

Network Working Group
Request for Comments: 3498
Category:Standards Track

J. Kuhfeld
J. Johnson
M. Thatcher
Redback Networks
March 2003

Definitions of Managed Objects
for Synchronous Optical Network (SONET)
Linear Automatic Protection Switching (APS) Architectures

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.

Copyright Notice

Copyright (C) The Internet Society (2003). All Rights Reserved.

Abstract

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in TCP/IP based internets. In particular, it defines objects for managing networks using Synchronous Optical Network (SONET) linear Automatic Protection Switching (APS) architectures.

Table of Contents

1. Introduction.....	2
2. The Internet-Standard Management Framework.....	2
3. Overview.....	2
4. Definitions.....	4
5. Intellectual Property.....	39
6. Acknowledgments.....	40
7. Normative References.....	40
8. Informative References.....	40
9. Security Considerations.....	41
10. Editors' Addresses.....	42
11. Full Copyright Statement.....	43

1. Introduction

This memo defines a portion of the Management Information Base (MIB) used for managing SONET linear Automatic Protection Switching (APS) architectures. Two linear APS architectures are supported, the 1+1 architecture and the 1:n architecture.

2. The Internet-Standard Management Framework

For a detailed overview of the documents that describe the current Internet-Standard Management Framework, please refer to section 7 of RFC 3410 [RFC3410].

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. MIB objects are generally accessed through the Simple Network Management Protocol (SNMP). Objects in the MIB are defined using the mechanisms defined in the Structure of Management Information (SMI). This memo specifies a MIB module that is compliant to the SMIV2, which is described in STD 58, RFC 2578 [RFC2578], STD 58, RFC 2579 [RFC2579] and STD 58, RFC 2580 [RFC2580].

3. Overview

These objects are used to control and manage SONET linear APS architectures. Ring APS groups are not currently supported by this MIB.

The MIB includes three scalars, containing counts of APS groups and SONET LTEs, a notification enable object, and six tables.

The apsMapTable contains entries for each SONET LTE interface available on the system. The table serves two purposes. It can be used to locate SONET LTE interfaces that are not currently included in APS groups. It also provides a mapping from InterfaceIndex to group name and channel number for those SONET LTE interfaces that are included in APS groups. Entries in apsMapTable cannot be added or deleted through operations defined in this MIB. However, an apsMapEntry may be added or deleted through other system mechanisms, such as hot swap. Also, existing entries cannot be directly modified and instead, such modifications occur as a result of side-effects of operations on the apsChanConfigTable.

The apsChanConfigTable supports addition, modification and deletion of entries representing linear APS channels. Entries are indexed by a text group name and integer channel number. Each entry contains an InterfaceIndex value identifying the SONET LTE used for the channel and the priority of the channel. A side effect of row creation or

deletion is the setting of map entry fields. Creation of two or more entries in this table with a common group name index and consecutive channel numbers is the first step in the creation and configuration of an APS group. It is not necessary to create channel numbers in order; however, before an APS group is made active, the set of channels must begin with channel number 0 (for architectures other than onePlusOneOptimized) or channel number 1 (for the onePlusOneOptimized architecture) and must have consecutive channel numbers not exceeding 14. Note that the term null channel, which is used throughout this document, refers to the protection line.

The `apsConfigTable` supports addition, modification, and deletion of entries representing linear APS groups. Entries are indexed by a text group name. Each entry contains parameters that specify the configuration of a particular linear APS group. Entries are created in this table after a set of channels are created in the `apsChanConfigTable`. To successfully set an instance of `apsConfigRowStatus` to active the `apsConfigEntry` must contain valid values and all associated `apsChanConfigEntry` rows must be valid and produce a consecutive set of channels beginning with channel number 0 or 1, depending on the selected architecture.

The `apsCommandTable` provides linear APS commands that support protection switching and the ability to modify APS operation. Entries in this table are created as a side effect of setting the associated `apsConfigRowStatus` object to active. Entries in this table are deleted if the associated `apsConfigRowStatus` object is set to any value except active.

The `apsChanStatusTable` provides individual channel statistics.

The `apsStatusTable` provides group level statistics.

An APS group is created and configured with the following sequence of events:

CHANNEL CONFIGURATION

Create an entry in the `apsChanConfigTable`. Set the `apsChanConfigGroupName` in an `apsChanConfigEntry` to a user-friendly text string which will serve as the APS group name. The string must not be equal to the `apsConfigName` of an existing `apsConfigEntry` with `apsConfigRowStatus` set to active, since a channel cannot be added to an active group. The string may be set equal to the `apsConfigName` of a row which is currently not set to active, or it may be set to a string which does not currently exist in any instance of `apsConfigName`. A channel number is entered in `apsChanConfigNumber`. A channel priority is entered in `apsChanConfigPriority`, if the

intended architecture is 1:n. `apsChanConfigPriority` is ignored if the architecture is 1+1. The `InterfaceIndex` value of a SONET LTE interface is entered in `apsChanConfigIfIndex`.

This step is repeated for all `apsChanConfigEntry` instances which are to be included in the APS group.

ACTIVATING THE GROUP

If the `apsChanConfigGroupName` does not exist in an instance of `apsConfigName`, an `apsConfigEntry` is created with the `apsChanConfigGroupName` value used as the index for the row. The `apsConfigRowStatus` value may be set to `createAndGo`. The `apsGroupConfigEntry` and `apsChanConfigEntry` instances with matching name fields will be checked for consistency. If any errors in the channel numbers, architecture or configuration are uncovered the `apsConfigRowStatus` set will return `inconsistentValue`, otherwise `noError` is returned.

If the `apsChanConfigGroupName` value used in channel configuration exists in a previously created, inactive `apsConfigEntry` instance, the `apsConfigRowStatus` value may be set to `active`.

An agent is not required to process SNMP Set Requests that affect multiple control objects within this MIB. This is intended to simplify the processing of Set Requests for the various control tables by eliminating the possibility that a single Set PDU will contain multiple varbinds which are in conflict, such as a PDU which both activates a given `apsConfigEntry` while at the same time it deactivates an associated `apsChanConfigEntry`.

4. Definitions

APS-MIB DEFINITIONS ::= BEGIN

IMPORTS

MODULE-IDENTITY, NOTIFICATION-TYPE, OBJECT-TYPE,
Gauge32, Counter32, Integer32, transmission
FROM SNMPv2-SMI

TEXTUAL-CONVENTION, RowStatus,
TimeStamp, StorageType
FROM SNMPv2-TC

SnmpAdminString
FROM SNMP-FRAMEWORK-MIB

ifIndex, InterfaceIndex
FROM IF-MIB

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

apsMIB MODULE-IDENTITY

LAST-UPDATED "200302280000Z" -- February 28, 2003

ORGANIZATION "IETF AToMMIB Working Group"

CONTACT-INFO

" Jim Kuhfeld
Postal: RedBack Networks. Inc.
300 Holger Way
San Jose, CA 95134-1362
Tel: +1 408 750 5465
Email: jkuhfeld@redback.com

Jeff Johnson
Postal: RedBack Networks. Inc.
300 Holger Way
San Jose, CA 95134-1362
Tel: +1 408 750 5460
Email: jeff@redback.com

Michael Thatcher
Postal: RedBack Networks. Inc.
300 Holger Way
San Jose, CA 95134-1362
Tel: +1 408 750 5449
Email: thatcher@redback.com"

DESCRIPTION

"This management information module supports the configuration and management of SONET linear APS groups. The definitions and descriptions used in this MIB have been derived from Synchronous Optical Network (SONET) Transport Systems: Common Generic Criteria, GR-253-CORE Issue 3, September 2000, section 5.3. The MIB is also consistent with the Multiplex Section Protection (MSP) protocol as specified in ITU-T Recommendation G.783, Characteristics of synchronous digital hierarchy (SDH) equipment function blocks, Annex A and B.

Copyright (C) The Internet Society (2003). This version of this MIB module is part of RFC 3498; see the RFC itself for full legal notices.

"

```
REVISION      "200302280000Z"  -- February 28, 2003
DESCRIPTION
  "Initial version of this MIB, published as RFC 3498."
  ::= { transmission 49 }

apsMIBObjects OBJECT IDENTIFIER
  ::= { apsMIB 1 }

apsMIBNotifications OBJECT IDENTIFIER
  ::= { apsMIB 2 }

apsMIBConformance OBJECT IDENTIFIER
  ::= { apsMIB 3 }

ApsK1K2 ::= TEXTUAL-CONVENTION
  STATUS current
  DESCRIPTION
    "This Textual Convention describes an object that stores
    a SONET K1 and K2 byte APS protocol field.

    K1 is located in the first octet, K2 is located in
    the second octet. Bits are numbered from left to right.

    Bits 1-4 of the K1 byte indicate a request.

    1111 Lockout of Protection
    1110 Forced Switch
    1101 SF - High Priority
    1100 SF - Low Priority
    1011 SD - High Priority
    1010 SD - Low Priority
    1001 not used
    1000 Manual Switch
    0111 not used
    0110 Wait-to-Restore
    0101 not used
    0100 Exercise
    0011 not used
    0010 Reverse Request
    0001 Do Not Revert
    0000 No Request

    Bits 5-8 of the K1 byte indicate the channel associated with
    the request defined in bits 1-4.

    0000 is the Null channel.
```

1-14 are working channels.
15 is the extra traffic channel

Bits 1-4 of the K2 byte indicate a channel. The channel is defined with the same syntax as K1 Bits 5-8.

Bit 5 of the K2 byte indicates the architecture.

0 if the architecture is 1+1
1 if the architecture is 1:n

Bits 6-8 of the K2 byte indicates the mode.

000 - 011 are reserved for future use
100 indicates the mode is unidirectional
101 indicates the mode is bidirectional
110 RDI-L
111 AIS-L

"

REFERENCE

"Bellcore (Telcordia Technologies) GR-253-CORE, Issue 3, September 2000, 5.3.5."

SYNTAX OCTET STRING (SIZE (2))

ApsSwitchCommand ::= TEXTUAL-CONVENTION

STATUS current

DESCRIPTION

"An APS switch command allows a user to perform protection switch actions.

If the APS switch command cannot be executed because an equal or higher priority request is in effect, an inconsistentValue error is returned.

The Switch command values are:

noCmd

This value should be returned by a read request when no switch command has been written to the object in question since initialization. This value may not be used in a write operation. If noCmd is used in a write operation a wrongValue error is returned.

`clear`

Clears all of the switch commands listed below for the specified channel.

`lockoutOfProtection`

Prevents any of the working channels from switching to the protection line. The specified channel should be the protection channel, otherwise an `inconsistentValue` error is returned.

`forcedSwitchWorkToProtect`

Switches the specified working channel to the protection line. If the protection channel is specified an `inconsistentValue` error is returned.

`forcedSwitchProtectToWork`

Switches the working channel back from the protection line to the working line. The specified channel should be the protection channel, otherwise an `inconsistentValue` error is returned.

`manualSwitchWorkToProtect`

Switches the specified working channel to the protection line. If the protection channel is specified an `inconsistentValue` error is returned.

`manualSwitchProtectToWork`

Switches the working channel back from the protection line to the working line. The specified channel should be the protection channel, otherwise an `inconsistentValue` error is returned.

`exercise`

Exercises the protocol for a protection switch of the specified channel by issuing an Exercise request for that channel and checking the response on the APS channel. "

```
SYNTAX      INTEGER {  
              noCmd(1),  
              clear(2),  
              lockoutOfProtection(3),  
              forcedSwitchWorkToProtect(4),  
              forcedSwitchProtectToWork(5),
```



```

        manualSwitchWorkToProtect(6),
        manualSwitchProtectToWork(7),
        exercise(8)
    }

ApsControlCommand ::= TEXTUAL-CONVENTION
    STATUS      current
    DESCRIPTION
        "An APS control command applies only to LTE that support the
        1:n architecture and performs the following actions.

        The Control command values are:

        noCmd

        This value should be returned by a read request when no control
        command has been written to the object in question since
        initialization. This value may not be used in a write
        operation. If noCmd is used in a write operation a wrongValue
        error is returned.

        lockoutWorkingChannel

        Prevents the specified working channel from switching to the
        protection line. If the protection line is specified an
        inconsistentValue error is returned.

        clearLockoutWorkingChannel

        Clears the lockout a working channel command for the channel
        specified. If the protection line is specified an
        inconsistentValue error is returned."
    SYNTAX      INTEGER {
        noCmd(1),
        lockoutWorkingChannel(2),
        clearLockoutWorkingChannel(3)
    }

--
-- APS Configuration Table
--
-- This table supports the addition, configuration and deletion of APS
-- groups.
--
apsConfig      OBJECT IDENTIFIER ::= { apsMIBObjects 1 }

```

```

apsConfigGroups OBJECT-TYPE
    SYNTAX      Gauge32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The count of APS groups. This count includes all rows in
        apsConfigTable, regardless of the value of apsConfigRowStatus."
    ::= { apsConfig 1 }

apsConfigTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF ApsConfigEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "This table lists the APS groups that have been configured
        on the system."
    ::= { apsConfig 2 }

apsConfigEntry OBJECT-TYPE
    SYNTAX      ApsConfigEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A conceptual row in the apsConfigTable."
    INDEX { IMPLIED apsConfigName }
    ::= { apsConfigTable 1 }

ApsConfigEntry ::= SEQUENCE {
    apsConfigName          SnmpAdminString,
    apsConfigRowStatus     RowStatus,
    apsConfigMode          INTEGER,
    apsConfigRevert        INTEGER,
    apsConfigDirection     INTEGER,
    apsConfigExtraTraffic  INTEGER,
    apsConfigSdBerThreshold Integer32,
    apsConfigSfBerThreshold Integer32,
    apsConfigWaitToRestore Integer32,
    apsConfigCreationTime  TimeStamp,
    apsConfigStorageType   StorageType
}

apsConfigName OBJECT-TYPE
    SYNTAX      SnmpAdminString (SIZE (1..32))
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A textual name for the APS group."
    ::= { apsConfigEntry 1 }

```

apsConfigRowStatus OBJECT-TYPE

```
SYNTAX      RowStatus
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION
```

"The status of this APS group entry.

An entry may not exist in the active state unless all objects in the entry have an appropriate value. Also, all associated apsChanConfigEntry rows must represent a set of consecutive channel numbers beginning with 0 or 1, depending on the selected architecture.

When set to notInService changes may be made to apsConfigMode, apsConfigRevert, apsConfigDirection, apsConfigExtraTraffic, apsConfigSdBerThreshold, apsConfigSfBerThreshold, and apsConfigWaitToRestore. Also, associated apsChanConfigTable objects may be added, deleted and modified."

```
::= { apsConfigEntry 2 }
```

apsConfigMode OBJECT-TYPE

```
SYNTAX      INTEGER {
                    onePlusOne(1),
                    oneToN(2),
                    onePlusOneCompatible(3),
                    onePlusOneOptimized(4)
                }
```

```
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION
```

"The architecture of the APS group.

onePlusOne

The 1+1 architecture permanently bridges the working line to the protection line.

oneToN

The 1:n architecture allows one protection channel to protect up to n working channels. When a fault is detected on one of the n working channels that channel is bridged over the protection channel.

onePlusOneCompatible

This refers to 1 + 1 bidirectional switching compatible with 1:n bidirectional switching as specified in ITU-T Recommendation G.783 (04/97) section A.3.4.1. Since this mode necessitates bidirectional switching, apsConfigDirection must be set to bidirectional whenever onePlusOneCompatible is set.

onePlusOneOptimized

This refers to 1 + 1 bidirectional switching optimized for a network using predominantly 1 + 1 bidirectional switching as specified in ITU-T Recommendation G.783 (04/97) section B.1. Since this mode necessitates bidirectional switching, apsConfigDirection must be set to bidirectional whenever onePlusOneOptimized is set.

This object may not be modified if the associated apsConfigRowStatus object is equal to active(1)."

```
DEFVAL {onePlusOne}
 ::= { apsConfigEntry 3 }
```

```
apsConfigRevert OBJECT-TYPE
SYNTAX          INTEGER { nonrevertive(1), revertive(2) }
MAX-ACCESS      read-create
STATUS          current
DESCRIPTION
```

"The revertive mode of the APS group.

nonrevertive

Traffic remains on the protection line until another switch request is received.

revertive

When the condition that caused a switch to the protection line has been cleared the signal is switched back to the working line. Since switching is revertive with the 1:n architecture, apsConfigRevert must be set to revertive if apsConfigMode is set to oneToN.

Switching may optionally be revertive with the 1+1 architecture.

This object may not be modified if the associated apsConfigRowStatus object is equal to active(1). "

```
DEFVAL { nonrevertive }
 ::= { apsConfigEntry 4 }
```

apsConfigDirection OBJECT-TYPE

SYNTAX INTEGER { unidirectional(1), bidirectional(2) }

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The directional mode of the APS group.

unidirectional

The unidirectional mode provides protection in one direction.

bidirectional

The bidirectional mode provides protection in both directions.

This object may not be modified if the associated
apsConfigRowStatus object is equal to active(1). "

DEFVAL { unidirectional }

::= { apsConfigEntry 5 }

apsConfigExtraTraffic OBJECT-TYPE

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

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This object enables or disables the transfer of extra traffic on the protection channel in a 1:n architecture. This object must be set to disabled if the architecture is 1+1. It may be necessary to disable this in order to interwork with other SONET network elements that don't support extra traffic.

This object may not be modified if the associated
apsConfigRowStatus object is equal to active(1). "

DEFVAL { disabled }

::= { apsConfigEntry 6 }

apsConfigSdBerThreshold OBJECT-TYPE

SYNTAX Integer32 (5..9)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The Signal Degrade Bit Error Rate.

The negated value of this number is used as the exponent of 10 for computing the threshold value for the Bit Error Rate (BER). For example, a value of 5 indicates a BER threshold of 10^{-5} .

This object may be modified if the associated
apsConfigRowStatus object is equal to active(1)."
DEFVAL { 5 }
::= { apsConfigEntry 7 }

apsConfigSfBerThreshold OBJECT-TYPE

SYNTAX Integer32 (3..5)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The Signal Failure Bit Error Rate.

The negated value of this number is used as the exponent of
10 for computing the threshold value for the Bit Error Rate
(BER). For example, a value of 5 indicates a BER threshold of
10⁻⁵.

This object may be modified if the associated
apsConfigRowStatus object is equal to active(1)."
DEFVAL { 3 }
::= { apsConfigEntry 8 }

apsConfigWaitToRestore OBJECT-TYPE

SYNTAX Integer32 (0..720)

UNITS "seconds"

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The Wait To Restore period in seconds.

After clearing of a condition that necessitated an
automatic switch, the wait to restore period must elapse
before reverting. This is intended to avoid rapid switch
oscillations.

GR-253-CORE specifies a Wait To Restore range of 5 to 12
minutes. G.783 defines a 5 to 12 minute Wait To Restore
range in section 5.4.1.1.3, but also allows for a shorter
WTR period in Table 2-1,
WaitToRestore value (MI_WTRtime: 0..(5)..12 minutes).

This object may not be modified if the associated
apsConfigRowStatus object is equal to active(1)."
DEFVAL { 300 }
::= { apsConfigEntry 9 }

```

apsConfigCreationTime OBJECT-TYPE
    SYNTAX      TimeStamp
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The value of sysUpTime at the time the row was
        created"
    ::= { apsConfigEntry 10 }

apsConfigStorageType OBJECT-TYPE
    SYNTAX      StorageType
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "The storage type for this conceptual row.
        Conceptual rows having the value 'permanent' need not
        allow write-access to any columnar objects in the row."
    DEFVAL     { nonVolatile }
    ::= { apsConfigEntry 11 }

--
-- APS Status Table
--
-- This table provides APS group statistics.
--

apsStatusTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF ApsStatusEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "This table provides status information about APS groups
        that have been configured on the system."
    ::= { apsMIBObjects 2 }

apsStatusEntry OBJECT-TYPE
    SYNTAX      ApsStatusEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A conceptual row in the apsStatusTable."
    AUGMENTS { apsConfigEntry }
    ::= { apsStatusTable 1 }

ApsStatusEntry ::= SEQUENCE {
    apsStatusK1K2Rcv          ApsK1K2,
    apsStatusK1K2Trans       ApsK1K2,
    apsStatusCurrent         BITS,

```

```

    apsStatusModeMismatches      Counter32,
    apsStatusChannelMismatches   Counter32,
    apsStatusPSBFs               Counter32,
    apsStatusFEPLFs              Counter32,
    apsStatusSwitchedChannel     Integer32,
    apsStatusDiscontinuityTime   TimeStamp
}

```

apsStatusK1K2Rcv OBJECT-TYPE

```

SYNTAX      ApsK1K2
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "The current value of the K1 and K2 bytes received on the
    protection channel."
 ::= { apsStatusEntry 1 }

```

apsStatusK1K2Trans OBJECT-TYPE

```

SYNTAX      ApsK1K2
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "The current value of the K1 and K2 bytes transmitted on the
    protection channel."
 ::= { apsStatusEntry 2 }

```

apsStatusCurrent OBJECT-TYPE

```

SYNTAX      BITS {
                modeMismatch(0),
                channelMismatch(1),
                psbf(2),
                feplf(3),
                extraTraffic(4)
            }
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "The current status of the APS group.

```

modeMismatch

Modes other than 1+1 unidirectional monitor protection line K2 bit 5, which indicates the architecture and K2 bits 6-8, which indicate if the mode is unidirectional or bidirectional. A conflict between the current local mode and the received K2 mode information constitutes a mode mismatch.

channelMismatch

This bit indicates a mismatch between the transmitted K1 channel and the received K2 channel has been detected.

psbf

This bit indicates a Protection Switch Byte Failure (PSBF) is in effect. This condition occurs when either an inconsistent APS byte or an invalid code is detected. An inconsistent APS byte occurs when no three consecutive K1 bytes of the last 12 successive frames are identical, starting with the last frame containing a previously consistent byte. An invalid code occurs when the incoming K1 byte contains an unused code or a code irrelevant for the specific switching operation (e.g., Reverse Request while no switching request is outstanding) in three consecutive frames. An invalid code also occurs when the incoming K1 byte contains an invalid channel number in three consecutive frames.

feplf

Modes other than 1+1 unidirectional monitor the K1 byte for Far-End Protection-Line failures. A Far-End Protection-Line defect is declared based on receiving SF on the protection line.

extraTraffic

This bit indicates whether extra traffic is currently being accepted on the protection line. "

```
::= { apsStatusEntry 3 }
```

apsStatusModeMismatches OBJECT-TYPE

```
SYNTAX Counter32
```

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

```
STATUS current
```

```
DESCRIPTION
```

```
"A count of Mode Mismatch conditions.
```

```
Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of apsStatusDiscontinuityTime."
```

```
::= { apsStatusEntry 4 }
```

apsStatusChannelMismatches OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A count of Channel Mismatch conditions.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of apsStatusDiscontinuityTime."

::= { apsStatusEntry 5 }

apsStatusPSBFs OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A count of Protection Switch Byte Failure conditions.

This condition occurs when either an inconsistent APS byte or an invalid code is detected. An inconsistent APS byte occurs when no three consecutive K1 bytes of the last 12 successive frames are identical, starting with the last frame containing a previously consistent byte. An invalid code occurs when the incoming K1 byte contains an unused code or a code irrelevant for the specific switching operation (e.g., Reverse Request while no switching request is outstanding) in three consecutive frames. An invalid code also occurs when the incoming K1 byte contains an invalid channel number in three consecutive frames.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of apsStatusDiscontinuityTime."

::= { apsStatusEntry 6 }

apsStatusFEPLFs OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A count of Far-End Protection-Line Failure conditions.

This condition is declared based on receiving SF on the protection line in the K1 byte.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of apsStatusDiscontinuityTime."

```
 ::= { apsStatusEntry 7 }
```

apsStatusSwitchedChannel OBJECT-TYPE

```
SYNTAX      Integer32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "This field is set to the number of the channel that is
    currently switched to protection. The value 0 indicates no
    channel is switched to protection. The values 1-14 indicate
    that working channel is switched to protection."
 ::= { apsStatusEntry 8 }
```

apsStatusDiscontinuityTime OBJECT-TYPE

```
SYNTAX      TimeStamp
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "The value of sysUpTime on the most recent occasion at which
    any one or more of this APS group's counters suffered a
    discontinuity. The relevant counters are the specific
    instances associated with this APS group of any Counter32
    object contained in apsStatusTable. If no such
    discontinuities have occurred since the last re-initialization
    of the local management subsystem, then this object contains
    a zero value."
 ::= { apsStatusEntry 9 }
```

```
--
-- APS Map Group
--
-- Lists the SONET LTE interfaces that may be used to create APS groups.
--
```

apsMap OBJECT IDENTIFIER ::= { apsMIBObjects 3 }

apsChanLTES OBJECT-TYPE

```
SYNTAX      Gauge32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "The count of SONET LTE interfaces on the system.
    Each interface that is included has an ifType value of
    sonet(39)."
```

```
 ::= { apsMap 1 }
```

```
apsMapTable OBJECT-TYPE
```

```
SYNTAX SEQUENCE OF ApsMapEntry
```

```
MAX-ACCESS not-accessible
```

```
STATUS current
```

```
DESCRIPTION
```

```
"This table lists the SONET LTE interfaces on the system.
```

```
Each interface that is listed has an ifType value of
```

```
sonet(39)."
```

```
 ::= { apsMap 2 }
```

```
apsMapEntry OBJECT-TYPE
```

```
SYNTAX ApsMapEntry
```

```
MAX-ACCESS not-accessible
```

```
STATUS current
```

```
DESCRIPTION
```

```
"A conceptual row in the apsMapTable."
```

```
INDEX { ifIndex }
```

```
 ::= { apsMapTable 1 }
```

```
ApsMapEntry ::= SEQUENCE {
```

```
apsMapGroupName SnmpAdminString,
```

```
apsMapChanNumber Integer32
```

```
}
```

```
apsMapGroupName OBJECT-TYPE
```

```
SYNTAX SnmpAdminString (SIZE (0..32))
```

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

```
STATUS current
```

```
DESCRIPTION
```

```
"A textual name for the APS group which this channel is
included in. If the channel is not part of an APS group
this value is set to a string of size 0.
```

```
When an instance of apsChanConfigIfIndex is set equal to an
instance of ifIndex that has an ifType value of sonet(39),
apsMapGroupName is set equal to the corresponding value of
apsChanConfigGroupName.
```

```
If an instance of ifIndex that has an ifType value of
sonet(39) ceases to be equal to an instance of
apsChanConfigIfIndex, either because of a change in the value
of apsChanConfigIfIndex, or because of row deletion in the
ApsChanConfigTable, apsMapGroupName is set to a string of
size 0."
```

```
 ::= { apsMapEntry 2 }
```

apsMapChanNumber OBJECT-TYPE

SYNTAX Integer32 (-1..14)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This field is set to a unique channel number within an APS group. The value 0 indicates the null channel. The values 1-14 define a working channel. If the SONET LTE is not part of an APS group this value is set to -1.

When an instance of apsChanConfigIfIndex is set equal to an instance of ifIndex that has an ifType value of sonet(39), apsMapChanNumber is set equal to the corresponding value of apsChanConfigNumber.

If an instance of ifIndex that has an ifType value of sonet(39) ceases to be equal to an instance of apsChanConfigIfIndex, either because of a change in the value of apsChanConfigIfIndex, or because of row deletion in the ApsChanConfigTable, apsMapChanNumber is set to -1."

::= { apsMapEntry 3 }

--

-- APS Channel Configuration Table

--

-- This table supports the addition, configuration and deletion of
-- channels in APS groups.

--

apsChanConfigTable OBJECT-TYPE

SYNTAX SEQUENCE OF ApsChanConfigEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This table lists the APS channels that have been configured in APS groups."

::= { apsMIBObjects 4 }

apsChanConfigEntry OBJECT-TYPE

SYNTAX ApsChanConfigEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A conceptual row in the apsChanConfigTable."

INDEX {apsChanConfigGroupName, apsChanConfigNumber}

::= { apsChanConfigTable 1 }

```
ApsChanConfigEntry ::= SEQUENCE {
    apsChanConfigGroupName      SnmpAdminString,
    apsChanConfigNumber         Integer32,
    apsChanConfigRowStatus      RowStatus,
    apsChanConfigIfIndex        InterfaceIndex,
    apsChanConfigPriority        INTEGER,
    apsChanConfigStorageType    StorageType
}

apsChanConfigGroupName OBJECT-TYPE
    SYNTAX      SnmpAdminString (SIZE (1..32))
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A textual name for the APS group which this channel is
        included in."
    ::= { apsChanConfigEntry 1 }

apsChanConfigNumber OBJECT-TYPE
    SYNTAX      Integer32 (0..14)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "This field is set to a unique channel number within an APS
        group. The value 0 indicates the null channel. The values
        1-14 define a working channel.

        This field must be assigned a unique number within the group."
    ::= { apsChanConfigEntry 2 }

apsChanConfigRowStatus OBJECT-TYPE
    SYNTAX      RowStatus
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "The status of this APS channel entry.

        An entry may not exist in the active state unless all
        objects in the entry have an appropriate value.

        A row in the apsChanConfigTable may not be created,
        deleted, set to notInService or otherwise modified
        if the apsChanConfigGroupName value is equal to an
        apsConfigName value and the associated apsConfigRowStatus
        object is equal to active. However, if the apsConfigRowStatus
        object is equal to notInService, a row may be created, deleted
        or modified. In other words, a channel may not be added,
        deleted or modified if the group is active."
```

A row may be created with an `apsChanConfigGroupName` value that is not equal to any existing instance of `apsConfigName`. This action is the initial step in adding a SONET LTE to a new APS group.

If this object is set to destroy, the associated instance of `apsMapGroupName` will be set to a string of size 0 and the `apsMapChanNumber` will be set to -1. The channel status entry will also be deleted by this action.

`apsChanConfigNumber` must be set to a unique channel number within the APS group. The value 0 indicates the null channel. The values 1-14 define a working channel. When an attempt is made to set the corresponding `apsConfigRowStatus` field to active the `apsChanConfigNumber` values of all entries with equal `apsChanConfigGroupName` fields must represent a set of consecutive integer values beginning with 0 or 1, depending on the architecture of the group, and ending with `n`, where `n` is greater than or equal to 1 and less than or equal to 14. Otherwise, the error `inconsistentValue` is returned to the `apsConfigRowStatus` set attempt."

```
::= { apsChanConfigEntry 3 }
```

`apsChanConfigIfIndex` OBJECT-TYPE

SYNTAX InterfaceIndex

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The Interface Index assigned to a SONET LTE. This is an interface with `ifType` `sonet(39)`. The value of this object must be unique among all instances of `apsChanConfigIfIndex`. In other words, a particular SONET LTE can only be configured in one APS group.

This object cannot be set if the `apsChanConfigGroupName` instance associated with this row is equal to an instance of `apsConfigName` and the corresponding `apsConfigRowStatus` object is set to active. In other words this value cannot be changed if the APS group is active. However, this value may be changed if the `apsConfigRowStatus` value is equal to `notInService`."

```
::= { apsChanConfigEntry 4 }
```

`apsChanConfigPriority` OBJECT-TYPE

SYNTAX INTEGER {low(1), high(2)}

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The priority of the channel.

This field determines whether high or low priority SD and SF codes are used in K1 requests.

This field is only applicable if the channel is to be included in a group using the 1:n architecture. It is not applicable if the channel is to be included in a group using the 1+1 architecture, and is ignored in that case.

This object cannot be set if the apsChanConfigGroupName instance associated with this row is equal to an instance of apsConfigName and the corresponding apsConfigRowStatus object is set to active. In other words this value cannot be changed if the APS group is active. However, this value may be changed if the apsConfigRowStatus value is equal to notInService."

```
DEFVAL { low }
 ::= { apsChanConfigEntry 5 }
```

apsChanConfigStorageType OBJECT-TYPE

SYNTAX StorageType

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The storage type for this conceptual row.
Conceptual rows having the value 'permanent' need not allow write-access to any columnar objects in the row."

```
DEFVAL { nonVolatile }
 ::= { apsChanConfigEntry 6 }
```

--

-- APS Command Table

--

-- This table provides the ability to initiate APS commands.

--

apsCommandTable OBJECT-TYPE

SYNTAX SEQUENCE OF ApsCommandEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This table allows commands to be sent to configured APS groups."

```
::= { apsMIBObjects 5 }
```

apsCommandEntry OBJECT-TYPE

SYNTAX ApsCommandEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION


```

        "A conceptual row in the apsCommandTable. This row exists only
        if the associated apsConfigEntry is active."
INDEX {apsChanConfigGroupName, apsChanConfigNumber}
 ::= { apsCommandTable 1 }

ApsCommandEntry ::= SEQUENCE {
    apsCommandSwitch      ApsSwitchCommand,
    apsCommandControl     ApsControlCommand
}

apsCommandSwitch OBJECT-TYPE
    SYNTAX      ApsSwitchCommand
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "Allows the initiation of an APS switch command on the
        APS group and channel specified by the index values.

        When read this object returns the last command written
        or noCmd if no command has been written to this
        channel since initialization. The return of the last command
        written does not imply that this command is currently in
        effect. This request may have been preempted by a higher
        priority local or remote request. In order to determine the
        current state of the APS group it is necessary to read
        the objects apsStatusK1k2Rcv and apsStatusK1k2Trans.

        The value lockoutOfProtection should only be applied to the
        protection line channel since that switch command prevents any
        of the working channels from switching to the protection line.
        Following the same logic, forcedSwitchProtectToWork and
        manualSwitchProtectToWork should only be applied to the
        protection line channel.

        forcedSwitchWorkToProtect and manualSwitchWorkToProtect
        should only be applied to a working channel."
 ::= { apsCommandEntry 1 }

apsCommandControl OBJECT-TYPE
    SYNTAX      ApsControlCommand
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "Allows the initiation of an APS control command on the
        APS group and channel specified by the index values."

```

When read this object returns the last command written or noCmd if no command has been written to this channel since initialization.

This object does not apply to the protection line."

```
::= { apsCommandEntry 2 }
```

```
--
```

```
-- APS Channel Status Table
```

```
--
```

```
-- This table provides APS channel statistics.
```

```
--
```

```
apsChanStatusTable OBJECT-TYPE
```

```
SYNTAX SEQUENCE OF ApsChanStatusEntry
```

```
MAX-ACCESS not-accessible
```

```
STATUS current
```

```
DESCRIPTION
```

```
"This table contains status information for all SONET LTE interfaces that are included in APS groups."
```

```
::= { apsMIBObjects 6 }
```

```
apsChanStatusEntry OBJECT-TYPE
```

```
SYNTAX ApsChanStatusEntry
```

```
MAX-ACCESS not-accessible
```

```
STATUS current
```

```
DESCRIPTION
```

```
"A conceptual row in the apsChanStatusTable."
```

```
AUGMENTS { apsChanConfigEntry }
```

```
::= { apsChanStatusTable 1 }
```

```
ApsChanStatusEntry ::= SEQUENCE {
```

```
apsChanStatusCurrent BITS,
apsChanStatusSignalDegrades Counter32,
apsChanStatusSignalFailures Counter32,
apsChanStatusSwitchovers Counter32,
apsChanStatusLastSwitchover TimeStamp,
apsChanStatusSwitchoverSeconds Counter32,
apsChanStatusDiscontinuityTime TimeStamp
```

```
}
```

```
apsChanStatusCurrent OBJECT-TYPE
```

```
SYNTAX BITS {
lockedOut(0),
sd(1),
sf(2),
switched(3),
wtr(4)
```

```

    }
MAX-ACCESS read-only
STATUS      current
DESCRIPTION
    "Indicates the current state of the port.

```

```

    lockedOut

```

```

    This bit, when applied to a working channel, indicates that
    the channel is prevented from switching to the protection
    line.  When applied to the null channel, this bit indicates
    that no working channel may switch to the protection line.

```

```

    sd

```

```

    A signal degrade condition is in effect.

```

```

    sf

```

```

    A signal failure condition is in effect.

```

```

    switched

```

```

    The switched bit is applied to a working channel if that
    channel is currently switched to the protection line.

```

```

    wtr

```

```

    A Wait-to-Restore state is in effect."

```

```

 ::= { apsChanStatusEntry 1 }

```

```

apsChanStatusSignalDegrades OBJECT-TYPE

```

```

SYNTAX      Counter32

```

```

MAX-ACCESS read-only

```

```

STATUS      current

```

```

DESCRIPTION

```

```

    "A count of Signal Degrade conditions. This condition
    occurs when the line Bit Error Rate exceeds the currently
    configured value of the relevant instance of
    apsConfigSdBerThreshold.

```

```

    Discontinuities in the value of this counter can occur at
    re-initialization of the management system, and at other
    times as indicated by the value of
    apsChanStatusDiscontinuityTime."

```

```

 ::= { apsChanStatusEntry 2 }

```

apsChanStatusSignalFailures OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A count of Signal Failure conditions that have been detected on the incoming signal. This condition occurs when a loss of signal, loss of frame, AIS-L or a Line bit error rate exceeding the currently configured value of the relevant instance of apsConfigSfBerThreshold.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of apsChanStatusDiscontinuityTime."

::= { apsChanStatusEntry 3 }

apsChanStatusSwitchovers OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"When queried with index value apsChanConfigNumber other than 0, this object will return the number of times this channel has switched to the protection line.

When queried with index value apsChanConfigNumber set to 0, which is the protection line, this object will return the number of times that any working channel has been switched back to the working line from this protection line.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of apsChanStatusDiscontinuityTime."

::= { apsChanStatusEntry 4 }

apsChanStatusLastSwitchover OBJECT-TYPE

SYNTAX TimeStamp

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"When queried with index value apsChanConfigNumber other than 0, this object will return the value of sysUpTime when this channel last completed a switch to the protection line. If

this channel has never switched to the protection line, the value 0 will be returned.

When queried with index value `apsChanConfigNumber` set to 0, which is the protection line, this object will return the value of `sysUpTime` the last time that a working channel was switched back to the working line from this protection line. If no working channel has ever switched back to the working line from this protection line, the value 0 will be returned."

```
::= { apsChanStatusEntry 5 }
```

`apsChanStatusSwitchoverSeconds` OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The cumulative Protection Switching Duration (PSD) time in seconds. For a working channel, this is the cumulative number of seconds that service was carried on the protection line. For the protection line, this is the cumulative number of seconds that the protection line has been used to carry any working channel traffic. This information is only valid if revertive switching is enabled. The value 0 will be returned otherwise.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by the value of `apsChanStatusDiscontinuityTime`. For example, if the value of an instance of `apsChanStatusSwitchoverSeconds` changes from a non-zero value to zero due to revertive switching being disabled, it is expected that the corresponding value of `apsChanStatusDiscontinuityTime` will be updated to reflect the time of the configuration change.

"

```
::= { apsChanStatusEntry 6 }
```

`apsChanStatusDiscontinuityTime` OBJECT-TYPE

SYNTAX TimeStamp

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of `sysUpTime` on the most recent occasion at which any one or more of this channel's counters suffered a discontinuity. The relevant counters are the specific instances associated with this channel of any Counter32 object contained in `apsChanStatusTable`. If no such

```

        discontinuities have occurred since the last re-initialization
        of the local management subsystem, then this object contains
        a zero value."
 ::= { apsChanStatusEntry 7 }

apsNotificationEnable OBJECT-TYPE
    SYNTAX      BITS {
        switchover(0),
        modeMismatch(1),
        channelMismatch(2),
        psbf(3),
        feplf(4)
    }
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "Provides the ability to enable and disable notifications
        defined in this MIB.

        switchover

        Indicates  apsEventSwitchover notifications
        should be generated.

        modeMismatch

        Indicates  apsEventModeMismatch notifications
        should be generated.

        channelMismatch

        Indicates  apsEventChannelMismatch notifications
        should be generated.

        psbf

        Indicates  apsEventPSBF notifications
        should be generated.

        feplf

        Indicates  apsEventFEPLF notifications
        should be generated. "
    DEFVAL     { { } }
 ::= { apsMIBObjects 7 }

```

```
--
```

```
-- APS EVENTS
```

--

apsNotificationsPrefix OBJECT IDENTIFIER
 ::= { apsMIBNotifications 0 }

apsEventSwitchover NOTIFICATION-TYPE
 OBJECTS { apsChanStatusSwitchovers, apsChanStatusCurrent }
 STATUS current
 DESCRIPTION
 "An apsEventSwitchover notification is sent when the
 value of an instance of apsChanStatusSwitchovers increments."
 ::= { apsNotificationsPrefix 1 }

apsEventModeMismatch NOTIFICATION-TYPE
 OBJECTS { apsStatusModeMismatches, apsStatusCurrent }
 STATUS current
 DESCRIPTION
 "An apsEventModeMismatch notification is sent when the
 value of an instance of apsStatusModeMismatches increments."
 ::= { apsNotificationsPrefix 2 }

apsEventChannelMismatch NOTIFICATION-TYPE
 OBJECTS { apsStatusChannelMismatches, apsStatusCurrent }
 STATUS current
 DESCRIPTION
 "An apsEventChannelMismatch notification is sent when the
 value of an instance of apsStatusChannelMismatches increments."
 ::= { apsNotificationsPrefix 3 }

apsEventPSBF NOTIFICATION-TYPE
 OBJECTS { apsStatusPSBFs, apsStatusCurrent }
 STATUS current
 DESCRIPTION
 "An apsEventPSBF notification is sent when the
 value of an instance of apsStatusPSBFs increments."
 ::= { apsNotificationsPrefix 4 }

apsEventFEPLF NOTIFICATION-TYPE
 OBJECTS { apsStatusFEPLFs, apsStatusCurrent }
 STATUS current
 DESCRIPTION
 "An apsEventFEPLFs notification is sent when the
 value of an instance of apsStatusFEPLFs increments."
 ::= { apsNotificationsPrefix 5 }

-- conformance information

```
apsGroups      OBJECT IDENTIFIER ::= { apsMIBConformance 1 }
apsCompliances OBJECT IDENTIFIER ::= { apsMIBConformance 2 }
```

```
apsFullCompliance MODULE-COMPLIANCE
```

```
STATUS current
```

```
DESCRIPTION
```

```
"When this MIB is implemented with support for read-create, then
such an implementation can claim read/write compliance. Linear
APS groups can then be both monitored and configured with this
MIB.
```

```
Note that An agent is not required to process SNMP Set Requests
that affect multiple control objects within this MIB. This is
intended to simplify the processing of Set Requests for the
various control tables by eliminating the possibility that a
single Set PDU will contain multiple varbinds which are in
conflict. "
```

```
MODULE
```

```
MANDATORY-GROUPS { apsConfigGeneral, apsStatusGeneral,
apsChanGeneral }
```

```
OBJECT apsConfigRowStatus
```

```
SYNTAX INTEGER { active(1) }
```

```
WRITE-SYNTAX INTEGER { createAndGo(4), destroy(6) }
```

```
DESCRIPTION
```

```
"Support for createAndWait and notInService is not
required."
```

```
OBJECT apsChanConfigRowStatus
```

```
SYNTAX INTEGER { active(1) }
```

```
WRITE-SYNTAX INTEGER { createAndGo(4), destroy(6) }
```

```
DESCRIPTION
```

```
"Support for createAndWait and notInService is not
required."
```

```
GROUP apsConfigWtr
```

```
DESCRIPTION
```

```
"Implementation of this group is optional for all
linear APS implementations. The information is
applicable to groups supporting a configurable
WTR period."
```

```
GROUP apsCommandOnePlusOne
```

```
DESCRIPTION
```

```
"Implementation of this group is optional for all
linear APS implementations. The information is
applicable to groups implementing the linear
```


APS 1+1 architecture and supporting set operations."

GROUP apsCommandOneToN

DESCRIPTION

"Implementation of this group is optional for all linear APS implementations. The information is applicable to groups implementing the linear APS 1:n architecture and supporting set operations."

GROUP apsChanOneToN

DESCRIPTION

"Implementation of this group is optional for all linear APS implementations. The information is applicable to groups implementing the linear APS 1:n architecture."

GROUP apsTotalsGroup

DESCRIPTION

"Implementation of this group is optional for all linear APS implementations."

GROUP apsMapGroup

DESCRIPTION

"Implementation of this group is optional for all linear APS implementations."

GROUP apsEventGroup

DESCRIPTION

"Implementation of this group is optional for all linear APS implementations."

::= { apsCompliances 1 }

--

-- Read-Only Compliance

--

apsReadOnlyCompliance MODULE-COMPLIANCE

STATUS current

DESCRIPTION

"When this MIB is implemented without support for read-create (i.e. in read-only mode), then that implementation can claim read-only compliance. In that case, linear APS groups can be monitored but cannot be configured with this MIB."

MODULE

MANDATORY-GROUPS { apsConfigGeneral, apsStatusGeneral,
 apsChanGeneral }

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

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

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

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

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

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

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

OBJECT apsConfigRowStatus
SYNTAX INTEGER { active(1) }
MIN-ACCESS read-only
DESCRIPTION
"Write access is not required, and active is the only status
that needs to be supported."

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

OBJECT apsChanConfigIfIndex

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

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

OBJECT apsChanConfigRowStatus
SYNTAX INTEGER { active(1) }
MIN-ACCESS read-only
DESCRIPTION
"Write access is not required, and active is the only status that needs to be supported."

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

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

GROUP apsConfigWtr
DESCRIPTION
"Implementation of this group is optional for all linear APS implementations. The information is applicable to groups supporting a configurable WTR period."

GROUP apsCommandOnePlusOne
DESCRIPTION
"Implementation of this group is optional for all linear APS implementations. The information is applicable to groups implementing the linear APS 1+1 architecture and supporting set operations."

GROUP apsCommandOneToN
DESCRIPTION
"Implementation of this group is optional for all linear APS implementations. The information is applicable to groups implementing the linear APS 1:n architecture and supporting set operations."

GROUP apsChanOneToN

```
DESCRIPTION
    "Implementation of this group is optional for all
    linear APS implementations. The information is
    applicable to groups implementing the linear
    APS 1:n architecture."

GROUP      apsTotalsGroup
DESCRIPTION
    "Implementation of this group is optional for all
    linear APS implementations."

GROUP      apsMapGroup
DESCRIPTION
    "Implementation of this group is optional for all
    linear APS implementations."

GROUP      apsEventGroup
DESCRIPTION
    "Implementation of this group is optional for all
    linear APS implementations."

 ::= { apsCompliances 2 }

-- units of conformance

apsConfigGeneral    OBJECT-GROUP
OBJECTS
{
    apsConfigMode,
    apsConfigRevert,
    apsConfigDirection,
    apsConfigExtraTraffic,
    apsConfigSdBerThreshold,
    apsConfigSfBerThreshold,
    apsConfigCreationTime,
    apsConfigRowStatus,
    apsConfigStorageType,
    apsNotificationEnable
}
STATUS current
DESCRIPTION
    "A collection of apsConfigTable objects providing configuration
    information applicable to all linear APS groups."
 ::= { apsGroups 1 }

apsConfigWtr        OBJECT-GROUP
OBJECTS
{
```

```
    apsConfigWaitToRestore
  }
  STATUS current
  DESCRIPTION
    "The apsConfigTable object that provides information which is
    applicable to groups supporting a configurable WTR period."
  ::= { apsGroups 2 }

-- If set operations are not supported neither of the following two
-- groups are implemented. If sets are supported only one of these
-- groups is implemented for a linear APS group instance.

apsCommandOnePlusOne    OBJECT-GROUP
  OBJECTS
  {
    apsCommandSwitch
  }
  STATUS current
  DESCRIPTION
    "The apsCommandTable object which is applicable to groups
    implementing the linear APS 1+1 architecture. Also, set
    operations must be supported."
  ::= { apsGroups 3 }

apsCommandOneToN        OBJECT-GROUP
  OBJECTS
  {
    apsCommandSwitch,
    apsCommandControl
  }
  STATUS current
  DESCRIPTION
    "A collection of apsCommandTable objects which are applicable to
    groups implementing the linear APS 1:n architecture. Also, set
    operations must be supported."
  ::= { apsGroups 4 }

apsStatusGeneral        OBJECT-GROUP
  OBJECTS
  {
    apsStatusK1K2Rcv,
    apsStatusK1K2Trans,
    apsStatusCurrent,
    apsStatusModeMismatches,
    apsStatusChannelMismatches,
    apsStatusPSBFs,
    apsStatusFEPLFs,
    apsStatusSwitchedChannel,
  }
```

```
        apsStatusDiscontinuityTime
    }
    STATUS current
    DESCRIPTION
        "A collection of apsStatusTable objects providing status
        information applicable to all linear APS groups."
    ::= { apsGroups 5 }

apsChanGeneral OBJECT-GROUP
OBJECTS
{
    apsChanConfigIfIndex,
    apsChanConfigRowStatus,
    apsChanConfigStorageType,
    apsChanStatusCurrent,
    apsChanStatusSignalDegrades,
    apsChanStatusSignalFailures,
    apsChanStatusSwitchovers,
    apsChanStatusLastSwitchover,
    apsChanStatusSwitchoverSeconds,
    apsChanStatusDiscontinuityTime
}
STATUS current
DESCRIPTION
    "A collection of channel objects providing information
    applicable to all linear APS channels."
::= { apsGroups 6 }

apsChanOneToN OBJECT-GROUP
OBJECTS
{
    apsChanConfigPriority
}
STATUS current
DESCRIPTION
    "The apsChanConfigTable object that provides information which
    is only applicable to groups implementing the linear APS 1:n
    architecture."
::= { apsGroups 7 }

apsTotalsGroup OBJECT-GROUP
OBJECTS
{
    apsConfigGroups,
    apsChanLTES
}
STATUS current
DESCRIPTION
```

```
        "A collection of objects providing optional counts of configured
        APS groups and SONET LTE interfaces."
 ::= { apsGroups 8 }

apsMapGroup OBJECT-GROUP
OBJECTS
{
    apsMapGroupName,
    apsMapChanNumber
}
STATUS current
DESCRIPTION
    "A collection of apsMapTable objects providing a mapping
    from sonet(39) InterfaceIndex to group name and channel
    number for assigned APS channels and a list of unassigned
    sonet(39) interfaces."
 ::= { apsGroups 9 }

apsEventGroup NOTIFICATION-GROUP
NOTIFICATIONS {apsEventSwitchover, apsEventModeMismatch,
               apsEventChannelMismatch, apsEventPSBF,
               apsEventFEPLF }
STATUS current
DESCRIPTION
    "A collection of SONET linear APS notifications."
 ::= { apsGroups 10 }

END
```

5. Intellectual Property

The IETF takes no position regarding the validity or scope of any intellectual property or other rights that might be claimed to pertain to the implementation or use of the technology described in this document or the extent to which any license under such rights might or might not be available; neither does it represent that it has made any effort to identify any such rights. Information on the IETF's procedures with respect to rights in standards-track and standards-related documentation can be found in [BCP11]. Copies of claims of rights made available for publication and any assurances of licenses to be made available, or the result of an attempt made to obtain a general license or permission for the use of such proprietary rights by implementors or users of this specification can be obtained from the IETF Secretariat.

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

6. Acknowledgments

This document is a product of the AToMMIB Working Group. A number of constructs from a separate draft submission by Ken Chapman have been included here. Suggestions by Orly Nicklass, Faye Ly, Ron Carmona, Kaj Tesink, C. M. Heard, Muly Ilan, and Mickey Spiegel have been incorporated. A quality review was provided by Lauren Heintz and an IESG review by John Flick and Bert Wijnen.

7. Normative References

- [RFC2578] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M. and S. Waldbusser, "Structure of Management Information Version 2 (SMIv2)", STD 58, RFC 2578, April 1999.
- [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.
- [RFC2863] McCloghrie, K. and F. Kastenholz, "The Interfaces Group MIB", RFC 2863, June 2000.
- [GR253CO] GR-253-CORE Issue 3, September 2000
- [G.783] ITU-T Recommendation G.783 (04/97)

8. Informative References

- [RFC3410] Case, J., Mundy, R., Partain, D. and B. Stewart, "Introduction and Applicability Statements for Internet-Standard Management Framework", RFC 3410, December 2002.
- [BCP11] Hovey, R, "The Organizations Involved in the IETF Standards Process", BCP 11, RFC 2028, October 1996.

9. 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. In particular, the APS command objects `apsCommandSwitch` and `apsCommandControl` and the APS configuration objects `apsConfigRowStatus`, `apsConfigMode`, `apsConfigRevert`, `apsConfigDirection`, `apsConfigExtraTraffic`, `apsConfigSdBerThreshold`, `apsConfigSfBerThreshold`, `apsConfigWaitToRestore`, `apsConfigStorageType`, `apsChanConfigRowStatus`, `apsChanConfigIfIndex`, `apsChanConfigPriority`, `apsChanConfigStorageType` and `apsNotificationEnable` have the potential of disrupting APS operations if set operations are performed with malicious intent.

SNMP versions prior to SNMPv3 did not include adequate security. Even if the network itself is secure (for example by using IPsec), there is no control as to who on the secure network is allowed to access and GET/SET (read/change/create/delete) the objects in this MIB module.

It is recommended that implementers consider the security features as provided by the SNMPv3 framework (see [RFC3410], section 8), including full support for the SNMPv3 cryptographic mechanisms (for authentication and privacy).

Further, deployment of SNMP versions prior to SNMPv3 is not recommended. Instead, it is recommended to deploy SNMPv3 and to enable cryptographic security. It is then a customer/operator responsibility to ensure that access to an instance of this MIB module is properly configured for only those principals (users) that have legitimate rights to GET or SET object instances.

10. Editors' Addresses

Jim Kuhfeld
RedBack Networks. Inc.
300 Holger Way
San Jose, CA 95134-1362

Phone: +1 408 750 5465
EMail: jkuhfeld@redback.com

Jeff Johnson
RedBack Networks. Inc.
300 Holger Way
San Jose, CA 95134-1362

Phone: +1 408 750 5460
EMail: jeff@redback.com

Michael Thatcher
RedBack Networks. Inc.
300 Holger Way
San Jose, CA 95134-1362

Phone: +1 408 750 5449
EMail: thatcher@redback.com

11. Full Copyright Statement

Copyright (C) The Internet Society (2003). All Rights Reserved.

This document and translations of it may be copied and furnished to others, and derivative works that comment on or otherwise explain it or assist in its implementation may be prepared, copied, published and distributed, in whole or in part, without restriction of any kind, provided that the above copyright notice and this paragraph are included on all such copies and derivative works. However, this document itself may not be modified in any way, such as by removing the copyright notice or references to the Internet Society or other Internet organizations, except as needed for the purpose of developing Internet standards in which case the procedures for copyrights defined in the Internet Standards process must be followed, or as required to translate it into languages other than English.

The limited permissions granted above are perpetual and will not be revoked by the Internet Society or its successors or assigns.

This document and the information contained herein is provided on an "AS IS" basis and THE INTERNET SOCIETY AND THE INTERNET ENGINEERING TASK FORCE DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY THAT THE USE OF THE INFORMATION HEREIN WILL NOT INFRINGE ANY RIGHTS OR ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Acknowledgement

Funding for the RFC Editor function is currently provided by the Internet Society.