [RFC1155], STD 16, RFC 1212 [RFC1212] and RFC 1215 [RFC1215]. The second version, called SMIv2, is described in STD 58, RFC 2578 [RFC2578], STD 58, RFC 2579 [RFC2579] and STD 58, RFC 2580 [RFC2580].

- Message protocols for transferring management information. The first version of the SNMP message protocol is called SNMPv1 and described in STD 15, RFC 1157 [RFC1157]. A second version of the SNMP message protocol, which is not an Internet standards track protocol, is called SNMPv2c and described in RFC 1901 [RFC1901] and RFC 1906 [RFC1906]. The third version of the message protocol is called SNMPv3 and described in RFC 1906 [RFC1906], RFC 2572 [RFC2572] and RFC 2574 [RFC2574].

- Protocol operations for accessing management information. The first set of protocol operations and associated PDU formats is described in STD 15, RFC 1157 [RFC1157]. A second set of protocol operations and associated PDU formats is described in RFC 1905 [RFC1905].

- A set of fundamental applications described in RFC 2573 [RFC2573] and the view-based access control mechanism described in RFC 2575 [RFC2575].

A more detailed introduction to the current SNMP Management Framework can be found in RFC 2570 [RFC2570].

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. Introduction

There are two main approaches to management. One is based on polling by a management application to determine node status, and the other is based on a node sending notifications to manager when status changes to and from fault conditions. The SNMP approach to date has been the first. Little has been done to support the second in the SNMP framework. This document provides the mechanisms for management to be based on exception reporting.

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 [1].

3. Exception Reporting Framework

3.1 Terminology

Error
: A deviation of a system from intended operation.

Fault
: A lasting error or warning condition.

Alarm
: Persistent indication of a fault. An alarm is said to be 'set' (or raised) when a fault is first detected and administratively enabled. An alarm is said to be 'cleared' when a fault is first noticed to have ceased or administratively disabled.

Event
: Something that happened. Examples include a change in status, crossing a threshold, an external input to the system. Additionally, setting or clearing an alarm is also an event.

Notification
: An unsolicited transmission of management information due to an event or condition.

3.2 Alarm Definitions

Each type of an alarm needs to be well specified. Ideally, a new construct (or template) would be added to the MIB module language, which is specified by SNMP's SMI. Unfortunately, this is not possible. Since alarms are identified with an OID value, the best choice of construct to use is OBJECT-IDENTITY. This construct allows a descriptor to be defined, a status and description specified, and

an OID value assigned. The contents of the DESCRIPTION text must be

structured to specify the attributes of an alarm type. The attributes include:

Raise Conditions
: What set of conditions or events cause the alarm to be raised?

Clear Conditions
: What must occur to cause the alarm to be cleared?

Source Identification
: How are the sources of the alarm identified (a source can be physical (such as port), or logical, such as a session)?

Perceived Severity
: How is the perceived severity of the alarm determined (it may be statically specified or dynamically determined)?

Service Affecting
: How is it determined if the condition is service affecting (it may be statically specified or dynamically determined)?

Associated Information
: What additional information is associated, if any, with the alarm? For example, if the alarm is due to a threshold being crossed, the additional information could be the threshold value and the current value.

Class (Category)
: What is the class (category) of the alarm using the ITU-T terminology?

Probable Cause
: How is the probable cause of the alarm determined (it may be statically specified or dynamically determined)?

Dependencies
: What are the dependencies, if any, between this alarm and other alarms. For example, a loss of signal alarm on a network interface would probably also result in a network interface down alarm.

In summary, instead of adding a new construct like the following:

```
TemperatureAlarm ALARM-TYPE
    STATUS       current
    DESCRIPTION  "The current temperature outside of the
                 acceptable operating range"
    RAISED-BY    "The measured temperature has been outside of the
                 acceptable operating range for the last 5 seconds."
    ClEARED-BY   "The measure temperature has been within the
```

acceptable range for the last 15 seconds."

```
    . . .
    ::= { myAlarms 1 }
```

the existing OBJECT-IDENTITY construct must be used and the DESCRIPTION field structured like in the following:

```
TemperatureAlarm OBJECT-IDENTITY
    STATUS       current
    DESCRIPTION  "An Alarm

                 Description:
                   The current temperature outside of the
                   acceptable operating range

                 RAISED-BY:
                   The measured temperature has been outside of the
                   acceptable operating range for the last 5
                   seconds.

                 ClEARED-BY:
                   The measure temperature has been within the
                   acceptable range for the last 15 seconds.
                  . . . "
    ::= { myAlarms 1 }
```

4. MIB Module Overview

The MIB module defines a list of current alarms and a log of alarms that have been raised and/or cleared. The current alarm list is specified as two tables. Table snmpAlarmCurrTable contains generic information about alarms and table snmpItuAlarmCurrTable contains ITU-T (from X.733 and X.736) information about alarms. The current varBind table provides additional information about each current alarm.

The alarm log table is specified as two tables. An entry is made in table snmpAlarmLogTable each time an entry is added or removed from the current alarm table. Likewise an entry is made in table snmpItuAlarmLogTable each time an entry is added or removed from the ITU-T augmentation of the current alarm table.

Scalar objects snmpAlarmLastChange, snmpAlarmLogFirstIndex, and snmpAlarmLogLastIndex provide the information so that a management application can efficiently track the current alarms and retrieve entries in the alarm log. Additionally, a manager may choose to use notifications to assist in tracking the current alarms and/or alarm log entries. The notification snmpAlarmStatusChange or snmpItuAlarmStatusChange can be used.

5. Definitions

```
SNMP-ALARM-MIB DEFINITIONS ::= BEGIN

IMPORTS
    MODULE-IDENTITY,
    OBJECT-TYPE,
    NOTIFICATION-TYPE,
    snmpModules,
    Gauge32,
    Unsigned32
        FROM SNMPv2-SMI

    TEXTUAL-CONVENTION,
    TruthValue,
    AutonomousType,
    VariablePointer,
    TimeStamp
        FROM SNMPv2-TC

    SnmpAdminString
        FROM SNMP-FRAMEWORK-MIB

    MODULE-COMPLIANCE,
    OBJECT-GROUP,
    NOTIFICATION-GROUP
        FROM SNMPv2-CONF;

snmpAlarmMIB MODULE-IDENTITY
    LAST-UPDATED "200102220000Z"  -- feb 22, 2001
    ORGANIZATION "IETF Distributed Management Working Group"
    CONTACT-INFO
        "WG-email:   disman@dorothy.bmc.com
        Subscribe:   disman-request@dorothy.bmc.com
                     In message body:
                         subscribe disman your_email_address
        Archive:     ftp://amethyst.bmc.com/pub/disman/archives

        Chair:      Randy Presuhn
                    BMC Software
        EMail:      rpresuhn@bmc.com
        Phone:      +1-301-854-6889

        Author:     David T. Perkins
                    SNMPinfo
        Postal:     3763 Benton Street
                    Santa Clara, CA 95051
        EMail:      dperkins@dsperkins.com
```

```
          Phone:      +1 408 394 8702"
      DESCRIPTION
          "This MIB module defines MIB objects and notifications that
          provide mechanisms to monitor alarms currently active and
          the history of alarms being set and cleared on a managed
          system.

          Terminology used in this MIB module:

          Error - A deviation from intended operation.

          Fault - A lasting error or warning condition.

          Alarm - A persistent indication of a fault.  An alarm is
                  said to be 'set' when a fault is first detected and
                  administratively enabled. An alarm is said to be
                  'cleared' when a fault is first noticed to have
                  ceased or administratively disabled.

          Event - Something that happened. Examples include a change
                  in status, crossing a threshold, an external input
                  to the system. Additionally, setting or clearing
                  an alarm is also an event."
      REVISION    "200102220000Z" -- feb 22, 2001
      DESCRIPTION "The initial revision"
      ::= { snmpModules xx }  -- replace "xx" with next appropriate
                              -- value

   snmpAlarmObjects       OBJECT IDENTIFIER ::= { snmpAlarmMIB 1 }
   snmpAlarmNotifications OBJECT IDENTIFIER ::= { snmpAlarmMIB 2 }
   snmpAlarmConformance   OBJECT IDENTIFIER ::= { snmpAlarmMIB 3 }
     snmpAlarmCompliances
                  OBJECT IDENTIFIER ::= { snmpAlarmConformance 1 }
     snmpAlarmGroups
                  OBJECT IDENTIFIER ::= { snmpAlarmConformance 2 }

   SnmpAlarmCond ::= TEXTUAL-CONVENTION
       STATUS      current
       DESCRIPTION "The alarm condition. The values are:
                     set(1)....the alarm condition detected
                     clear(2)..the alarm condition ceased"
       SYNTAX      INTEGER {
                       set(1),
                       clear(2)
                       }

   SnmpAlarmType ::= TEXTUAL-CONVENTION
       STATUS      current
       DESCRIPTION "The identity of the type of an SNMP alarm. The SNMP
```

SMI does not have a construct to define SNMP alarms.
Thus, the OBJECT-IDENTITY construct must be

```
                used with the text of the DESCRIPTION clause
                describing the conditions that cause the alarm
                to be set and to be clear, and a description of
                each varBind to be associated with the alarm."
        SYNTAX      OBJECT IDENTIFIER -- really AutonomousType

    OptDateAndTime ::= TEXTUAL-CONVENTION
        DISPLAY-HINT "2d-1d-1d,1d:1d:1d.1d,1a1d:1d"
        STATUS       current
        DESCRIPTION
            "An date-time specification, or a zero length string.

             field  octets  contents                  range
             -----  ------  --------                  -----
               1      1-2   year                      0..65536
               2       3    month                     1..12
               3       4    day                       1..31
               4       5    hour                      0..23
               5       6    minutes                   0..59
               6       7    seconds                   0..60
                            (use 60 for leap-second)
               7       8    deci-seconds              0..9
               8       9    direction from UTC        '+' / '-'
               9      10    hours from UTC            0..11
              10      11    minutes from UTC          0..59

            For example, Tuesday May 26, 1992 at 1:30:15 PM EDT would be
            displayed as:

                                 1992-5-26,13:30:15.0,-4:0

            Note that if only local time is known, then time zone
            information (fields 8-10) is not present."
        SYNTAX       OCTET STRING (SIZE (0 | 8 | 11)) -- DateAndTime

    SnmpValUnion ::= TEXTUAL-CONVENTION
        STATUS      current
        DESCRIPTION "A descriminated union, which is the
                    following ASN.1 sequence BER encoded
                    and wrapped as the value of an OCTET
                    STRING.
                      <details later>
                    "
        SYNTAX      OCTET STRING


    snmpAlarmGlobals OBJECT IDENTIFIER ::= { snmpAlarmObjects 1 }

    snmpAlarmCurrEntries OBJECT-TYPE
        SYNTAX      Gauge32
```

```
        MAX-ACCESS  read-only
```

```
        STATUS      current
        DESCRIPTION "The number of entries in the current alarm table."
        ::= { snmpAlarmGlobals 1 }

    snmpAlarmLastChange OBJECT-TYPE
        SYNTAX      TimeStamp
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION "The value of object sysUpTime when an entry was
                     added or removed from the current alarm table and
                     added to the alarm log table."
        ::= { snmpAlarmGlobals 2 }

    snmpAlarmLogFirstIndex OBJECT-TYPE
        SYNTAX      Unsigned32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION "The index of the oldest entry in the alarm log
                     table, or zero. The value of zero is used to
                     indicate that no entry exists in the alarm log."
        ::= { snmpAlarmGlobals 3 }

    snmpAlarmLogLastIndex OBJECT-TYPE
        SYNTAX      Unsigned32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION "The index of the youngest entry in the alarm log
                     table, or zero. The value of zero is used to
                     indicate that no entry exists in the alarm log."
        ::= { snmpAlarmGlobals 4 }

    snmpAlarmGenNotify OBJECT-TYPE
        SYNTAX      TruthValue
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION "The controls whether or not notification
                     snmpAlarmStatusChange may be generated. The
                     values are:
                       true(1)...notifications may be generated
                       false(2)..notifications may not be generated"
        ::= { snmpAlarmGlobals 5 }

    -- ITU extension
    snmpItuAlarmGenNotify OBJECT-TYPE
        SYNTAX      TruthValue
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION "The controls whether or not notification
                     snmpItuAlarmStatusChange may be generated.
```

The values are:
  true(1)...notifications may be generated

```
                    false(2)..notifications may not be generated

                  Note: if this is enabled, then most likely
                  generation of notification snmpAlarmStatusChange
                  should be disabled."
      ::= { snmpAlarmGlobals 6 }


   snmpAlarmCurrTable OBJECT-TYPE
       SYNTAX      SEQUENCE OF SnmpAlarmCurrEntry
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION "A table listing all the current 'alarms'. An
                   alarm indicates a persistent fault condition
                   in a software or hardware component or sub-system
                   that is intended to be operating. An alarm is
                   cleared by 'fixing' the fault condition or
                   administratively disabling the alarm."
       ::= { snmpAlarmObjects 2 }

   snmpAlarmCurrEntry OBJECT-TYPE
       SYNTAX      SnmpAlarmCurrEntry
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION "A row in the table of current alarms. Rows cannot
                   be created or deleted via SNMP operations."
       INDEX       { snmpAlarmCurrIndex }
       ::= { snmpAlarmCurrTable 1 }

   SnmpAlarmCurrEntry ::= SEQUENCE {
       snmpAlarmCurrIndex             Unsigned32,
       snmpAlarmCurrOccurDateAndTime  OptDateAndTime,
       snmpAlarmCurrOccurUpTime       TimeStamp,
       snmpAlarmCurrType              SnmpAlarmType,
       snmpAlarmCurrId                Unsigned32,
       snmpAlarmCurrContextName       SnmpAdminString,
       snmpAlarmCurrVarBinds          Gauge32
       }

   snmpAlarmCurrIndex OBJECT-TYPE
       SYNTAX      Unsigned32(1..4294967295)
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION "An arbitrary index of the alarm in the current
                   alarm table. The index for an existing entry is
                   not affected when a entry is added or removed from
                   the table. Index values may be cycled to the max
                   before reuse or follow any implementation specific
                   reuse strategy."
```

```
       ::= { snmpAlarmCurrEntry 1 }
```

```
   snmpAlarmCurrOccurDateAndTime OBJECT-TYPE
       SYNTAX      OptDateAndTime
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION "The local date and time when the alarm was set,
                   or a zero length string. The value is a zero
                   length string when the local time cannot be
                   determined."
       ::= { snmpAlarmCurrEntry 2 }

   snmpAlarmCurrOccurUpTime OBJECT-TYPE
       SYNTAX      TimeStamp
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION "The value of sysUpTime when the alarm was set
                   or zero. The value is zero when the alarm occurred
                   before the most recent reset of the management
                   system."
       ::= { snmpAlarmCurrEntry 3 }

   snmpAlarmCurrType OBJECT-TYPE
       SYNTAX      SnmpAlarmType
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION "The type of the alarm."
       ::= { snmpAlarmCurrEntry 4 }

   snmpAlarmCurrId OBJECT-TYPE
       SYNTAX      Unsigned32
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION "The ID of the alarm. No two active alarms
                   may have the same value. This value is used
                   in matching the set and clear entries in
                   the alarm log."
       ::= { snmpAlarmCurrEntry 5 }

   snmpAlarmCurrContextName OBJECT-TYPE
       SYNTAX      SnmpAdminString (SIZE(0..32))
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION "The context in which the alarm occurred."
       ::= { snmpAlarmCurrEntry 6 }

   snmpAlarmCurrVarBinds OBJECT-TYPE
       SYNTAX      Gauge32
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION "The number of varBinds associated with the
```

alarm. The count is usually at least one,
with at least one varBind identifying

```
                    the source of the alarm."
        ::= { snmpAlarmCurrEntry 7 }


    snmpAlarmCurrVarBindTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF SnmpAlarmCurrVarBindEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION "A table of varBinds (pairs of variable and value)
                    that sparse extends the rows in table
                    snmpAlarmCurrTable. That is, for each row in table
                    snmpAlarmCurrTable, there is zero, one, or more
                    associated rows in this table. The value of object
                    snmpAlarmCurrVarBinds specifies the number of rows
                    in this table."
          ::= { snmpAlarmObjects 3 }

    snmpAlarmCurrVarBindEntry OBJECT-TYPE
        SYNTAX      SnmpAlarmCurrVarBindEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION "A row in the table of varBinds for current
                    alarms. Rows cannot be created or deleted via
                    SNMP operations."
        INDEX       { snmpAlarmCurrIndex,
                      snmpAlarmCurrVarBindIndex }
        ::= { snmpAlarmCurrVarBindTable 1 }

    SnmpAlarmCurrVarBindEntry ::= SEQUENCE {
        snmpAlarmCurrVarBindIndex   Unsigned32,
        snmpAlarmCurrVarBindId      VariablePointer,
        snmpAlarmCurrVarBindVal     SnmpValUnion
        }

    snmpAlarmCurrVarBindIndex OBJECT-TYPE
        SYNTAX      Unsigned32 (1..4294967295)
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION "The index of the varBind. The value is between
                    one and the value of the associated object
                    snmpAlarmCurrVarBinds."
        ::= { snmpAlarmCurrVarBindEntry 1 }

    snmpAlarmCurrVarBindId OBJECT-TYPE
        SYNTAX      VariablePointer
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION "The ID of the object instance."
          ::= { snmpAlarmCurrVarBindEntry 2 }
```

```
   snmpAlarmCurrVarBindVal OBJECT-TYPE
```

```
        SYNTAX      SnmpValUnion
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION "The value of the object instance."
        ::= { snmpAlarmCurrVarBindEntry 3 }


    snmpAlarmLogTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF SnmpAlarmLogEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION "A table containing a log of when each 'alarm'
                    has been 'set' or 'cleared'. An alarm indicates
                    a persistent fault condition in a software or
                    hardware component or sub-system that is intended
                    to be operating. An alarm is cleared by 'fixing'
                    the fault condition or administratively disabling
                    the alarm.

                    The alarm log operates like a circular buffer.
                    The index of the oldest entry is specified by
                    object snmpAlarmLogFirstIndex and the index
                    of the youngest entry is specified by object
                    tbtSystemAlarmLogLastIndex.

                    The alarm log may be preserved in part or in
                    total across restarts of a management system.
                    The last few entries SHOULD be saved to assist
                    in determining the cause of an unplanned
                    restart."
        ::= { snmpAlarmObjects 4 }

    snmpAlarmLogEntry OBJECT-TYPE
        SYNTAX      SnmpAlarmLogEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION "A row in the alarm log table. Rows cannot
                    be created or deleted via SNMP operations."
        INDEX       { snmpAlarmLogIndex }
        ::= { snmpAlarmLogTable 1 }

    SnmpAlarmLogEntry ::= SEQUENCE {
        snmpAlarmLogIndex           Unsigned32,
        snmpAlarmLogCond            SnmpAlarmCond,
        snmpAlarmLogOccurDateAndTime OptDateAndTime,
        snmpAlarmLogOccurUpTime     TimeStamp,
        snmpAlarmLogType            SnmpAlarmType,
        snmpAlarmLogId              Unsigned32,
        snmpAlarmLogContextName     SnmpAdminString,
```

```
        snmpAlarmLogVarBinds         Gauge32
        }
```

```
   snmpAlarmLogIndex OBJECT-TYPE
       SYNTAX      Unsigned32(1..4294967295)
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION "An index of the alarm in the alarm log table. The
                   index is increased by one for each new entry in the
                   table until the maximum value is reach and then the
                   index restarts at 1. The index of the oldest entry
                   is specified by object snmpAlarmLogFirstIndex and
                   index of the youngest entry is specified by object
                   snmpAlarmLogLastIndex."
       ::= { snmpAlarmLogEntry 1 }

   snmpAlarmLogCond OBJECT-TYPE
       SYNTAX      SnmpAlarmCond
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION "Indicates if the log entry is due to the alarm
                   Being set (raised) or being cleared."
       ::= { snmpAlarmLogEntry 2 }

   snmpAlarmLogOccurDateAndTime OBJECT-TYPE
       SYNTAX      OptDateAndTime
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION "The local date and time when the alarm was set
                   or clear, or a zero length string. The value is a
                   zero length string when the local time cannot be
                   determined."
       ::= { snmpAlarmLogEntry 3 }

   snmpAlarmLogOccurUpTime OBJECT-TYPE
       SYNTAX      TimeStamp
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION "The value of sysUpTime when the alarm was set or
                   cleared, or zero. The value is zero when the alarm
                   was set or cleared before the most recent reset of
                   the management system."
       ::= { snmpAlarmLogEntry 4 }

   snmpAlarmLogType OBJECT-TYPE
       SYNTAX      SnmpAlarmType
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION "The type of the alarm."
       ::= { snmpAlarmLogEntry 5 }
```

```
   snmpAlarmLogId OBJECT-TYPE
       SYNTAX      Unsigned32
```

```
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION "The ID of the alarm. Each alarm that is set
                    is assigned a unique ID among active alarms.
                    That is, no two active alarms may have the
                    same value. This value is used in matching
                    the set and clear entries in this log.
                    Note: alarms may be cleared and not recorded
                    across restarts of the management system.
                    Thus, additional checks must be performed
                    to match set and clear entries in the
                    log that occur on opposite sides of a
                    restart."
        ::= { snmpAlarmLogEntry 6 }

    snmpAlarmLogContextName OBJECT-TYPE
        SYNTAX      SnmpAdminString (SIZE(0..32))
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION "The context in which the alarm occurred."
        ::= { snmpAlarmLogEntry 7 }

    snmpAlarmLogVarBinds OBJECT-TYPE
        SYNTAX      Gauge32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION "The number of varBinds associated with the
                    alarm. The count is usually at least one,
                    with at least one varBind identifying
                    the source of the alarm."
        ::= { snmpAlarmLogEntry 8 }


    snmpAlarmLogVarBindTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF SnmpAlarmLogVarBindEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION "A table of varBinds (pairs of variable and value)
                    that sparse extends the rows in table
                    snmpAlarmLogTable. That is, for each row in table
                    snmpAlarmLogTable, there is zero, one, or more
                    associated rows in this table. The value of object
                    snmpAlarmLogVarBinds specifies the number of rows
                    in this table."
          ::= { snmpAlarmObjects 5 }

    snmpAlarmLogVarBindEntry OBJECT-TYPE
        SYNTAX      SnmpAlarmLogVarBindEntry
        MAX-ACCESS  not-accessible
```

```
        STATUS      current
        DESCRIPTION "A row in the table of varBinds for the alarm
```

```
                    log. Rows cannot be created or deleted via
                    SNMP operations."
        INDEX       { snmpAlarmLogIndex,
                      snmpAlarmLogVarBindIndex }
        ::= { snmpAlarmLogVarBindTable 1 }

    SnmpAlarmLogVarBindEntry ::= SEQUENCE {
        snmpAlarmLogVarBindIndex   Unsigned32,
        snmpAlarmLogVarBindId      VariablePointer,
        snmpAlarmLogVarBindVal     SnmpValUnion
        }

    snmpAlarmLogVarBindIndex OBJECT-TYPE
        SYNTAX      Unsigned32 (1..4294967295)
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION "The index of the varBind. The value is between
                    one and the value of the associated object
                    snmpAlarmLogVarBinds."
        ::= { snmpAlarmLogVarBindEntry 1 }

    snmpAlarmLogVarBindId OBJECT-TYPE
        SYNTAX      VariablePointer
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION "The ID of the object instance."
          ::= { snmpAlarmLogVarBindEntry 2 }

    snmpAlarmLogVarBindVal OBJECT-TYPE
        SYNTAX      SnmpValUnion
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION "The value of the object instance."
        ::= { snmpAlarmLogVarBindEntry 3 }


    -- ITU-T extensions
    SnmpItuAlarmClass ::= TEXTUAL-CONVENTION
        STATUS      current
        DESCRIPTION "The class of alarm as specified in
                    [X.733] and [X.736].
                    <expand this>"
        SYNTAX   INTEGER {
                    other (1),
                    communicationsAlarm (2),
                    qualityOfServiceAlarm (3),
                    processingErrorAlarm (4),
                    equipmentAlarm (5),
                    environmentalAlarm (6),
```

```
                integrityViolation (7),
                operationalViolation (8),
```

```
                    physicalViolation (9),
                    securityServiceOrMechanismViolation (10),
                    timeDomainViolation (11)
                    }

   SnmpItuAlarmProbCause ::= TEXTUAL-CONVENTION
       STATUS      current
       DESCRIPTION "The probable cause of the alarm as
                    specified in [X.733] and [X.736].
                    <expand this>"
       SYNTAX      INTEGER {
                    other (1),
                    adapterError (2),
                    applicationSubsystemFailure (3),
                    bandwidthReduced (4),
                    callEstablishmentError (5),
                    communicationsProtocolError (6),
                    communicationsSubsystemFailure (7),
                    configurationOrCustomizationError (8),
                    congestion (9),
                    corruptData (10),
                    cpuCyclesLimitExceeded (11),
                    dataSetOrModemError (12),
                    degradedSignal (13),
                    dteDceInterfaceError (14),
                    enclosureDoorOpen (15),
                    equipmentMalfunction (16),
                    excessiveVibration (17),
                    fileError (18),
                    fireDetected (19),
                    floodDetected (20),
                    framingError (21),
                    heatingVentCoolingSystemProblem (22),
                    humidityUnacceptable (23),
                    inputOutputDeviceError (24),
                    inputDeviceError (25),
                    lanError (26),
                    leakDetected (27),
                    localNodeTransmissionError (28),
                    lossOfFrame (29),
                    lossOfSignal (30),
                    materialSupplyExhausted (31),
                    multiplexerProblem (32),
                    outOfMemory (33),
                    ouputDeviceError (34),
                    performanceDegraded (35),
                    powerProblem (36),
                    pressureUnacceptable (37),
                    processorProblem (38),
```

```
                    pumpFailure (39),
                    queueSizeExceeded (40),
```

```
                    receiveFailure (41),
                    receiverFailure (42),
                    remoteNodeTransmissionError (43),
                    resourceAtOrNearingCapacity (44),
                    responseTimeExecessive (45),
                    retransmissionRateExcessive (46),
                    softwareError (47),
                    softwareProgramAbnormallyTerminated (48),
                    softwareProgramError (49),
                    storageCapacityProblem (50),
                    temperatureUnacceptable (51),
                    thresholdCrossed (52),
                    timingProblem (53),
                    toxicLeakDetected (54),
                    transmitFailure (55),
                    transmitterFailure (56),
                    underlyingResourceUnavailable (57),
                    versionMismatch (58),
                    authenticationFailure (59),
                    breachOfConfidentiality (60),
                    cableTamper (61),
                    delayedInformation (62),
                    denialOfService (63),
                    duplicateInformation (64),
                    informationMissing (65),
                    informationModificationDetected (66),
                    informationOutOfSequence (67),
                    intrusionDetection (68),
                    keyExpired (69),
                    nonRepudiationFailure (70),
                    outOfHoursActivity (71),
                    outOfService (72),
                    proceduralError (73),
                    unauthorizedAccessAttempt (74),
                    unexpectedInformation (75)
                    }

   SnmpItuAlarmPercSeverity ::= TEXTUAL-CONVENTION
       STATUS      current
       DESCRIPTION "The perceived severity of the alarm as
                    specified in [X.733] and [X.736].
                    <expand this>"
       SYNTAX      INTEGER {
                    indeterminate (2),
                    critical (3),
                    major (4),
                    minor (5),
                    warning (6)
                    }
```

```
   SnmpItuAlarmTrendInd ::= TEXTUAL-CONVENTION
```

```
        STATUS      current
        DESCRIPTION "The trend indication of the alarm as
                    specified in [X.733].
                    <expand this>"
        SYNTAX      INTEGER {
                    moreSevere (1),
                    noChange (2),
                    lessSevere (3)
                    }


    snmpItuAlarmCurrTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF SnmpItuAlarmCurrEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION "A table augmenting the current alarm table
                    (snmpAlarmCurrTable) with additional information
                    from the ITU-T alarm model."
        ::= { snmpAlarmObjects 6 }

    snmpItuAlarmCurrEntry OBJECT-TYPE
        SYNTAX      SnmpItuAlarmCurrEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION "A row in the table of ITU-T current alarms. Rows
                    cannot be created or deleted via SNMP operations."
        AUGMENTS    { snmpAlarmCurrEntry }
        ::= { snmpItuAlarmCurrTable 1 }

    SnmpItuAlarmCurrEntry ::= SEQUENCE {
        snmpItuAlarmCurrClass         SnmpItuAlarmClass,
        snmpItuAlarmCurrProbCause     SnmpItuAlarmProbCause,
        snmpItuAlarmCurrPercSeverity  SnmpItuAlarmPercSeverity,
        snmpItuAlarmCurrAdditText     SnmpAdminString,
        snmpItuAlarmCurrTrendInd      SnmpItuAlarmTrendInd,
        snmpItuAlarmCurrDetector      AutonomousType,
        snmpItuAlarmCurrServiceProvider AutonomousType,
        snmpItuAlarmCurrServiceUser   AutonomousType
        }

    snmpItuAlarmCurrClass OBJECT-TYPE
        SYNTAX      SnmpItuAlarmClass
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION "The class of the alarm as specified in
                    [X.733] and [X.736].
                    <expand this>"
        ::= { snmpItuAlarmCurrEntry 1 }
```

```
   snmpItuAlarmCurrProbCause OBJECT-TYPE
       SYNTAX      SnmpItuAlarmProbCause
```

```
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION "The probable cause of the alarm as
                    specified in [X.733] and [X.736].
                    <expand this>"
        ::= { snmpItuAlarmCurrEntry 2 }

    snmpItuAlarmCurrPercSeverity OBJECT-TYPE
        SYNTAX      SnmpItuAlarmPercSeverity
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION "The perceived severity of the alarm as
                    specified in [X.733] and [X.736].
                    <expand this>"
        ::= { snmpItuAlarmCurrEntry 3 }

    snmpItuAlarmCurrAdditText OBJECT-TYPE
        SYNTAX      SnmpAdminString
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION "The additional text field of the alarm as
                    specified in [X.733].
                    <expand this>"
        ::= { snmpItuAlarmCurrEntry 4 }

    snmpItuAlarmCurrTrendInd OBJECT-TYPE
        SYNTAX      SnmpItuAlarmTrendInd
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION "The trend indication of the alarm as
                    specified in [X.733].
                    <expand this>"
        ::= { snmpItuAlarmCurrEntry 5 }

    -- more investigation is needed for the following objects
    snmpItuAlarmCurrDetector OBJECT-TYPE
        SYNTAX      AutonomousType
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION "The SecurityAlarmDetector object from [X.736].
                    <expand this>"
        ::= { snmpItuAlarmCurrEntry 6 }

    snmpItuAlarmCurrServiceProvider OBJECT-TYPE
        SYNTAX      AutonomousType
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION "The ServiceProvider object from [X.736].
                    <expand this>"
```

```
       ::= { snmpItuAlarmCurrEntry 7 }
```

```
   snmpItuAlarmCurrServiceUser OBJECT-TYPE
       SYNTAX      AutonomousType
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION "The SericeUser object from [X.736].
                   <expand this>"
       ::= { snmpItuAlarmCurrEntry 8 }

   snmpItuAlarmLogTable OBJECT-TYPE
       SYNTAX      SEQUENCE OF SnmpItuAlarmLogEntry
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION "A table augmenting the alarm log table
                   (snmpAlarmLogTable) with additional information
                   from the ITU-T alarm model."
       ::= { snmpAlarmObjects 7 }

   snmpItuAlarmLogEntry OBJECT-TYPE
       SYNTAX      SnmpItuAlarmLogEntry
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION "A row in the ITU-T alarm log table. Rows cannot
                   be created or deleted via SNMP operations."
       AUGMENTS    { snmpAlarmLogEntry }
       ::= { snmpItuAlarmLogTable 1 }

   SnmpItuAlarmLogEntry ::= SEQUENCE {
       snmpItuAlarmLogClass         SnmpItuAlarmClass,
       snmpItuAlarmLogProbCause     SnmpItuAlarmProbCause,
       snmpItuAlarmLogPercSeverity  SnmpItuAlarmPercSeverity,
       snmpItuAlarmLogAdditText     SnmpAdminString,
       snmpItuAlarmLogTrendInd      SnmpItuAlarmTrendInd,
       snmpItuAlarmLogDetector      AutonomousType,
       snmpItuAlarmLogServiceProvider AutonomousType,
       snmpItuAlarmLogServiceUser   AutonomousType
       }

   snmpItuAlarmLogClass OBJECT-TYPE
       SYNTAX      SnmpItuAlarmClass
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION "The class of the alarm as specified in
                   [X.733] and [X.736].
                   <expand this>"
       ::= { snmpItuAlarmLogEntry 1 }

   snmpItuAlarmLogProbCause OBJECT-TYPE
       SYNTAX      SnmpItuAlarmProbCause
       MAX-ACCESS  read-only
```

```
        STATUS      current
        DESCRIPTION "The probable cause of the alarm as
```

```
                    specified in [X.733] and [X.736].
                    <expand this>"
        ::= { snmpItuAlarmLogEntry 2 }

    snmpItuAlarmLogPercSeverity OBJECT-TYPE
        SYNTAX      SnmpItuAlarmPercSeverity
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION "The perceived severity of the alarm as
                    specified in [X.733] and [X.736].
                    <expand this>"
        ::= { snmpItuAlarmLogEntry 3 }

    snmpItuAlarmLogAdditText OBJECT-TYPE
        SYNTAX      SnmpAdminString
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION "The additional text field of the alarm as
                    specified in [X.733].
                    <expand this>"
        ::= { snmpItuAlarmLogEntry 4 }

    snmpItuAlarmLogTrendInd OBJECT-TYPE
        SYNTAX      SnmpItuAlarmTrendInd
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION "The trend indication of the alarm as
                    specified in [X.733].
                    <expand this>"
        ::= { snmpItuAlarmLogEntry 5 }

    -- more investigation is needed for the following objects
    snmpItuAlarmLogDetector OBJECT-TYPE
        SYNTAX      AutonomousType
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION "The SecurityAlarmDetector object from [X.736].
                    <expand this>"
        ::= { snmpItuAlarmLogEntry 6 }

    snmpItuAlarmLogServiceProvider OBJECT-TYPE
        SYNTAX      AutonomousType
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION "The ServiceProvider object from [X.736].
                    <expand this>"
        ::= { snmpItuAlarmLogEntry 7 }

    snmpItuAlarmLogServiceUser OBJECT-TYPE
```

```
        SYNTAX      AutonomousType
        MAX-ACCESS  read-only
```

```
        STATUS      current
        DESCRIPTION "The SericeUser object from [X.736].
                    <expand this>"
        ::= { snmpItuAlarmLogEntry 8 }


    -- notifications

    snmpAlarmStatusChange NOTIFICATION-TYPE
        OBJECTS     { snmpAlarmLogCond,
                      snmpAlarmLogOccurDateAndTime,
                      snmpAlarmLogOccurUpTime,
                      snmpAlarmLogId,
                      snmpAlarmLogVarBinds }
        STATUS      current
        DESCRIPTION "An entry has been added to the alarm log
                    table. That is, an alarm has been set or cleared.
                    The objects all have the same instance, which is
                    the row in the alarm log, and the objects are:
                      snmpAlarmLogCond....alarm condition, either
                          set or clear
                      snmpAlarmLogOccurDateAndTime...date/time the
                          alarm log entry created
                      snmpAlarmLogOccurUpTime...timestamp the alarm
                          log entry created
                      snmpAlarmLogId....the ID of the alarm
                      snmpAlarmLogVarBinds....the number of varBinds
                          associated with the alarm

                    Note 1: after these varBinds, the associated
                    varBinds, if any, from table
                    snmpAlarmLogVarBindTable must be specified in the
                    varBind list for the notification.

                    Note 2: object snmpAlarmGenNotify controls
                    if or if not this notification may be generated."
        ::= { snmpAlarmNotifications 0 1 }

    snmpItuAlarmStatusChange NOTIFICATION-TYPE
        OBJECTS     { snmpAlarmLogCond,
                      snmpAlarmLogOccurDateAndTime,
                      snmpAlarmLogOccurUpTime,
                      snmpAlarmLogId,
                      snmpAlarmLogVarBinds,
                      snmpItuAlarmLogClass,
                      snmpItuAlarmLogProbCause,
                      snmpItuAlarmLogPercSeverity,
                      snmpItuAlarmLogAdditText,
                      snmpItuAlarmLogTrendInd,
```

```
                    snmpItuAlarmLogDetector,
                    snmpItuAlarmLogServiceProvider,
```

```
                    snmpItuAlarmLogServiceUser }
        STATUS      current
        DESCRIPTION "An entry has been added to the alarm log
                    table and the ITU extensions are supported.
                    That is, an alarm has been set or cleared.
                    The objects all have the same instance, which is
                    the row in the alarm log, and the objects are:
                      snmpAlarmLogCond....alarm condition, either
                          set or clear
                      snmpAlarmLogOccurDateAndTime...date/time the
                          alarm log entry created
                      snmpAlarmLogOccurUpTime...timestamp the alarm
                          log entry created
                      snmpAlarmLogId....the ID of the alarm
                      snmpAlarmLogVarBinds....the number of varBinds
                          associated with the alarm
                       <finish this>
                      snmpItuAlarmLogClass...
                      snmpItuAlarmLogProbCause...
                      snmpItuAlarmLogPercSeverity...
                      snmpItuAlarmLogAdditText...
                      snmpItuAlarmLogTrendInd...
                      snmpItuAlarmLogDetector...
                      snmpItuAlarmLogServiceProvider...
                      snmpItuAlarmLogServiceUser...

                    Note 1: after these varBinds, the associated
                    varBinds, if any, from table
                    snmpAlarmLogVarBindTable must be specified in the
                    varBind list for the notification.

                    Note 2: object snmpItuAlarmGenNotify controls
                    if or if not this notification may be generated."
        ::= { snmpAlarmNotifications 0 2 }


    -- Conformance

    snmpAlarmCompliance MODULE-COMPLIANCE
        STATUS  current
        DESCRIPTION
                "The compliance statement for systems supporting
                the SNMP alarms."
        MODULE -- this module
            MANDATORY-GROUPS { snmpAlarmGblGroup,
                               snmpAlarmCurrGroup,
                               snmpAlarmLogGroup,
                               snmpAlarmNotifyGroup }
        ::= { snmpAlarmCompliances 1 }
```

```
   snmpItuAlarmCompliance MODULE-COMPLIANCE
```

```
        STATUS  current
        DESCRIPTION
                "The compliance statement for systems supporting
                the ITU-T extension to SNMP alarms."
        MODULE -- this module
            MANDATORY-GROUPS { snmpAlarmGblGroup,
                               snmpAlarmCurrGroup,
                               snmpAlarmLogGroup,
                               snmpAlarmNotifyGroup,
                               snmpItuAlarmGblGroup,
                               snmpItuAlarmCurrGroup,
                               snmpItuAlarmLogGroup,
                               snmpItuAlarmNotifyGroup }
        ::= { snmpAlarmCompliances 2 }



    snmpAlarmGblGroup OBJECT-GROUP
        OBJECTS     { snmpAlarmCurrEntries,
                      snmpAlarmLastChange,
                      snmpAlarmLogFirstIndex,
                      snmpAlarmLogLastIndex,
                      snmpAlarmGenNotify }
        STATUS      current
        DESCRIPTION "Global objects for managing SNMP alarms."
        ::= { snmpAlarmGroups 1 }

    snmpAlarmCurrGroup OBJECT-GROUP
        OBJECTS     { snmpAlarmCurrOccurDateAndTime,
                      snmpAlarmCurrOccurUpTime,
                      snmpAlarmCurrType,
                      snmpAlarmCurrId,
                      snmpAlarmCurrContextName,
                      snmpAlarmCurrVarBinds,
                      snmpAlarmCurrVarBindId,
                      snmpAlarmCurrVarBindVal }
        STATUS      current
        DESCRIPTION "Objects in the SNMP current alarm and
                     current varBind tables."
        ::= { snmpAlarmGroups 2 }

    snmpAlarmLogGroup OBJECT-GROUP
        OBJECTS     { snmpAlarmLogCond,
                      snmpAlarmLogOccurDateAndTime,
                      snmpAlarmLogOccurUpTime,
                      snmpAlarmLogType,
                      snmpAlarmLogId,
                      snmpAlarmLogContextName,
                      snmpAlarmLogVarBinds,
```

```
                    snmpAlarmLogVarBindId,
                    snmpAlarmLogVarBindVal }
```

```
        STATUS      current
        DESCRIPTION "Objects in the SNMP alarm log and
                    log varBind tables."
        ::= { snmpAlarmGroups 3 }

    snmpAlarmNotifyGroup NOTIFICATION-GROUP
        NOTIFICATIONS { snmpAlarmStatusChange }
        STATUS      current
        DESCRIPTION "Notifications for SNMP alarms."
        ::= { snmpAlarmGroups 4 }

    snmpItuAlarmGblGroup OBJECT-GROUP
        OBJECTS     { snmpItuAlarmGenNotify }
        STATUS      current
        DESCRIPTION "Global objects for managing ITU-T
                    extensions to SNMP alarms."
        ::= { snmpAlarmGroups 5 }

    snmpItuAlarmCurrGroup OBJECT-GROUP
        OBJECTS     { snmpItuAlarmCurrClass,
                      snmpItuAlarmCurrProbCause,
                      snmpItuAlarmCurrPercSeverity,
                      snmpItuAlarmCurrAdditText,
                      snmpItuAlarmCurrTrendInd,
                      snmpItuAlarmCurrDetector,
                      snmpItuAlarmCurrServiceProvider,
                      snmpItuAlarmCurrServiceUser }
        STATUS      current
        DESCRIPTION "Objects in the ITU-T extension to the
                    SNMP current alarm and current varBind
                    tables."
        ::= { snmpAlarmGroups 6 }

    snmpItuAlarmLogGroup OBJECT-GROUP
        OBJECTS     { snmpItuAlarmLogClass,
                      snmpItuAlarmLogProbCause,
                      snmpItuAlarmLogPercSeverity,
                      snmpItuAlarmLogAdditText,
                      snmpItuAlarmLogTrendInd,
                      snmpItuAlarmLogDetector,
                      snmpItuAlarmLogServiceProvider,
                      snmpItuAlarmLogServiceUser }
        STATUS      current
        DESCRIPTION "Objects in the ITU-T extension to the
                    SNMP alarm log and log varBind tables."
        ::= { snmpAlarmGroups 7 }

    snmpItuAlarmNotifyGroup NOTIFICATION-GROUP
        NOTIFICATIONS { snmpItuAlarmStatusChange }
```

```
        STATUS      current
        DESCRIPTION "Notifications for ITU-T extension to SNMP alarms."
```

```
       ::= { snmpAlarmGroups 8 }

   END
```

6. Examples

<later>

7. 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.

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 [RFC2574] and the View-based Access Control Model RFC 2575 [RFC2575] 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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9. Acknowledgements

This document is a product of the DISMAN Working Group.
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10. References

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[RFC2579] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case,J., Rose, M., and S. Waldbusser, "Textual Conventions for SMIv2", STD 58, RFC 2579, April 1999.

[RFC2580] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case,J., Rose, M., and S. Waldbusser, "Conformance Statements for SMIv2", STD 58, RFC 2580, April 1999.

[X.733] <finish this>

[X.736]] <finish this>

11. Full Copyright Statement

1 RFC 2119 Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997