Internet Engineering Task Force (IETF)
Request for Comments: 6766
Category: Standards Track
ISSN: 2070-1721

E. Beili
Actelis Networks

February 2013

# xDSL Multi-Pair Bonding Using Time-Division Inverse Multiplexing (G.Bond/TDIM) MIB

## Abstract

This document defines a Management Information Base (MIB) module for use with network management protocols in TCP/IP-based internets. This document proposes an extension to the GBOND-MIB module with a set of objects for managing multi-pair bonded xDSL interfaces using Time-Division Inverse Multiplexing (TDIM), as defined in ITU-T Recommendation G.998.3.

## Status of This Memo

This is an Internet Standards Track document.

This document is a product of the Internet Engineering Task Force (IETF). It represents the consensus of the IETF community. It has received public review and has been approved for publication by the Internet Engineering Steering Group (IESG). Further information on Internet Standards is available in Section 2 of RFC 5741.

Information about the current status of this document, any errata, and how to provide feedback on it may be obtained at http://www.rfc-editor.org/info/rfc6766.

Table of Contents



## 1. Introduction

Multi-pair bonding using Time-Division Inverse Multiplexing (TDIM), a.k.a. G.Bond/TDIM, is specified in ITU-T Recommendation G.998.3 [G.998.3], which defines a method for bonding (or aggregating) multiple xDSL lines (or individual bearer channels in multiple xDSL lines) into a single bidirectional logical link carrying a mix of various traffic streams, e.g., Ethernet, Asynchronous Transfer Mode (ATM), Time-Division Multiplexing (TDM).

The MIB module defined in this document provides G.Bond/TDIM-specific objects for the management of G.998.3 bonded interfaces, extending the common bonding objects specified in the GBOND-MIB [RFC6765] module.

## 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].

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14, RFC 2119 [RFC2119].

## 3. The Broadband Forum Management Framework for xDSL Bonding

This document makes use of the Broadband Forum technical report "Management Framework for xDSL Bonding" [TR-159], defining a management model and a hierarchy of management objects for the bonded xDSL interfaces.

## 4. Relationship to Other MIB Modules

This section outlines the relationship of the MIB modules defined in this document with other MIB modules described in the relevant RFCs. Specifically, the following MIB modules are discussed: the Interfaces Group MIB (IF-MIB) and the G.Bond MIB (GBOND-MIB).

### 4.1. Relationship to the Interfaces Group MIB Module

A G.Bond/TDIM port is a private case of a bonded multi-pair xDSL interface and as such is managed using generic interface management objects defined in the IF-MIB [RFC2863]. In particular, an interface index (ifIndex) is used to index instances of G.Bond/TDIM ports, as well as xDSL lines/channels, in a managed system.

### 4.2. Relationship to the G.Bond MIB Module

The GBOND-MIB module [RFC6765] defines management objects common for all bonded multi-pair xDSL interfaces. In particular, it describes the bonding management, bonded port and channel configuration, initialization sequence, etc.

Both the GBOND-MIB and G9983-MIB modules are REQUIRED to manage a G.Bond/TDIM port.

# 5. MIB Structure

## 5.1. Overview

All management objects defined in the G9983-MIB module are contained in a single group g9983Port. This group is further split into 6 sub-groups, structured as recommended by RFC 4181 [RFC4181]:

- g9983PortNotifications - containing notifications (TDIM Service 'down''up').
- g9983PortConfTable - containing objects for configuration of a G.Bond/TDIM port.
- g9983PortCapTable - containing objects reflecting capabilities of a G.Bond/TDIM port.
- g9983PortStatTable - containing objects providing overall status information of a G.Bond/TDIM port, complementing the generic status information from the ifTable of the IF-MIB and the gBondPortStatFltStatus of GBOND-MIB.
- g9983SvcTable - containing objects for configuration and status of the services in a G.Bond/TDIM port.
- g9983PM - containing objects for OPTIONAL historical Performance Monitoring (PM) of a G.Bond/TDIM port.

## 5.2. Link Protection Configuration

The G.Bond/TDIM specification allows an optional Forward Error Correction (FEC) and Interleaver block, which if supported and enabled provides a degree of protection against micro-interruptions, alien noise, and even individual Bonding Channel Entity (BCE) failures, a.k.a. cut-line protection.

Management objects in the g9983PortConfTable can be used to configure and query the FEC and Interleaver function of the G.Bond/TDIM port.

## 5.3. Service Configuration

Unlike the other two xDSL Multi-Pair Bonding schemes (G.Bond/ATM and G.Bond/Ethernet), which send the information required for reassembly of the fragmented data along with the data, G.Bond/TDIM is a synchronous scheme, requiring both ends to know the data distribution tables before any actual data transfer can happen.

Management objects in the g9983PortConfTable (g9983PortConfAdminServices), g9983SvcTable, and g9983OperSvcTable can be used to configure and query the configuration of services transported via the G.Bond/TDIM link. The services may be configured independently of the link state (i.e., in-service and out-of-service), as G.998.3 communicates changes in the service configuration via specific Bonding Communication Channel (BCC) messages, switching both ends of the link to the new configuration synchronously.

There can be up to 60 active services defined on a G.Bond/TDIM link. This MIB module provides an ability to define up to 255 services via the g9983SvcTable, with each row representing a possible service, and then set the actual service configuration using the g9983PortConfAdminServices object (a byte-vector of service indices), listing the active services in the order of their position in the G.Bond/TDIM frame. This design allows one to easily modify service drop priority, which directly corresponds to the service position.

The actual list of services is provided via the read-only g9983OperSvcTable, where each entry's index corresponds to the service position, starting from index 1 for the first entry, 2 for the second entry, etc., providing an easy service navigation for a management application using GET-NEXT (instead of counting bytes in the g9983PortConfAdminServices object).

The service configuration can only be changed on a Bonding Terminating Unit at the Central Office (BTU-C).

When configuring the services, please bear in mind that the sum of all the services' bandwidth SHOULD be less than or equal to the target data rate of the bonded link. Note that G.Bond/TDIM links are symmetrical; i.e., their upstream data rate equals the downstream data rate.

### 5.3.1. Management of TDM Services and Service Drop Priority during Bandwidth Degradation

The G.Bond/TDIM protocol provides an ability to map TDM services into the TDIM bonded link directly, without any additional overhead. It addresses only structure-agnostic TDM transport, disregarding any structure that may be imposed on these streams, in particular, the structure imposed by the standard TDM framing [G.704].

During bandwidth degradation, services with a lower priority are impaired or dropped first. Synchronous services (fractional DS1/E1, clear channel E1/T1, T3/E3, clock) that are positioned in the beginning of the G.Bond/TDIM frame have higher priority than asynchronous services (Ethernet, ATM, Generic Framing Procedure (GFP) encapsulated) that are positioned farther away. Within the services of the same type, those with a lower position (index) have higher priority.

### 5.3.2. Service Notifications

This MIB module provides specific 'up'/'down' notifications (g9983SvcUp/g9983SvcDown) for each of the configured services. During bandwidth degradation, a number of services may be suspended (dropped) simultaneously, according to their drop priority (position in the service list). Please note that it is possible for a higher-priority service to be dropped before a lower-priority one. For example, suppose there are two services configured on a 2-Mbps G.Bond/TDIM link: a T1 service (g9983SvcType with a value of ds1, with a bandwidth requirement of 1.5 Mbps), and an Ethernet service with a size of 0.5 Mbps. When the actual link bandwidth is reduced to 1.4 Mbps, the T1 service with a g9983OperSvcPosition value of 1 would be dropped, while the Ethernet service with a g9983OperSvcPosition value of 2 would remain up.

Notifications SHOULD be rate-limited (throttled) such that there is an implementation-specific gap between the generation of consecutive notifications of the same event. This mechanism prevents "notification flooding" in cases where g9983OperSvcState oscillates between the 'up' and 'down' states. When notifications are rate-limited, they are dropped and not queued for sending at a future time. This is intended to be a general rate-limiting statement for notifications that otherwise have no explicit rate-limiting assertions in this document.

## 5.4. Performance Monitoring

The OPTIONAL Performance Monitoring counters, thresholds, and history buckets (interval-counters), similar to those defined in [TR-159], are implemented using the textual conventions defined in the HC-PerfHist-TC-MIB [RFC3705]. The HC-PerfHist-TC-MIB defines 64-bit versions of the textual conventions found in the PerfHist-TC-MIB [RFC3593].

The agent SHOULD align the beginning of each interval to a fifteen-minute boundary of a wall clock. Likewise, the beginning of each one-day interval SHOULD be aligned with the start of a day.

Counters are not reset when a G.Bond TDIM port is re-initialized, but rather only when the agent is reset or re-initialized.

Note that the accumulation of certain performance events for a monitored entity is inhibited (counting stops) during periods of service unavailability on that entity. The DESCRIPTION clause of Performance Monitoring counters in this MIB module specifies which of the counters are inhibited during periods of service unavailability.

## 5.5. Mapping of Broadband Forum TR-159 and ITU-T G.998.3 Managed Objects

This section contains the mapping between relevant managed objects (attributes) defined in [TR-159] and the managed objects defined in this document. Note that all management objects defined in [G.998.3] have corresponding objects in [TR-159].

| TR-159 Managed Object | Corresponding SNMP Object |
|---|---|
| oBondTDIM - Basic Package (Mandatory) | |
| aCRC4Errors | g9983PortStatCrc4Errors |
| aCRC6Errors | g9983PortStatCrc6Errors |
| aCRC8Errors | g9983PortStatCrc8Errors |
| aFECSupported | g9983PortCapFecSupported |

| oBondTDIM - FEC Package (Optional) | |
|---|---|
| aFECAdminState | g9983PortConfFecAdminState |
| aFECOperState | g9983PortStatFecOperState |
| aFECWordSize | g9983PortConfFecWordSize |
| aFECRedundancySize | g9983PortConfFecRedundancySize |
| aFECInterleaverType | g9983PortConfFecInterleaverType |
| aFECInterleaverDepth | g9983PortConfFecInterleaverDepth |
| aFECMaxWordSize | g9983PortCapFecMaxWordSize |
| aFECMaxRedundancySize | g9983PortCapFecMaxRedundancySize |
| aFECInterleaverTypesSupported | g9983PortCapFecInterleaverTypeSupported |
| aFECMaxInterleaverDepth | g9983PortCapFecMaxInterleaverDepth |
| oTDIMService - Basic Package (Mandatory) | |
| aServiceID | g9983OperSvcPosition |
| aServiceIfIdx | g9983SvcIfIdx |
| aServiceType | g9983SvcType |
| aServiceSize | g9983SvcSize |
| aServiceOperState | g9983OperSvcState |
| aServiceUpDownEnable | g9983PortConfSvcUpDownEnable |
| nServiceUp | g9983SvcUp |
| nServiceDown | g9983SvcDown |

Table 1: Mapping of TR-159 Managed Objects

Note that some of the mapping between the objects defined in TR-159 and the ones defined in this MIB module is not one-to-one; for example, while TR-159 PM attributes aGroupPerf* map to the corresponding gBondPortPm* objects of the GBOND-MIB module, there are no dedicated PM attributes for the g9983PortPm* and g9983SvcPm* objects introduced in this MIB module. However, since their definition is identical to the definition of gBondPortPm* objects of the GBOND-MIB module, we can map g9983PortPm* and g9983SvcPm* to the relevant aGroupPerf* attributes of TR-159 and use the term 'partial mapping' to denote the fact that this mapping is not one-to-one.

## 6. G.Bond/TDIM MIB Definitions

The G9983-MIB module IMPORTS objects from SNMPv2-SMI [RFC2578], SNMPv2-TC [RFC2579], SNMPv2-CONF [RFC2580], IF-MIB [RFC2863], and HC-PerfHist-TC-MIB [RFC3705]. The module has been structured as recommended by [RFC4181].

```
G9983-MIB DEFINITIONS ::= BEGIN

  IMPORTS
    MODULE-IDENTITY,
    OBJECT-TYPE,
    NOTIFICATION-TYPE,
    mib-2,
    Unsigned32,
    Counter32
      FROM SNMPv2-SMI           -- RFC 2578
    TEXTUAL-CONVENTION,
    RowStatus,
    TruthValue
      FROM SNMPv2-TC            -- RFC 2579
    MODULE-COMPLIANCE,
    OBJECT-GROUP,
    NOTIFICATION-GROUP
      FROM SNMPv2-CONF          -- RFC 2580
    ifIndex,
    InterfaceIndex
      FROM IF-MIB               -- RFC 2863
    HCPerfCurrentCount,
    HCPerfIntervalCount,
    HCPerfValidIntervals,
    HCPerfInvalidIntervals,
    HCPerfTimeElapsed
      FROM HC-PerfHist-TC-MIB   -- RFC 3705
    ;
--------------------------------------------------------------------------
  g9983MIB MODULE-IDENTITY
    LAST-UPDATED "201302200000Z"  -- 20 February 2013
    ORGANIZATION "IETF ADSL MIB Working Group"
    CONTACT-INFO
      "WG charter:
        http://datatracker.ietf.org/wg/adslmib/charter/

      Mailing Lists:
        General Discussion: adslmib@ietf.org
        To Subscribe: adslmib-request@ietf.org
        In Body: subscribe your_email_address
```

```
       Chair: Menachem Dodge
      Postal: ECI Telecom, Ltd.
              30 Hasivim St.
              Petach-Tikva  4951169
              Israel
       Phone: +972-3-926-8421
       EMail: menachemdodge1@gmail.com

      Editor: Edward Beili
      Postal: Actelis Networks, Inc.
              25 Bazel St., P.O.B. 10173
              Petach-Tikva  49103
              Israel
       Phone: +972-3-924-3491
       EMail: edward.beili@actelis.com"

    DESCRIPTION
      "The objects in this MIB module are used to manage the
      multi-pair bonded xDSL interfaces using time-division inverse
      multiplexing (TDIM), as defined in ITU-T Recommendation G.998.3
      (G.Bond/TDIM).

      This MIB module MUST be used in conjunction with the GBOND-MIB
      module, common to all G.Bond technologies.

      The following references are used throughout this MIB module:

      [G.998.3] refers to:
        ITU-T Recommendation G.998.3: 'Multi-pair bonding using
        time-division inverse multiplexing', January 2005.

      [TR-159] refers to:
        Broadband Forum Technical Report: 'Management Framework for
        xDSL Bonding', December 2008.

      Naming Conventions:
        BCE    - Bonding Channel Entity
        BTU    - Bonding Terminating Unit
        BTU-C  - Bonding Terminating Unit, CO side
        BTU-R  - Bonding Terminating Unit, Remote Terminal (CPE) side
        CO     - Central Office
        CPE    - Customer Premises Equipment
        GBS    - Generic Bonding Sub-layer
        GBS-C  - Generic Bonding Sub-layer, CO side
        GBS-R  - Generic Bonding Sub-layer, Remote Terminal (CPE) side
        SNR    - Signal to Noise Ratio
```

```
 REVISION    "201302200000Z"  -- 20 February 2013
 DESCRIPTION "Initial version, published as RFC 6766."

 ::= { mib-2 210 }

-- Sections of the module
-- Structured as recommended by RFC 4181, Appendix D

g9983Objects     OBJECT IDENTIFIER ::= { g9983MIB 1 }

g9983Conformance OBJECT IDENTIFIER ::= { g9983MIB 2 }

-- Groups in the module

g9983Port        OBJECT IDENTIFIER ::= { g9983Objects 1 }

-- Textual Conventions

G9983SvcIndex ::= TEXTUAL-CONVENTION
  DISPLAY-HINT "d"
  STATUS      current
  DESCRIPTION
    "A unique value, greater than zero, for each service defined
    in the managed G.Bond/TDIM port.
    It is RECOMMENDED that values be assigned contiguously
    starting from 1.  The value for each service MUST remain
    constant at least from one re-initialization of the local
    management subsystem to the next re-initialization."
  SYNTAX      Unsigned32 (1..255)

G9983SvcIndexList ::= TEXTUAL-CONVENTION
  DISPLAY-HINT "1d:"
  STATUS      current
  DESCRIPTION
    "This textual convention represents a continuous ordered list of
    all the services defined for the managed G.Bond/TDIM port.
    The value of this object is a concatenation of zero or more (up
    to 60) octets, where each octet contains an 8-bit
    G9983SvcIndex value, identifying a particular service.
```

```
      An octet's position reflects the associated service position
      and its priority in the G.Bond/TDIM frame, with the first octet
      being the first service of highest priority.

      A zero-length octet string is object-specific and MUST
      therefore be defined as part of the description of any object
      that uses this syntax.  Examples of the usage of a zero-length
      value might include situations where an object using this
      textual convention is irrelevant for a specific G.Bond/TDIM port
      type or where no services have been defined for this port."
    SYNTAX      OCTET STRING (SIZE (0..60))

  G9983SvcOrderIndex ::= TEXTUAL-CONVENTION
    DISPLAY-HINT "d"
    STATUS      current
    DESCRIPTION
      "A unique value, greater than zero, for each service defined
      in the managed G.Bond/TDIM port, showing its relative position
      inside the G.Bond/TDIM frame."
    SYNTAX      Unsigned32 (1..60)

 -- Port Notifications group

  g9983PortNotifications OBJECT IDENTIFIER
    ::= { g9983Port 0 }

  g9983SvcUp NOTIFICATION-TYPE
    OBJECTS {
      -- ifIndex and g9983OperSvcPosition would be part of the trap OID
      g9983OperSvcIdx,
      g9983SvcIfIdx
    }
    STATUS      current
    DESCRIPTION
      "This notification indicates that a service, indicated by the
      g9983OperSvcIdx (mapped to a particular interface
      indicated by the g9983SvcIfIdx), in a particular
      G.Bond/TDIM port is passing traffic.

      This notification is generated (unless disabled or dropped by
      the rate-limiting mechanism) when the g9983OperSvcState
      object has left the 'down' state, while the G.Bond/TDIM port
      state (the ifOperStatus of the IF-MIB) is 'up'.

      Generation of this notification is controlled by the
      g9983PortConfSvcUpDownEnable object.

      This object maps to the TR-159 notification nServiceUp."
```

```
    REFERENCE
      "[TR-159], Section 5.5.5.7"
    ::= { g9983PortNotifications 1 }

  g9983SvcDown NOTIFICATION-TYPE
    OBJECTS {
      -- ifIndex and g9983OperSvcPosition would be part of the trap OID
      g9983OperSvcIdx,
      g9983SvcIfIdx
    }
    STATUS      current
    DESCRIPTION
      "This notification indicates that a service indicated by the
      g9983OperSvcIdx (mapped to a particular interface
      indicated by the g9983SvcIfIdx) in a particular
      G.Bond/TDIM port has stopped passing traffic.

      This notification is generated (unless disabled or dropped by
      the rate-limiting mechanism), when the g9983OperSvcState
      object has entered the 'down' state, while the G.Bond/TDIM port
      state (the ifOperStatus of the IF-MIB) is 'up'.

      Generation of this notification is controlled by the
      g9983PortConfSvcUpDownEnable object.

      This object maps to the TR-159 notification nServiceDown."
    REFERENCE
      "[TR-159], Section 5.5.5.8"
    ::= { g9983PortNotifications 2 }

  -- G.Bond/TDIM Port group

  g9983PortConfTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF G9983PortConfEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
      "Table for configuration of G.Bond/TDIM ports.  Entries in
      this table MUST be maintained in a persistent manner."
    ::= { g9983Port 1 }

  g9983PortConfEntry OBJECT-TYPE
    SYNTAX      G9983PortConfEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
      "An entry in the G.Bond/TDIM Port Configuration table.
      Each entry represents a G.Bond/TDIM port indexed by the
```

```
      ifIndex.  Additional configuration parameters are available
      via the gBondPortConfEntry of the GBOND-MIB.
      Note that a G.Bond/TDIM port runs on top of a single or
      multiple BCE port(s), which are also indexed by the ifIndex."
    INDEX  { ifIndex }
    ::= { g9983PortConfTable 1 }

  G9983PortConfEntry ::=
    SEQUENCE {
      g9983PortConfFecAdminState        TruthValue,
      g9983PortConfFecWordSize          Unsigned32,
      g9983PortConfFecRedundancySize    Unsigned32,
      g9983PortConfFecInterleaverType   INTEGER,
      g9983PortConfFecInterleaverDepth  Unsigned32,
      g9983PortConfAdminServices        G9983SvcIndexList,
      g9983PortConfSvcUpDownEnable      TruthValue
    }

  g9983PortConfFecAdminState  OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
      "A desired state of the OPTIONAL Forward Error Correction
      (FEC) function of the G.Bond/TDIM port.

      A value of 'false' indicates that the FEC function SHALL be
      disabled.  A value of 'true' indicates that the FEC function
      SHALL be enabled, if supported by the G.Bond/TDIM port, as
      indicated by the g9983PortCapFecSupported object.
      The g9983PortStatFecOperState object indicates the current
      operational state of the FEC function.

      For the GBS-R ports, the value of this object cannot be changed
      directly.  This value may be changed as a result of a write
      operation on the g9983PortCapFecSupported object of a remote
      GBS-C.

      Modifications of this object MUST be performed when the link
      is 'down'.
      Attempts to change this object MUST be rejected if the link is
      'up' or initializing, or if it is a GBS-R.

      This object maps to the TR-159/G.998.3 attribute aFECAdminState."
    REFERENCE
      "[TR-159], Section 5.5.4.5; [G.998.3], Appendix II, B-X"
    ::= { g9983PortConfEntry 1 }
```

```
   g9983PortConfFecWordSize  OBJECT-TYPE
     SYNTAX      Unsigned32 (0|20..255)
     UNITS       "octets"
     MAX-ACCESS  read-write
     STATUS      current
     DESCRIPTION
       "A FEC code word size, in octets, for G.Bond/TDIM ports
       supporting the FEC function.

       This object is read-write for the GBS-C ports and read-only
       for the GBS-R.

       A value of zero SHALL be returned if the FEC function is
       disabled (via g9983PortConfFecAdminState) or not supported.

       Changing of the FEC code word size MUST be performed when the
       FEC-enabled link is 'down'.  Attempts to change this object MUST
       be rejected if the link is 'up' or initializing or if the
       FEC function is disabled/not supported.

       This object maps to the TR-159/G.998.3 attribute aFECWordSize."
     REFERENCE
       "[TR-159], Section 5.5.4.7; [G.998.3], Appendix II, B-XI"
     ::= { g9983PortConfEntry 2 }

   g9983PortConfFecRedundancySize  OBJECT-TYPE
     SYNTAX      Unsigned32 (0|2|4|8|16|20)
     UNITS       "octets"
     MAX-ACCESS  read-write
     STATUS      current
     DESCRIPTION
       "A FEC redundancy word size, in octets, for G.Bond/TDIM
       ports supporting the FEC function.

       This object is read-write for the GBS-C ports and read-only
       for the GBS-R.

       A value of zero SHALL be returned if the FEC function is
       disabled (via g9983PortConfFecAdminState) or not supported.

       Changing of the FEC redundancy word size MUST be performed
       when the FEC-enabled link is 'down'.  Attempts to change this
       object MUST be rejected if the link is 'up' or initializing or
       if the FEC function is disabled/not supported.

       This object maps to the TR-159/G.998.3 attribute
       aFECRedundancySize."
```

```
    REFERENCE
      "[TR-159], Section 5.5.4.8; [G.998.3], Appendix II, B-XII"
    ::= { g9983PortConfEntry 3 }

  g9983PortConfFecInterleaverType  OBJECT-TYPE
    SYNTAX      INTEGER {
      none(0),
      block(1),
      convolution(2)
    }
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
      "An Interleaver type for G.Bond/TDIM ports supporting the
      FEC function.

      This object is read-write for the GBS-C ports and read-only
      for the GBS-R.

      A value of none(0) SHALL be returned if the FEC function is
      disabled (via g9983PortConfFecAdminState) or not supported.

      Changing of the Interleaver type MUST be performed when the
      FEC-enabled link is 'down'.  Attempts to change this object MUST
      be rejected if the link is 'up' or initializing or if the FEC
      function is disabled/not supported.

      This object maps to the TR-159/G.998.3 attribute
      aFECInterleaverType."
    REFERENCE
      "[TR-159], Section 5.5.4.9; [G.998.3], Appendix II, B-XIII"
    ::= { g9983PortConfEntry 4 }

  g9983PortConfFecInterleaverDepth  OBJECT-TYPE
    SYNTAX      Unsigned32 (0|1|2|3|4|6|8|12|16|24|32|48|96)
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
      "An Interleaver depth for G.Bond/TDIM ports supporting the
      FEC function.

      This object is read-write for the GBS-C ports and read-only
      for the GBS-R.

      A value of zero SHALL be returned if the FEC function is
      disabled (via g9983PortConfFecAdminState) or not supported.
```

```
      Changing of the Interleaver depth MUST be performed when the
      FEC-enabled link is 'down'.  Attempts to change this object MUST
      be rejected if the link is 'up' or initializing or if the FEC
      function is disabled/not supported.

      This object maps to the TR-159/G.998.3 attribute
      aFECInterleaverDepth."
    REFERENCE
      "[TR-159], Section 5.5.4.10; [G.998.3], Appendix II, B-XIV"
    ::= { g9983PortConfEntry 5 }

  g9983PortConfAdminServices  OBJECT-TYPE
    SYNTAX      G9983SvcIndexList
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
      "Desired list of services for a G.Bond/TDIM port.  This object
      is a list of pointers to entries in the g9983SvcTable.

      The value of this object is a continuous ordered list of up to
      60 indices (g9983SvcIdx) of the active services carried
      via the G.Bond/TDIM link.  The position of a service in the
      list determines its relative priority in cases of bandwidth
      degradation -- the priority decreases towards the end of the
      list, which means that the last service in the list would be
      suspended first when the bandwidth degrades.

      This object is writable and readable for the GBS-C ports.
      It is irrelevant for the GBS-R ports -- a zero-length octet
      string SHALL be returned on an attempt to read this object, and
      an attempt to change this object MUST be rejected in this case.

      Note that the current operational service list is available
      via the g9983OperSvcTable object.

      This object for a GBS-C port MAY be modified independently of
      the link's state, i.e., in-service and out-of-service.
      Attempts to set this object to a list with a member value that
      is not the value of the index for an active entry in the
      corresponding g9983SvcTable table MUST be rejected."
    REFERENCE
      "[G.998.3], Sections 10.2.3, 13.3.4.6-13.3.4.11"
    ::= { g9983PortConfEntry 6 }

  g9983PortConfSvcUpDownEnable  OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS  read-write
    STATUS      current
```

```
    DESCRIPTION
      "Indicates whether g9983SvcUp and g9983SvcDown
      notifications should be generated for this interface.

      A value of true(1) indicates that the notifications are enabled.
      A value of false(2) indicates that the notifications are
      disabled.

      This object maps to the TR-159 attribute
      aServiceUpDownEnable."
    REFERENCE
      "[TR-159], Section 5.5.5.6"
    ::= { g9983PortConfEntry 7 }


  g9983PortCapTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF G9983PortCapEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
      "Table for capabilities of G.Bond/TDIM ports.  Entries in this
      table MUST be maintained in a persistent manner."
    ::= { g9983Port 2 }

  g9983PortCapEntry OBJECT-TYPE
    SYNTAX      G9983PortCapEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
      "An entry in the G.Bond/TDIM Port Capability table.
      Each entry represents a G.Bond/TDIM port indexed by the
      ifIndex.  Additional capabilities are available via the
      gBondPortCapabilityEntry of the GBOND-MIB.
      Note that a G.Bond/TDIM port runs on top of a single
      or multiple BCE port(s), which are also indexed by the ifIndex."
    INDEX  { ifIndex }
    ::= { g9983PortCapTable 1 }

  G9983PortCapEntry ::=
    SEQUENCE {
      g9983PortCapFecSupported                TruthValue,
      g9983PortCapFecMaxWordSize              Unsigned32,
      g9983PortCapFecMaxRedundancySize        Unsigned32,
      g9983PortCapFecInterleaverTypeSupported INTEGER,
      g9983PortCapFecMaxInterleaverDepth      Unsigned32
    }
```

```
   g9983PortCapFecSupported  OBJECT-TYPE
     SYNTAX      TruthValue
     MAX-ACCESS  read-only
     STATUS      current
     DESCRIPTION
       "FEC and Interleaver capability of the G.Bond/TDIM port.
       This object has a value of true(1) when the port supports the
       FEC and Interleaver function.
       A value of false(2) is returned when the port does not
       support the FEC and Interleaver function.

       This object maps to the TR-159/G.998.3 attribute
       aFECSupported."
     REFERENCE
       "[TR-159], Section 5.5.4.4; [G.998.3], Appendix II, B-VI"
     ::= { g9983PortCapEntry 1 }

   g9983PortCapFecMaxWordSize  OBJECT-TYPE
     SYNTAX      Unsigned32 (0|20..255)
     UNITS       "octets"
     MAX-ACCESS  read-only
     STATUS      current
     DESCRIPTION
       "A maximum supported FEC code word size, in octets, for
       G.Bond/TDIM ports supporting the FEC function.

       A value of zero SHALL be returned if the FEC function is not
       supported.

       This object maps to the TR-159 attribute aFECWordSize."
     REFERENCE
       "[TR-159], Section 5.5.4.11; [G.998.3], Appendix II, B-XI"
     ::= { g9983PortCapEntry 2 }

   g9983PortCapFecMaxRedundancySize  OBJECT-TYPE
     SYNTAX      Unsigned32 (0|2|4|8|16|20)
     UNITS       "octets"
     MAX-ACCESS  read-only
     STATUS      current
     DESCRIPTION
       "A maximum supported FEC redundancy word size, in octets, for
       G.Bond/TDIM ports supporting the FEC function.

       A value of zero SHALL be returned if the FEC function is not
       supported.

       This object maps to the TR-159 attribute
       aFECMaxRedundancySize."
```

```
    REFERENCE
      "[TR-159], Section 5.5.4.12; [G.998.3], Appendix II, B-XII"
    ::= { g9983PortCapEntry 3 }

  g9983PortCapFecInterleaverTypeSupported  OBJECT-TYPE
    SYNTAX      INTEGER {
      none(0),
      block(1),
      convolution(2),
      blockConvolution(3)
    }
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "Supported Interleaver types for G.Bond/TDIM ports supporting
      the FEC function.

      Possible values are:
        none             - the port does not support interleaving
        block            - the port supports Block Interleaver
        convolution      - the port supports Convolution Interleaver
        blockConvolution - the port supports both Block Interleaver
                           and Convolution Interleaver

      This object maps to the TR-159 attribute
      aFECInterleaverTypesSupported."
    REFERENCE
      "[TR-159], Section 5.5.4.13; [G.998.3], Appendix II, B-XIII"
    ::= { g9983PortCapEntry 4 }

  g9983PortCapFecMaxInterleaverDepth  OBJECT-TYPE
    SYNTAX      Unsigned32 (0|1|2|3|4|6|8|12|16|24|32|48|96)
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "A maximum Interleaver depth for G.Bond/TDIM ports supporting
      the FEC function.

      A value of zero SHALL be returned if the Interleaver is not
      supported.

      This object maps to the TR-159 attribute
      aFECMaxInterleaverDepth."
    REFERENCE
      "[TR-159], Section 5.5.4.14; [G.998.3], Appendix II, B-XIV"
    ::= { g9983PortCapEntry 5 }
```

```
   g9983PortStatTable OBJECT-TYPE
     SYNTAX      SEQUENCE OF G9983PortStatEntry
     MAX-ACCESS  not-accessible
     STATUS      current
     DESCRIPTION
       "This table provides overall status information of G.Bond
       TDIM ports, complementing the generic status information from
       the ifTable of the IF-MIB and the gBondPortStatFltStatus of
       the GBOND-MIB.  Additional status information about connected
       BCEs is available from the relevant line MIBs.

       This table contains live data from the equipment.  As such,
       it is NOT persistent."
     ::= { g9983Port 3 }

   g9983PortStatEntry OBJECT-TYPE
     SYNTAX      G9983PortStatEntry
     MAX-ACCESS  not-accessible
     STATUS      current
     DESCRIPTION
       "An entry in the G.Bond/TDIM Port Status table.
       Each entry represents a G.Bond/TDIM port indexed by the
       ifIndex.
       Note that a G.Bond GBS port runs on top of a single
       or multiple BCE port(s), which are also indexed by the ifIndex."
     INDEX  { ifIndex }
     ::= { g9983PortStatTable 1 }

   G9983PortStatEntry ::=
     SEQUENCE {
       g9983PortStatFecOperState         TruthValue,
       g9983PortStatFltStatus            BITS,
       g9983PortStatCrc4Errors           Counter32,
       g9983PortStatCrc6Errors           Counter32,
       g9983PortStatCrc8Errors           Counter32
     }

   g9983PortStatFecOperState  OBJECT-TYPE
     SYNTAX      TruthValue
     MAX-ACCESS  read-only
     STATUS      current
     DESCRIPTION
       "A read-only value indicating the current operational state
       of the OPTIONAL Forward Error Correction (FEC) function for
       the G.998.3 port.
       A value of 'false' indicates that the FEC function is
       disabled.  A value of 'true' indicates that the FEC function
       is enabled (and supported).
```

```
      This object maps to the TR-159 attribute aFECOperState."
    REFERENCE
      "[TR-159], Section 5.5.4.6"
    ::= { g9983PortStatEntry 1 }

  g9983PortStatFltStatus  OBJECT-TYPE
    SYNTAX      BITS {
      serviceDown(0),
      wrongConfig(1)
    }
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "G.Bond/TDIM port fault status.  This is a bitmap of possible
      conditions.  The various bit positions are:
        serviceDown         - at least one of the services defined
                              for this aggregation group is down
                              (due to low rate).
        wrongConfig         - at least one BCE at the remote GBS-R
                              is already connected to another GBS.

      This object is intended to supplement the ifOperStatus object
      in the IF-MIB and the gBondPortStatFltStatus object in the
      GBOND-MIB."
    REFERENCE
      "[G.998.3], Section 6.3; RFC 2863, IF-MIB, ifOperStatus;
      RFC 6765, GBOND-MIB, gBondPortStatFltStatus"
    ::= { g9983PortStatEntry 2 }

  g9983PortStatCrc4Errors  OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "The total number of CRC-4 errors (frame header errors) on all
      pairs in the G.Bond/TDIM port.  Simultaneous errors on M lines
      SHOULD be counted M times.

      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 ifCounterDiscontinuityTime as
      defined in the IF-MIB.

      This object maps to the TR-159/G.998.3 attribute aCRC4Errors."
    REFERENCE
      "[TR-159], Section 5.5.4.1; [G.998.3], Appendix II, B-VII"
    ::= { g9983PortStatEntry 3 }
```

```
   g9983PortStatCrc6Errors  OBJECT-TYPE
     SYNTAX      Counter32
     MAX-ACCESS  read-only
     STATUS      current
     DESCRIPTION
       "The total number of CRC-6 errors (super-frame errors) on all
       pairs in the G.Bond/TDIM port.  Simultaneous errors on M lines
       SHOULD be counted 1 time.

       Discontinuities in the value of this counter can occur at
       re-initialization of the local management subsystem, and at
       other times as indicated by the value of
       ifCounterDiscontinuityTime as defined in the IF-MIB.

       This object maps to the TR-159/G.998.3 attribute aCRC6Errors."
     REFERENCE
       "[TR-159], Section 5.5.4.2; [G.998.3], Appendix II, B-VIII"
     ::= { g9983PortStatEntry 4 }

   g9983PortStatCrc8Errors  OBJECT-TYPE
     SYNTAX      Counter32
     MAX-ACCESS  read-only
     STATUS      current
     DESCRIPTION
       "The total number of CRC-8 errors (event/message errors) on all
       pairs in the G.Bond/TDIM port.  Simultaneous errors on M lines
       SHOULD be counted M times.

       Discontinuities in the value of this counter can occur at
       re-initialization of the local management subsystem, and at
       other times as indicated by the value of
       ifCounterDiscontinuityTime as defined in the IF-MIB.

       This object maps to the TR-159/G.998.3 attribute aCRC8Errors."
     REFERENCE
       "[TR-159], Section 5.5.4.3; [G.998.3], Appendix II, B-IX"
     ::= { g9983PortStatEntry 5 }


   g9983OperSvcTable OBJECT-TYPE
     SYNTAX      SEQUENCE OF G9983OperSvcEntry
     MAX-ACCESS  not-accessible
     STATUS      current
     DESCRIPTION
       "Table of the operational services configured on a G.Bond/TDIM
       port.  This table reflects current actual service configuration,
       set by the g9983PortConfAdminServices object.  The number of
       entries (services) in this table therefore can vary between
```

```
      0, when no services are configured, and 60, for the maximum
      number of services.
      This table contains live data from the equipment.  As such,
      it is NOT persistent."
    ::= { g9983Port 4 }

  g9983OperSvcEntry OBJECT-TYPE
    SYNTAX      G9983OperSvcEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
      "An entry in the G.Bond/TDIM Port Operational Service table,
      containing the index of an active service entry in the
      g9983SvcTable.  The entry is indexed by the ifIndex,
      indicating a corresponding G.Bond/TDIM port, and by
      g9983OperSvcPosition (1..60), indicating the
      corresponding service position in the G.Bond/TDIM frame."
    INDEX  { ifIndex, g9983OperSvcPosition }
    ::= { g9983OperSvcTable 1 }

  G9983OperSvcEntry ::=
    SEQUENCE {
      g9983OperSvcPosition          G9983SvcOrderIndex,
      g9983OperSvcIdx               G9983SvcIndex,
      g9983OperSvcState             INTEGER
    }

  g9983OperSvcPosition OBJECT-TYPE
    SYNTAX      G9983SvcOrderIndex
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
      "G.Bond/TDIM operational service position -- a unique index,
      indicating relative placement of the associated service
      pointed to by g9983OperSvcIdx, within the G.Bond/TDIM frame.

      There can be up to 60 services defined over a TDIM bonded
      facility.  Services with lower indices have higher priority in
      cases of bandwidth degradation.

      The value of g9983OperSvcPosition for the first
      g9983OperSvcEntry is always 1, incrementing sequentially
      for each consecutive entry, i.e., 2 for the second entry,
      3 for the third, etc.

      This objects maps to the TR-159/G.998.3 attribute aServiceID."
```

```
    REFERENCE
      "[TR-159], Section 5.5.5.1; [G.998.3], Appendix II, C-I"
    ::= { g9983OperSvcEntry 1 }

  g9983OperSvcIdx OBJECT-TYPE
    SYNTAX      G9983SvcIndex
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "G.Bond/TDIM operational service index -- a read-only pointer
      to an existing entry in the g9983SvcTable (value of
      g9983SvcIdx) describing a particular service."
    ::= { g9983OperSvcEntry 2 }

  g9983OperSvcState  OBJECT-TYPE
    SYNTAX      INTEGER {
      up(1),
      down(2)
    }
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "G.Bond/TDIM service operational state.

      Possible values are:
        up                  - Service is up and passing traffic.
        down                - Service is down, due to a variety of
                              reasons, e.g., G.Bond/TDIM port is
                              down, current link bandwidth is too
                              low to support a particular service,
                              etc.
      This objects maps to the TR-159 attribute aServiceOperState."
    REFERENCE
      "[TR-159], Section 5.5.5.5"
    ::= { g9983OperSvcEntry 3 }


  g9983SvcTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF G9983SvcEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
      "Table of possible services for G.Bond/TDIM ports.
      Entries in this table MUST be maintained in a persistent
      manner."
    ::= { g9983Port 5 }
```

```
   g9983SvcEntry OBJECT-TYPE
     SYNTAX      G9983SvcEntry
     MAX-ACCESS  not-accessible
     STATUS      current
     DESCRIPTION
       "An entry in the G.Bond/TDIM Port Service table, containing
       the management information applicable to a particular service,
       indexed by the g9983SvcIdx, on a G.Bond/TDIM port,
       indexed by the ifIndex."
     INDEX  { ifIndex, g9983SvcIdx }
     ::= { g9983SvcTable 1 }

   G9983SvcEntry ::=
     SEQUENCE {
       g9983SvcIdx           G9983SvcIndex,
       g9983SvcIfIdx         InterfaceIndex,
       g9983SvcType          INTEGER,
       g9983SvcSize          Unsigned32,
       g9983SvcRowStatus     RowStatus
     }

   g9983SvcIdx OBJECT-TYPE
     SYNTAX      G9983SvcIndex
     MAX-ACCESS  not-accessible
     STATUS      current
     DESCRIPTION
       "G.Bond/TDIM service index -- a unique index associated with
       a particular service entry."
     ::= { g9983SvcEntry 1 }

   g9983SvcIfIdx OBJECT-TYPE
     SYNTAX      InterfaceIndex
     MAX-ACCESS  read-create
     STATUS      current
     DESCRIPTION
       "This is a unique index within the ifTable.  It represents
       the interface index of a service to be transmitted over the
       G.Bond/TDIM service instance.

       This objects maps to the TR-159 attribute aServiceIfIndex."
     REFERENCE
       "[TR-159], Section 5.5.5.2"
     ::= { g9983SvcEntry 2 }

   g9983SvcType  OBJECT-TYPE
     SYNTAX      INTEGER {
       ds1(0),
       e1(1),
```

```
      nxds0(2),
      nxe0(3),
      ds3(4),
      e3(5),
      clock(6),
      ethernet(7),
      atm(8),
      gfpNoFCS(9),
      gfp(10)
    }
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
      "G.Bond/TDIM service type.

      Possible values are:
        ds1             - Clear Channel DS1 (synchronous)
        e1              - Clear Channel E1 (synchronous)
        nxds0           - Fractional DS1 (synchronous)
        nxe0            - Fractional E1 (synchronous)
        ds3             - DS3 (synchronous)
        e3              - E3 (synchronous)
        clock           - Clock transfer (synchronous)
        ethernet        - Ethernet (asynchronous)
        atm             - ATM (asynchronous)
        gfpNoFCS        - GFP encapsulated without FCS (asynchronous)
        gfp             - GFP encapsulated with FCS (asynchronous)

      For the GBS-R ports, the value of this object cannot be
      changed directly.  This value may be changed as a result of a
      write operation on the g9983SvcType object of a remote GBS-C.

      Attempts to change this object MUST be rejected for the GBS-R
      ports.

      This object maps to the TR-159/G.998.3 attribute aServiceType."
    REFERENCE
      "[TR-159], Section 5.5.5.3; [G.998.3], Appendix II, C-II"
    ::= { g9983SvcEntry 3 }

  g9983SvcSize  OBJECT-TYPE
    SYNTAX      Unsigned32 (0|20..255)
    UNITS       "octets"
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
      "Service size, in octets, per bonding sub-block for a specific
      service identified by g9983SvcIdx.
```

```
      For TDM (synchronous) services with variable size
      (e.g., fractional DS1/E1), this object represents the number of
      DS0/E0 channels.
      For asynchronous services (Ethernet, ATM, GFPnoFCS, or GFP),
      this object represents the maximum number of octets.
      For non-fractional TDM services (i.e., DS1, E1, DS3, E3, and
      clock), the value of this object MUST be 0.

      A GET operation returns the current value.
      A SET operation, allowed on GBS-C ports, changes the service
      size to the indicated value.  If the service type is a
      fixed-rate synchronous service (g9983SvcType is nxds0, nxe0,
      ds1, e1, ds3, e3, or clock), the operation MUST be rejected.

      This object maps to the TR-159/G.998.3 attribute aServiceSize."
    REFERENCE
      "[TR-159], Section 5.5.5.4; [G.998.3], Appendix II, C-III"
    ::= { g9983SvcEntry 4 }

  g9983SvcRowStatus  OBJECT-TYPE
    SYNTAX      RowStatus
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
      "This object controls the creation, modification, or deletion
      of the associated entry in the g9983SvcTable per the
      semantics of RowStatus.

      If an 'active' entry is referenced via g9983OperSvcIdx
      or a g9983PortConfAdminServices instance, or indexes a
      g9983SvcPm*Entry, the entry MUST remain 'active'.

      An 'active' entry SHALL NOT be modified.  In order to modify an
      existing entry, it MUST be taken out of service (by setting
      this object to 'notInService'), modified, and set to 'active'
      again."
    ::= { g9983SvcEntry 5 }


  --------------------------------
  -- Performance Monitoring group
  --------------------------------

  g9983PM   OBJECT IDENTIFIER ::= { g9983Port 6 }

  g9983PortPmCurTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF G9983PortPmCurEntry
    MAX-ACCESS  not-accessible
```

```
    STATUS      current
    DESCRIPTION
      "This table contains current Performance Monitoring information
      for a G.Bond/TDIM port.  This table contains live data from the
      equipment and as such is NOT persistent."
    ::= { g9983PM 1 }

  g9983PortPmCurEntry OBJECT-TYPE
    SYNTAX      G9983PortPmCurEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
      "An entry in the G.Bond/TDIM Port PM table.
      Each entry represents a G.Bond/TDIM port indexed by the
      ifIndex."
    INDEX  { ifIndex }
    ::= { g9983PortPmCurTable 1 }

  G9983PortPmCurEntry ::=
    SEQUENCE {
      g9983PortPmCur15MinValidIntervals   HCPerfValidIntervals,
      g9983PortPmCur15MinInvalidIntervals HCPerfInvalidIntervals,
      g9983PortPmCur15MinTimeElapsed      HCPerfTimeElapsed,
      g9983PortPmCur15MinCrc4s            HCPerfCurrentCount,
      g9983PortPmCur15MinCrc6s            HCPerfCurrentCount,
      g9983PortPmCur15MinCrc8s            HCPerfCurrentCount,
      g9983PortPmCur1DayValidIntervals    Unsigned32,
      g9983PortPmCur1DayInvalidIntervals  Unsigned32,
      g9983PortPmCur1DayTimeElapsed       HCPerfTimeElapsed,
      g9983PortPmCur1DayCrc4s             HCPerfCurrentCount,
      g9983PortPmCur1DayCrc6s             HCPerfCurrentCount,
      g9983PortPmCur1DayCrc8s             HCPerfCurrentCount
    }

  g9983PortPmCur15MinValidIntervals  OBJECT-TYPE
    SYNTAX      HCPerfValidIntervals
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "A read-only number of 15-minute intervals for which the
      performance data was collected.  The value of this object will
      be 96 or the maximum number of 15-minute history intervals
      collected by the implementation, unless the measurement was
      (re)started recently, in which case the value will be the
      number of complete 15-minute intervals for which there are at
      least some data.
```

```
      In certain cases, it is possible that some intervals are
      unavailable.  In this case, this object reports the maximum
      interval number for which data is available.

      This object partially maps to the TR-159 attribute
      aGroupPerf15MinValidIntervals."
    REFERENCE
      "[TR-159], Section 5.5.1.32"
    ::= { g9983PortPmCurEntry 1 }

  g9983PortPmCur15MinInvalidIntervals  OBJECT-TYPE
    SYNTAX      HCPerfInvalidIntervals
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "A read-only number of 15-minute intervals for which the
      performance data was not always available.  The value will
      typically be zero, except in cases where the data for some
      intervals are not available.

      This object partially maps to the TR-159 attribute
      aGroupPerf15MinInvalidIntervals."
    REFERENCE
      "[TR-159], Section 5.5.1.33"
    ::= { g9983PortPmCurEntry 2 }

  g9983PortPmCur15MinTimeElapsed  OBJECT-TYPE
    SYNTAX      HCPerfTimeElapsed
    UNITS       "seconds"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "A read-only count of seconds that have elapsed since the
      beginning of the current 15-minute performance interval.

      This object partially maps to the TR-159 attribute
      aGroupPerfCurr15MinTimeElapsed."
    REFERENCE
      "[TR-159], Section 5.5.1.34"
    ::= { g9983PortPmCurEntry 3 }

  g9983PortPmCur15MinCrc4s  OBJECT-TYPE
    SYNTAX      HCPerfCurrentCount
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "A read-only count of CRC-4 errors (frame header errors) on all
      active pairs in the G.Bond/TDIM port during the current
```

```
      15-minute performance interval.
      Simultaneous errors on M lines SHOULD be counted M times.

      Note that the total number of CRC-4 errors is indicated by the
      g9983PortStatCrc4Errors object.

      This object is inhibited during Severely Errored Seconds (SES)
      or Unavailable Seconds (UAS)."
    REFERENCE
      "[TR-159], Section 5.5.4.1"
    ::= { g9983PortPmCurEntry 4}

  g9983PortPmCur15MinCrc6s  OBJECT-TYPE
    SYNTAX      HCPerfCurrentCount
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "A read-only count of CRC-6 errors (super-frame errors) on all
      active pairs in the G.Bond/TDIM port during the current
      15-minute performance interval.
      Simultaneous errors on M lines SHOULD be counted 1 time.

      Note that the total number of CRC-6 errors is indicated by the
      g9983PortStatCrc6Errors object.

      This object is inhibited during Unavailable Seconds (UAS)."
    REFERENCE
      "[TR-159], Section 5.5.4.2"
    ::= { g9983PortPmCurEntry 5}

  g9983PortPmCur15MinCrc8s  OBJECT-TYPE
    SYNTAX      HCPerfCurrentCount
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "A read-only count of CRC-8 errors (event/message errors) on all
      active pairs in the G.Bond/TDIM port during the current
      15-minute performance interval.
      Simultaneous errors on M lines SHOULD be counted M times.

      Note that the total number of CRC-8 errors is indicated by the
      g9983PortStatCrc8Errors object.

      This object is inhibited during Unavailable Seconds (UAS)."
    REFERENCE
      "[TR-159], Section 5.5.4.3"
    ::= { g9983PortPmCurEntry 6}
```

```
   g9983PortPmCur1DayValidIntervals  OBJECT-TYPE
     SYNTAX      Unsigned32 (0..7)
     MAX-ACCESS  read-only
     STATUS      current
     DESCRIPTION
       "A read-only number of 1-day intervals for which data was
       collected.  The value of this object will be 7 or the maximum
       number of 1-day history intervals collected by the
       implementation, unless the measurement was (re)started recently,
       in which case the value will be the number of complete 1-day
       intervals for which there are at least some data.
       In certain cases, it is possible that some intervals are
       unavailable.  In this case, this object reports the maximum
       interval number for which data is available."
     REFERENCE
       "[TR-159], Section 5.5.1.45"
     ::= { g9983PortPmCurEntry 7 }

   g9983PortPmCur1DayInvalidIntervals  OBJECT-TYPE
     SYNTAX      Unsigned32 (0..7)
     MAX-ACCESS  read-only
     STATUS      current
     DESCRIPTION
       "A read-only number of 1-day intervals for which data was
       not always available.  The value will typically be zero, except
       in cases where the data for some intervals are not available."
     REFERENCE
       "[TR-159], Section 5.5.1.46"
     ::= { g9983PortPmCurEntry 8 }

   g9983PortPmCur1DayTimeElapsed  OBJECT-TYPE
     SYNTAX      HCPerfTimeElapsed
     UNITS       "seconds"
     MAX-ACCESS  read-only
     STATUS      current
     DESCRIPTION
       "A read-only count of seconds that have elapsed since the
       beginning of the current 1-day performance interval."
     REFERENCE
       "[TR-159], Section 5.5.1.47"
     ::= { g9983PortPmCurEntry 9 }

   g9983PortPmCur1DayCrc4s  OBJECT-TYPE
     SYNTAX      HCPerfCurrentCount
     MAX-ACCESS  read-only
     STATUS      current
```

```
    DESCRIPTION
      "A read-only count of CRC-4 errors on the G.Bond/TDIM port in
      the current 1-day performance interval.

      This object is inhibited during Severely Errored Seconds (SES)
      and Unavailable Seconds (UAS)."
    ::= { g9983PortPmCurEntry 10 }

  g9983PortPmCur1DayCrc6s  OBJECT-TYPE
    SYNTAX      HCPerfCurrentCount
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "A read-only count of CRC-6 errors on the G.Bond/TDIM port
      in the current 1-day performance interval.

      This object is inhibited during Unavailable Seconds (UAS)."
    ::= { g9983PortPmCurEntry 11 }

  g9983PortPmCur1DayCrc8s  OBJECT-TYPE
    SYNTAX      HCPerfCurrentCount
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "A read-only count of CRC-8 errors on the G.Bond/TDIM port in
      the current 1-day performance interval.

      This object is inhibited during Unavailable Seconds (UAS)."
    ::= { g9983PortPmCurEntry 12 }

  -- Port PM history: 15-min buckets

  g9983PortPm15MinTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF G9983PortPm15MinEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
      "This table contains historical 15-minute buckets of Performance
      Monitoring information for a G.Bond/TDIM port (a row for each
      15-minute interval, up to 96 intervals).
      Entries in this table MUST be maintained in a persistent manner."
    ::= { g9983PM 2 }

  g9983PortPm15MinEntry OBJECT-TYPE
    SYNTAX      G9983PortPm15MinEntry
    MAX-ACCESS  not-accessible
    STATUS      current
```

```
    DESCRIPTION
      "An entry in the G.Bond/TDIM Port historical 15-minute PM table.
      Each entry represents Performance Monitoring data for a G.Bond
      TDIM port, indexed by the ifIndex, collected during a particular
      15-minute interval, indexed by the
      g9983PortPm15MinIntervalIndex."
    INDEX  { ifIndex, g9983PortPm15MinIntervalIndex }
    ::= { g9983PortPm15MinTable 1 }

  G9983PortPm15MinEntry ::=
    SEQUENCE {
      g9983PortPm15MinIntervalIndex      Unsigned32,
      g9983PortPm15MinIntervalMoniTime   HCPerfTimeElapsed,
      g9983PortPm15MinIntervalCrc4s      HCPerfIntervalCount,
      g9983PortPm15MinIntervalCrc6s      HCPerfIntervalCount,
      g9983PortPm15MinIntervalCrc8s      HCPerfIntervalCount,
      g9983PortPm15MinIntervalValid      TruthValue
    }

  g9983PortPm15MinIntervalIndex  OBJECT-TYPE
    SYNTAX      Unsigned32 (1..96)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
      "Performance data interval number.  1 is the most recent
      previous interval; interval 96 is 24 hours ago.
      Intervals 2..96 are OPTIONAL.

      This object partially maps to the TR-159 attribute
      aGroupPerf15MinIntervalNumber."
    REFERENCE
      "[TR-159], Section 5.5.1.57"
    ::= { g9983PortPm15MinEntry 1 }

  g9983PortPm15MinIntervalMoniTime  OBJECT-TYPE
    SYNTAX      HCPerfTimeElapsed
    UNITS       "seconds"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "A read-only count of seconds over which the performance data
      was actually monitored.  This value will be the same as the
      interval duration (900 seconds), except in a situation where
      performance data could not be collected for any reason."
    ::= { g9983PortPm15MinEntry 2 }

  g9983PortPm15MinIntervalCrc4s  OBJECT-TYPE
    SYNTAX      HCPerfIntervalCount
```

```
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "A read-only count of CRC-4 errors on the G.Bond/TDIM port
      during the 15-minute performance history interval.

      This object is inhibited during Severely Errored Seconds (SES)
      and Unavailable Seconds (UAS)."
    ::= { g9983PortPm15MinEntry 3 }

  g9983PortPm15MinIntervalCrc6s  OBJECT-TYPE
    SYNTAX      HCPerfIntervalCount
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "A read-only count of CRC-6 errors on the G.Bond/TDIM port
      during the 15-minute performance history interval.

      This object is inhibited during Unavailable Seconds (UAS)."
    ::= { g9983PortPm15MinEntry 4 }

  g9983PortPm15MinIntervalCrc8s  OBJECT-TYPE
    SYNTAX      HCPerfIntervalCount
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "A read-only count of CRC-8 errors on the G.Bond/TDIM port
      during the current 15-minute performance interval.

      This object is inhibited during Unavailable Seconds (UAS)."
    ::= { g9983PortPm15MinEntry 5 }

  g9983PortPm15MinIntervalValid  OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "A read-only object indicating whether or not this history
      bucket contains valid data.  A valid bucket is reported as
      true(1) and an invalid bucket as false(2).
      If this history bucket is invalid, the BTU-C MUST NOT produce
      notifications based upon the value of the counters in this
      bucket.
      Note that an implementation may decide not to store invalid
      history buckets in its database.  In such a case, this object
      is not required, as only valid history buckets are available
      while invalid history buckets are simply not in the database.
```

```
      This object partially maps to the TR-159 attribute
      aGroupPerf15MinIntervalValid."
    REFERENCE
      "[TR-159], Section 5.5.1.58"
    ::= { g9983PortPm15MinEntry 6 }

  -- Port PM history: 1-day buckets

  g9983PortPm1DayTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF G9983PortPm1DayEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
      "This table contains historical 1-day buckets of Performance
      Monitoring information for a G.Bond/TDIM port (a row for each
      1-day interval, up to 7 intervals).
      Entries in this table MUST be maintained in a persistent manner."
    ::= { g9983PM 3 }

  g9983PortPm1DayEntry OBJECT-TYPE
    SYNTAX      G9983PortPm1DayEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
      "An entry in the G.Bond/TDIM Port historical 1-day PM table.
      Each entry represents Performance Monitoring data for such a
      port, indexed by the ifIndex, collected during a particular
      1-day interval, indexed by the g9983PortPm1DayIntervalIndex."
    INDEX  { ifIndex, g9983PortPm1DayIntervalIndex }
    ::= { g9983PortPm1DayTable 1 }

  G9983PortPm1DayEntry ::=
    SEQUENCE {
      g9983PortPm1DayIntervalIndex      Unsigned32,
      g9983PortPm1DayIntervalMoniTime   HCPerfTimeElapsed,
      g9983PortPm1DayIntervalCrc4s      HCPerfIntervalCount,
      g9983PortPm1DayIntervalCrc6s      HCPerfIntervalCount,
      g9983PortPm1DayIntervalCrc8s      HCPerfIntervalCount,
      g9983PortPm1DayIntervalValid      TruthValue
    }

  g9983PortPm1DayIntervalIndex  OBJECT-TYPE
    SYNTAX      Unsigned32 (1..7)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
      "Performance data interval number.  1 is the most recent
      previous interval; interval 7 is 7 days ago.
```

```
      Intervals 2..7 are OPTIONAL.

      This object partially maps to the TR-159 attribute
      aGroupPerf1DayIntervalNumber."
    REFERENCE
      "[TR-159], Section 5.5.1.62"
    ::= { g9983PortPm1DayEntry 1 }

  g9983PortPm1DayIntervalMoniTime  OBJECT-TYPE
    SYNTAX      HCPerfTimeElapsed
    UNITS       "seconds"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "A read-only count of seconds over which the performance data
      was actually monitored.  This value will be the same as the
      interval duration (86400 seconds), except in a situation where
      performance data could not be collected for any reason.

      This object partially maps to the TR-159 attribute
      aGroupPerf1DayIntervalMoniSecs."
    REFERENCE
      "[TR-159], Section 5.5.1.64"
    ::= { g9983PortPm1DayEntry 2 }

  g9983PortPm1DayIntervalCrc4s  OBJECT-TYPE
    SYNTAX      HCPerfIntervalCount
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "A read-only count of CRC-4 errors on the G.Bond/TDIM port
      during the 1-day performance history interval.

      This object is inhibited during Severely Errored Seconds (SES)
      and Unavailable Seconds (UAS)."
    ::= { g9983PortPm1DayEntry 3 }

  g9983PortPm1DayIntervalCrc6s  OBJECT-TYPE
    SYNTAX      HCPerfIntervalCount
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "A read-only count of CRC-6 errors on the G.Bond/TDIM port
      during the 1-day performance history interval.

      This object is inhibited during Unavailable Seconds (UAS)."
    ::= { g9983PortPm1DayEntry 4 }
```

```
   g9983PortPm1DayIntervalCrc8s  OBJECT-TYPE
     SYNTAX      HCPerfIntervalCount
     MAX-ACCESS  read-only
     STATUS      current
     DESCRIPTION
       "A read-only count of CRC-8 errors on the G.Bond/TDIM port
       during the current 1-day performance interval.

       This object is inhibited during Unavailable Seconds (UAS)."
     ::= { g9983PortPm1DayEntry 5 }

   g9983PortPm1DayIntervalValid  OBJECT-TYPE
     SYNTAX      TruthValue
     MAX-ACCESS  read-only
     STATUS      current
     DESCRIPTION
       "A read-only object indicating whether or not this history
       bucket contains valid data.  A valid bucket is reported as
       true(1) and an invalid bucket as false(2).
       If this history bucket is invalid, the BTU-C MUST NOT produce
       notifications based upon the value of the counters in this
       bucket.
       Note that an implementation may decide not to store invalid
       history buckets in its database.  In such a case, this object
       is not required, as only valid history buckets are available
       while invalid history buckets are simply not in the database.

       This object partially maps to the TR-159 attribute
       aGroupPerf1DayIntervalValid."
     REFERENCE
       "[TR-159], Section 5.5.1.63"
     ::= { g9983PortPm1DayEntry 6 }

   -- Services PM

   g9983SvcPmCurTable OBJECT-TYPE
     SYNTAX      SEQUENCE OF G9983SvcPmCurEntry
     MAX-ACCESS  not-accessible
     STATUS      current
     DESCRIPTION
       "This table contains current Performance Monitoring information
       for the services of a G.Bond/TDIM port.
       This table contains live data from the equipment and as such is
       NOT persistent."
     ::= { g9983PM 4 }

   g9983SvcPmCurEntry OBJECT-TYPE
     SYNTAX      G9983SvcPmCurEntry
```

```
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
      "An entry in the G.Bond/TDIM Services PM table.
      Each entry represents a service, indexed by the
      g9983SvcIdx, in a G.Bond/TDIM port, indexed by the
      ifIndex."
    INDEX  { ifIndex, g9983SvcIdx }
    ::= { g9983SvcPmCurTable 1 }

  G9983SvcPmCurEntry ::=
    SEQUENCE {
      g9983SvcPmCur15MinValidIntervals   HCPerfValidIntervals,
      g9983SvcPmCur15MinInvalidIntervals HCPerfInvalidIntervals,
      g9983SvcPmCur15MinTimeElapsed      HCPerfTimeElapsed,
      g9983SvcPmCur15MinDowns            HCPerfCurrentCount,
      g9983SvcPmCur1DayValidIntervals    Unsigned32,
      g9983SvcPmCur1DayInvalidIntervals  Unsigned32,
      g9983SvcPmCur1DayTimeElapsed       HCPerfTimeElapsed,
      g9983SvcPmCur1DayDowns             HCPerfCurrentCount
    }

  g9983SvcPmCur15MinValidIntervals  OBJECT-TYPE
    SYNTAX      HCPerfValidIntervals
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "A read-only number of 15-minute intervals for which the
      performance data was collected.  The value of this object will
      be 96 or the maximum number of 15-minute history intervals
      collected by the implementation, unless the measurement was
      (re)started recently, in which case the value will be the
      number of complete 15-minute intervals for which there are at
      least some data.
      In certain cases, it is possible that some intervals are
      unavailable.  In this case, this object reports the maximum
      interval number for which data is available.

      This object partially maps to the TR-159 attribute
      aGroupPerf15MinValidIntervals."
    REFERENCE
      "[TR-159], Section 5.5.1.32"
    ::= { g9983SvcPmCurEntry 1 }

  g9983SvcPmCur15MinInvalidIntervals  OBJECT-TYPE
    SYNTAX      HCPerfInvalidIntervals
    MAX-ACCESS  read-only
    STATUS      current
```

```
    DESCRIPTION
      "A read-only number of 15-minute intervals for which the
      performance data was not always available.  The value will
      typically be zero, except in cases where the data for some
      intervals are not available.

      This object partially maps to the TR-159 attribute
      aGroupPerf15MinInvalidIntervals."
    REFERENCE
      "[TR-159], Section 5.5.1.33"
    ::= { g9983SvcPmCurEntry 2 }

  g9983SvcPmCur15MinTimeElapsed  OBJECT-TYPE
    SYNTAX      HCPerfTimeElapsed
    UNITS       "seconds"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "A read-only count of seconds that have elapsed since the
      beginning of the current 15-minute performance interval.

      This object partially maps to the TR-159 attribute
      aGroupPerfCurr15MinTimeElapsed."
    REFERENCE
      "[TR-159], Section 5.5.1.34"
    ::= { g9983SvcPmCurEntry 3 }

  g9983SvcPmCur15MinDowns  OBJECT-TYPE
    SYNTAX      HCPerfCurrentCount
    UNITS       "seconds"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "A read-only count of seconds in the current 15-minute
      performance interval during which a particular TDIM
      service was 'down', as indicated by the
      g9983OperSvcState object.

      This object is inhibited during Unavailable Seconds (UAS)."
    ::= { g9983SvcPmCurEntry 4}

  g9983SvcPmCur1DayValidIntervals  OBJECT-TYPE
    SYNTAX      Unsigned32 (0..7)
    UNITS       "days"
    MAX-ACCESS  read-only
    STATUS      current
```

```
    DESCRIPTION
      "A read-only number of 1-day performance history intervals for
      which the data was collected.  The value of this object will be
      7 or the maximum number of 1-day history intervals collected by
      the implementation, unless the measurement was (re)started
      recently, in which case the value will be the number of complete
      1-day intervals for which there are at least some data.
      In certain cases, it is possible that some intervals are
      unavailable.  In this case, this object reports the maximum
      interval number for which data is available."
    REFERENCE
      "[TR-159], Section 5.5.1.45"
    ::= { g9983SvcPmCurEntry 5 }

  g9983SvcPmCur1DayInvalidIntervals  OBJECT-TYPE
    SYNTAX      Unsigned32 (0..7)
    UNITS       "days"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "A read-only number of 1-day performance history intervals for
      which the performance data was not always available.  The value
      will typically be zero, except in cases where the data for some
      intervals are not available."
    REFERENCE
      "[TR-159], Section 5.5.1.46"
    ::= { g9983SvcPmCurEntry 6 }

  g9983SvcPmCur1DayTimeElapsed  OBJECT-TYPE
    SYNTAX      HCPerfTimeElapsed
    UNITS       "seconds"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "A read-only count of seconds that have elapsed since the
      beginning of the current 1-day performance interval."
    REFERENCE
      "[TR-159], Section 5.5.1.47"
    ::= { g9983SvcPmCurEntry 7 }

  g9983SvcPmCur1DayDowns  OBJECT-TYPE
    SYNTAX      HCPerfCurrentCount
    UNITS       "seconds"
    MAX-ACCESS  read-only
    STATUS      current
```

```
    DESCRIPTION
      "A read-only count of seconds in the current 1-day performance
      interval during which a particular TDIM service was
      'down', as indicated by the g9983OperSvcState object.

      This object is inhibited during Unavailable Seconds (UAS)."
    ::= { g9983SvcPmCurEntry 8 }

  -- Service PM history: 15-min buckets

  g9983SvcPm15MinTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF G9983SvcPm15MinEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
      "This table contains historical 15-minute buckets of Performance
      Monitoring information for the services of a G.Bond/TDIM port
      (a multi-dimensional row for each 15-minute interval, up to 96
      intervals).

      Entries in this table MUST be maintained in a persistent manner."
    ::= { g9983PM 5 }

  g9983SvcPm15MinEntry OBJECT-TYPE
    SYNTAX      G9983SvcPm15MinEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
      "An entry in the G.Bond/TDIM Service historical 15-minute PM
      table.
      Each entry represents Performance Monitoring data for a
      particular service, indexed by the g9983SvcIdx, in a G.Bond
      TDIM port, indexed by the ifIndex, collected during a particular
      15-minute interval, indexed by the
      g9983SvcPm15MinIntervalIndex."
    INDEX  { ifIndex, g9983SvcIdx,
             g9983SvcPm15MinIntervalIndex }
    ::= { g9983SvcPm15MinTable 1 }

  G9983SvcPm15MinEntry ::=
    SEQUENCE {
      g9983SvcPm15MinIntervalIndex      Unsigned32,
      g9983SvcPm15MinIntervalMoniTime   HCPerfTimeElapsed,
      g9983SvcPm15MinIntervalDowns      HCPerfIntervalCount,
      g9983SvcPm15MinIntervalValid      TruthValue
    }
```

```
   g9983SvcPm15MinIntervalIndex  OBJECT-TYPE
     SYNTAX      Unsigned32 (1..96)
     MAX-ACCESS  not-accessible
     STATUS      current
     DESCRIPTION
       "Performance data interval number.  1 is the most recent
       previous interval; interval 96 is 24 hours ago.
       Intervals 2..96 are OPTIONAL.

       This object partially maps to the TR-159 attribute
       aGroupPerf15MinIntervalNumber."
     REFERENCE
       "[TR-159], Section 5.5.1.57"
     ::= { g9983SvcPm15MinEntry 1 }

   g9983SvcPm15MinIntervalMoniTime  OBJECT-TYPE
     SYNTAX      HCPerfTimeElapsed
     UNITS       "seconds"
     MAX-ACCESS  read-only
     STATUS      current
     DESCRIPTION
       "A read-only count of seconds over which the performance data
       was actually monitored.  This value will be the same as the
       interval duration (900 seconds), except in a situation where
       performance data could not be collected for any reason."
     ::= { g9983SvcPm15MinEntry 2 }

   g9983SvcPm15MinIntervalDowns  OBJECT-TYPE
     SYNTAX      HCPerfIntervalCount
     UNITS       "seconds"
     MAX-ACCESS  read-only
     STATUS      current
     DESCRIPTION
       "A read-only count of seconds in the 15-minute performance
       history interval during which a particular TDIM service was
       'down', as indicated by the g9983OperSvcState object.

       This object is inhibited during Unavailable Seconds (UAS)."
     ::= { g9983SvcPm15MinEntry 3 }

   g9983SvcPm15MinIntervalValid  OBJECT-TYPE
     SYNTAX      TruthValue
     MAX-ACCESS  read-only
     STATUS      current
     DESCRIPTION
       "A read-only object indicating whether or not this history
       bucket contains valid data.  A valid bucket is reported as
       true(1) and an invalid bucket as false(2).
```

```
      If this history bucket is invalid, the BTU-C MUST NOT produce
      notifications based upon the value of the counters in this
      bucket.
      Note that an implementation may decide not to store invalid
      history buckets in its database.  In such a case, this object
      is not required, as only valid history buckets are available
      while invalid history buckets are simply not in the database.

      This object partially maps to the TR-159 attribute
      aGroupPerf15MinIntervalValid."
    REFERENCE
      "[TR-159], Section 5.5.1.58"
    ::= { g9983SvcPm15MinEntry 4 }

  -- Service PM history: 1-day buckets

  g9983SvcPm1DayTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF G9983SvcPm1DayEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
      "This table contains historical 1-day buckets of Performance
      Monitoring information for the services of a G.Bond/TDIM port
      (a multi-dimensional row for each 1-day interval, up to 7
      intervals).
      Entries in this table MUST be maintained in a persistent manner."
    ::= { g9983PM 6 }

  g9983SvcPm1DayEntry OBJECT-TYPE
    SYNTAX      G9983SvcPm1DayEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
      "An entry in the G.Bond/TDIM Service historical 1-day PM table.
      Each entry represents Performance Monitoring data for a
      particular service, indexed by the g9983SvcIdx, defined in a
      G.Bond/TDIM port, indexed by the ifIndex, collected during a
      particular 1-day interval, indexed by the
      g9983SvcPm1DayIntervalIndex."
    INDEX  { ifIndex, g9983SvcIdx,
             g9983SvcPm1DayIntervalIndex }
    ::= { g9983SvcPm1DayTable 1 }

  G9983SvcPm1DayEntry ::=
    SEQUENCE {
      g9983SvcPm1DayIntervalIndex       Unsigned32,
      g9983SvcPm1DayIntervalMoniTime    HCPerfTimeElapsed,
      g9983SvcPm1DayIntervalDowns       HCPerfIntervalCount,
```

```
      g9983SvcPm1DayIntervalValid       TruthValue
    }

  g9983SvcPm1DayIntervalIndex  OBJECT-TYPE
    SYNTAX      Unsigned32 (1..7)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
      "Performance data interval number.  1 is the most recent
      previous interval; interval 7 is 7 days ago.
      Intervals 2..7 are OPTIONAL.

      This object partially maps to the TR-159 attribute
      aGroupPerf1DayIntervalNumber."
    REFERENCE
      "[TR-159], Section 5.5.1.62"
    ::= { g9983SvcPm1DayEntry 1 }

  g9983SvcPm1DayIntervalMoniTime  OBJECT-TYPE
    SYNTAX      HCPerfTimeElapsed
    UNITS       "seconds"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "A read-only count of seconds over which the performance data
      was actually monitored.  This value will be the same as the
      interval duration (86400 seconds), except in a situation where
      performance data could not be collected for any reason.

      This object partially maps to the TR-159 attribute
      aGroupPerf1DayIntervalMoniSecs."
    REFERENCE
      "[TR-159], Section 5.5.1.64"
    ::= { g9983SvcPm1DayEntry 2 }

  g9983SvcPm1DayIntervalDowns  OBJECT-TYPE
    SYNTAX      HCPerfIntervalCount
    UNITS       "seconds"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
      "A read-only count of seconds in the 1-day performance history
      interval during which a particular TDIM service was 'down',
      as indicated by the g9983OperSvcState object.

      This object is inhibited during Unavailable Seconds (UAS)."
    ::= { g9983SvcPm1DayEntry 3 }
```

```
   g9983SvcPm1DayIntervalValid  OBJECT-TYPE
     SYNTAX      TruthValue
     MAX-ACCESS  read-only
     STATUS      current
     DESCRIPTION
       "A read-only object indicating whether or not this history
       bucket contains valid data.  A valid bucket is reported as
       true(1) and an invalid bucket as false(2).
       If this history bucket is invalid, the BTU-C MUST NOT produce
       notifications based upon the value of the counters in this
       bucket.
       Note that an implementation may decide not to store invalid
       history buckets in its database.  In such a case, this object
       is not required, as only valid history buckets are available
       while invalid history buckets are simply not in the database.

       This object partially maps to the TR-159 attribute
       aGroupPerf1DayIntervalValid."
     REFERENCE
       "[TR-159], Section 5.5.1.63"
     ::= { g9983SvcPm1DayEntry 4 }

  --
  -- Conformance Statements
  --

   g9983Groups      OBJECT IDENTIFIER
     ::= { g9983Conformance 1 }

   g9983Compliances OBJECT IDENTIFIER
     ::= { g9983Conformance 2 }

   -- Object Groups

   g9983BasicGroup OBJECT-GROUP
     OBJECTS {
       g9983PortConfAdminServices,
       g9983PortStatCrc4Errors,
       g9983PortStatCrc6Errors,
       g9983PortStatCrc8Errors,
       g9983PortCapFecSupported,
       g9983OperSvcIdx,
       g9983OperSvcState,
       g9983SvcIfIdx,
       g9983SvcType,
```

```
      g9983SvcSize,
      g9983SvcRowStatus,
      g9983PortStatFltStatus
    }
    STATUS      current
    DESCRIPTION
      "A collection of objects representing management information
      for G.Bond/TDIM ports."
    ::= { g9983Groups 1 }

  g9983FecGroup OBJECT-GROUP
    OBJECTS {
      g9983PortCapFecSupported,
      g9983PortConfFecAdminState,
      g9983PortStatFecOperState,
      g9983PortConfFecWordSize,
      g9983PortConfFecRedundancySize,
      g9983PortConfFecInterleaverType,
      g9983PortConfFecInterleaverDepth,
      g9983PortCapFecMaxWordSize,
      g9983PortCapFecMaxRedundancySize,
      g9983PortCapFecInterleaverTypeSupported,
      g9983PortCapFecMaxInterleaverDepth
    }
    STATUS      current
    DESCRIPTION
      "A collection of objects supporting the OPTIONAL Forward Error
      Correction (FEC) and Interleaver function in G.Bond/TDIM
      ports."
    ::= { g9983Groups 2 }

  g9983AlarmConfGroup OBJECT-GROUP
    OBJECTS {
      g9983PortConfSvcUpDownEnable
    }
    STATUS      current
    DESCRIPTION
      "A collection of objects required for configuration of alarm
      thresholds and notifications in G.Bond/TDIM ports."
    ::= { g9983Groups 3 }

  g9983NotificationGroup NOTIFICATION-GROUP
    NOTIFICATIONS {
      g9983SvcUp,
      g9983SvcDown
    }
    STATUS      current
```

```
    DESCRIPTION
      "This group supports notifications of significant conditions
      associated with G.Bond/TDIM ports."
    ::= { g9983Groups 4 }

  g9983PerfCurrGroup OBJECT-GROUP
    OBJECTS {
      g9983PortPmCur15MinValidIntervals,
      g9983PortPmCur15MinInvalidIntervals,
      g9983PortPmCur15MinTimeElapsed,
      g9983PortPmCur15MinCrc4s,
      g9983PortPmCur15MinCrc6s,
      g9983PortPmCur15MinCrc8s,
      g9983PortPmCur1DayValidIntervals,
      g9983PortPmCur1DayInvalidIntervals,
      g9983PortPmCur1DayTimeElapsed,
      g9983PortPmCur1DayCrc4s,
      g9983PortPmCur1DayCrc6s,
      g9983PortPmCur1DayCrc8s,
      g9983SvcPmCur15MinValidIntervals,
      g9983SvcPmCur15MinInvalidIntervals,
      g9983SvcPmCur15MinTimeElapsed,
      g9983SvcPmCur15MinDowns,
      g9983SvcPmCur1DayValidIntervals,
      g9983SvcPmCur1DayInvalidIntervals,
      g9983SvcPmCur1DayTimeElapsed,
      g9983SvcPmCur1DayDowns
    }
    STATUS      current
    DESCRIPTION
      "A collection of objects supporting OPTIONAL current Performance
      Monitoring information for G.Bond/TDIM ports."
    ::= { g9983Groups 5 }

  g9983Perf15MinGroup OBJECT-GROUP
    OBJECTS {
      g9983PortPm15MinIntervalMoniTime,
      g9983PortPm15MinIntervalCrc4s,
      g9983PortPm15MinIntervalCrc6s,
      g9983PortPm15MinIntervalCrc8s,
      g9983PortPm15MinIntervalValid,
      g9983SvcPm15MinIntervalMoniTime,
      g9983SvcPm15MinIntervalDowns,
      g9983SvcPm15MinIntervalValid
    }
    STATUS      current
```

```
    DESCRIPTION
      "A collection of objects supporting OPTIONAL historical
      Performance Monitoring information for G.Bond/TDIM ports, during
      previous 15-minute intervals."
    ::= { g9983Groups 6 }

  g9983Perf1DayGroup OBJECT-GROUP
    OBJECTS {
      g9983PortPm1DayIntervalMoniTime,
      g9983PortPm1DayIntervalCrc4s,
      g9983PortPm1DayIntervalCrc6s,
      g9983PortPm1DayIntervalCrc8s,
      g9983PortPm1DayIntervalValid,
      g9983SvcPm1DayIntervalMoniTime,
      g9983SvcPm1DayIntervalDowns,
      g9983SvcPm1DayIntervalValid
    }
    STATUS      current
    DESCRIPTION
      "A collection of objects supporting OPTIONAL historical
      Performance Monitoring information for G.Bond/TDIM ports, during
      previous 1-day intervals."
    ::= { g9983Groups 7 }

  -- Compliance Statements

  g9983Compliance MODULE-COMPLIANCE
    STATUS      current
    DESCRIPTION
      "The compliance statement for G.Bond/TDIM interfaces.
      Compliance with the following external compliance statements
      is REQUIRED:

      MIB Module             Compliance Statement
      ----------             --------------------
      IF-MIB                 ifCompliance3
      GBOND-MIB              gBondCompliance"

    MODULE  -- this module
      MANDATORY-GROUPS {
        g9983BasicGroup,
        g9983AlarmConfGroup,
        g9983NotificationGroup
      }

      GROUP       g9983FecGroup
```

```
        DESCRIPTION
          "Support for this group is only required for implementations
          supporting the G.Bond/TDIM FEC and Interleaver function."

        GROUP       g9983PerfCurrGroup
        DESCRIPTION
          "Support for this group is only required for implementations
          supporting Performance Monitoring."

        GROUP       g9983Perf15MinGroup
        DESCRIPTION
          "Support for this group is only required for implementations
          supporting historical Performance Monitoring."

        GROUP       g9983Perf1DayGroup
        DESCRIPTION
          "Support for this group is only required for implementations
          supporting historical Performance Monitoring."

     ::= { g9983Compliances 1 }
END
```

## 7. Security Considerations

There are a number of managed objects defined in this MIB module with 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. These are the tables and objects and their sensitivity/vulnerability:

- Changing of the g9983PortConfAdminServices object may lead to a potential service disruption, by changing a particular service's position (therefore changing its drop priority) or even removing the service from the link altogether.

- Changing of g9983SvcTable configuration parameters (e.g., g9983SvcType or g9983SvcSize) may lead to a potential service impairment; for example, a TDM service would be dropped if there is not enough actual bandwidth on the bonded link to support this service.

- Changing of g9983PortConfTable configuration parameters (e.g., g9983PortConfFecAdminState) may lead to anything from link quality and rate degradation to a complete link initialization failure.

Some of the readable objects in this MIB module (i.e., those with MAX-ACCESS other than not-accessible) may be considered sensitive or vulnerable in some network environments since, collectively, they provide information about the performance of network interfaces and can reveal some aspects of their configuration.

In particular, since a bonded xDSL port can be comprised of multiple Unshielded Twisted Pair (UTP) voice-grade copper, located in the same bundle with other pairs belonging to another operator/customer, it is theoretically possible to eavesdrop on a G.Bond transmission, simply by "listening" to cross-talk from the bonded pairs, especially if the operating parameters of the G.Bond link in question are known.

It is thus important to control even GET and/or NOTIFY access to these objects and possibly to even encrypt the values of these objects when sending them over the network via SNMP. These are the tables and objects and their sensitivity/vulnerability:

- g9983PortStatFecOperState in the g9983PortStatTable indicates whether the FEC function is enabled, which may aid in deciphering the G.Bond/TDIM transmissions.

- The g9983OperSvcTable provides current operational service configuration, which may aid in deciphering the G.Bond/TDIM transmissions.

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.

Implementations SHOULD provide the security features described by the SNMPv3 framework (see [RFC3410]), and implementations claiming compliance to the SNMPv3 standard MUST include full support for authentication and privacy via the User-based Security Model (USM) [RFC3414] with the AES cipher algorithm [RFC3826]. Implementations MAY also provide support for the Transport Security Model (TSM) [RFC5591] in combination with a secure transport such as SSH [RFC5592] or TLS/DTLS [RFC6353].

Further, deployment of SNMP versions prior to SNMPv3 is NOT RECOMMENDED. Instead, it is RECOMMENDED to deploy SNMPv3 and to enable cryptographic security. It is then a customer/operator responsibility to ensure that the SNMP entity giving access to an instance of this MIB module is properly configured to give access to the objects only to those principals (users) that have legitimate rights to indeed GET or SET (change/create/delete) them.

## 8. IANA Considerations

IANA has allocated value 210 as the Object identifier for g9983MIB MODULE-IDENTITY <http://www.iana.org/> in the MIB-2 transmission sub-tree.

## 9. Acknowledgments

This document was produced by the [ADSLMIB] working group.

Special thanks to Dan Romascanu for his meticulous review of this text.

## 10. References

### 10.1. Normative References

[G.998.3] ITU-T, "Multi-pair bonding using time-division inverse multiplexing", ITU-T Recommendation G.998.3, January 2005, <http://www.itu.int/rec/T-REC-G.998.3/en>.

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.

[RFC2578] McCloghrie, K., Ed., Perkins, D., Ed., and J. Schoenwaelder, Ed., "Structure of Management Information Version 2 (SMIv2)", STD 58, RFC 2578, April 1999.

[RFC2579] McCloghrie, K., Ed., Perkins, D., Ed., and J. Schoenwaelder, Ed., "Textual Conventions for SMIv2", STD 58, RFC 2579, April 1999.

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

[RFC2863] McCloghrie, K. and F. Kastenholz, "The Interfaces Group MIB", RFC 2863, June 2000.

[RFC3414] Blumenthal, U. and B. Wijnen, "User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3)", STD 62, RFC 3414, December 2002.

[RFC3705] Ray, B. and R. Abbi, "High Capacity Textual Conventions for MIB Modules Using Performance History Based on 15 Minute Intervals", RFC 3705, February 2004.

[RFC3826] Blumenthal, U., Maino, F., and K. McCloghrie, "The Advanced Encryption Standard (AES) Cipher Algorithm in the SNMP User-based Security Model", RFC 3826, June 2004.

[RFC5591] Harrington, D. and W. Hardaker, "Transport Security Model for the Simple Network Management Protocol (SNMP)", RFC 5591, June 2009.

[RFC5592] Harrington, D., Salowey, J., and W. Hardaker, "Secure Shell Transport Model for the Simple Network Management Protocol (SNMP)", RFC 5592, June 2009.

[RFC6353] Hardaker, W., "Transport Layer Security (TLS) Transport Model for the Simple Network Management Protocol (SNMP)", RFC 6353, July 2011.

[RFC6765] Beili, E. and M. Morgenstern, "xDSL Multi-Pair Bonding (G.Bond) MIB", RFC 6765, February 2013.

[TR-159] Beili, E. and M. Morgenstern, "Management Framework for xDSL Bonding", Broadband Forum Technical Report TR-159, December 2008, <http://www.broadband-forum.org/technical/download/TR-159.pdf>.

## 10.2. Informative References

[ADSLMIB] IETF, "ADSL MIB (adslmib) Charter", <http://datatracker.ietf.org/wg/adslmib/charter/>.

[G.704] ITU-T, "Synchronous frame structures used at 1544, 6312, 2048, 8448 and 44 736 kbit/s hierarchical levels", ITU-T Recommendation G.704, October 1998, <http://www.itu.int/rec/T-REC-G.704/en>.

[RFC3410] Case, J., Mundy, R., Partain, D., and B. Stewart, "Introduction and Applicability Statements for Internet-Standard Management Framework", RFC 3410, December 2002.

[RFC3593] Tesink, K., "Textual Conventions for MIB Modules Using Performance History Based on 15 Minute Intervals", RFC 3593, September 2003.

[RFC4181] Heard, C., "Guidelines for Authors and Reviewers of MIB Documents", BCP 111, RFC 4181, September 2005.

Author's Address

Edward Beili
Actelis Networks
25 Bazel St.
Petach-Tikva 49103
Israel

Phone: +972-3-924-3491
EMail: edward.beili@actelis.com