               xDSL multi-pair bonding (G.Bond) MIB
               draft-ietf-adslmib-gbond-mib-09.txt

Abstract

   This document defines Management Information Base (MIB) module for
   use with network management protocols in TCP/IP-based internets.
   This document proposes an extension to the Interfaces Group MIB with
   a set of common objects for managing multi-pair bonded Digital
   Subscriber Line (xDSL) interfaces, defined in ITU-T recommendations
   G.998.1, G.998.2 and G.998.3. The MIB modules specific to each
   bonding technology are defined in GBOND-ATM-MIB, GBOND-ETH-MIB and
   GBOND-TDIM-MIB respectively.

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1. Introduction

The xDSL Multi-Pair Bonding, allows a service provider to provide
high bandwidth services to business and residential customers over
multiple xDSL lines, with greater speed and resiliency, than the
service over a single xDSL line, bridging the gap between xDSL and
fiber-based transport.

There are three xDSL Multi-Pair Bonding schemes, also known under
collective name G.Bond:

o The ATM-Based Multi-Pair Bonding, specified in ITU-T G.998.1
   recommendation [G.998.1], which defines a method for bonding (or
   aggregating) of multiple xDSL lines (or individual bearer channels
   in multiple xDSL lines) into a single bi-directional logical link
   carrying an ATM stream. This specification can be viewed as an
   evolution of the legacy Inverse Multiplexing over ATM (IMA)
   technology [af-phy-0086], applied to xDSL with variable rates on
   each line/bearer channel.

o The Ethernet-Based Multi-Pair Bonding, specified in ITU-T G.998.2
   recommendation [G.998.2], which defines a method for bonding (or
   aggregating) of multiple xDSL lines (or individual bearer channels
   in multiple xDSL lines) into a single bi-directional logical link
   carrying an Ethernet stream. This specification can be viewed as
   IEEE 802.3-2005 [802.3] Clause 61 Physical Medium Entity (PME)
   Aggregation, generalized to work over any xDSL technology
   (2Base-TL and 10Pass-TS interfaces defined by IEEE use G.SHDSL and
   VDSL technology respectively).

o The Multi-pair bonding using time-division inverse multiplexing
   (TDIM), specified in ITU-T G.998.3 recommendation [G.998.3], which
   defines a method for bonding (or aggregating) of multiple xDSL
   lines into a single bi-directional logical link carrying a mix of
   various traffic streams (e.g., Ethernet, ATM, TDM).

Architecturally all three bonding schemes define a new "bonded"
Transport Protocol Specific - Transmission Convergence (TPS-TC) sub-
layer, stacked above multiple ATM-TC, Ethernet/PTM-TC or STM-TC
(clear channel) sub-layers for the ATM, Ethernet or TDIM bonding
respectively. Each underlying TPS-TC sub-layer represents a protocol
specific interface to an xDSL line or an individual bearer channel of
an xDSL line. Bonding of multiple bearer channels in the same xDSL
line is not allowed.

All schemes allow bonding of up to 32 individual line/channel sub-
layers with variable rates, providing common functionality for the
configuration, initialization, operation and monitoring of the bonded

link.

This document defines a MIB module common to all 3 schemes.
Additional managed objects, specific to each bonding technology, are
defined in GBOND-ATM-MIB [I-D.ietf-adslmib-gbond-atm-mib], GBOND-ETH-
MIB [I-D.ietf-adslmib-gbond-eth-mib] and GBOND-TDIM-MIB
[I-D.ietf-adslmib-gbond-tdim-mib] modules.

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 document 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 RFC
2119 [RFC2119].

3. The DSL Forum Management Framework for xDSL Bonding

This document makes use of the DSL 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: Interfaces
Group MIB (IF-MIB), Inverse Stack Table MIB (IF-INVERTED-STACK-MIB)
Interface Stack Capability MIB (IF-CAP-STACK-MIB), G.Bond scheme
specific modules: G.Bond/ATM (GBOND-ATM-MIB), G.Bond/Ethernet (GBOND-
ETH-MIB) and G.Bond/TDIM (GBOND-TDIM-MIB), and DSL specific MIB
modules: ADSL (ADSL-LINE-EXT-MIB), ADSL2 (ADSL2-LINE-MIB), SHDSL
(HDSL2-SHDSL-LINE-MIB), VDSL (VDSL-LINE-MIB) and VDSL2 (VDSL2-LINE-
MIB).

4.1. Relationship to Interfaces Group MIB module

A bonded xDSL port is a stacked (a.k.a. aggregated or bonded)
interface and as such is managed using generic interface management
objects defined in the IF-MIB [RFC2863].

The stack management, i.e., actual connection of the sub-layers to
the top layer interface, is done via the ifStackTable, as defined in
the IF-MIB [RFC2863] and its inverse ifInvStackTable, as defined in
the IF-INVERTED-STACK-MIB [RFC2864].

The ifCapStackTable and its inverse ifInvCapStackTable defined in the
IF-CAP-STACK-MIB [RFC5066], extend the stack management with an
ability to describe possible connections or cross-connect capability,
when a flexible cross-connect matrix is present between the interface
layers.

4.1.1. Layering Model

A G.Bond interface can aggregate up to 32 channel sub-layers, with
each channel representing an xDSL line or an xDSL bearer channel.
For the purpose of brevity we will refer to the bonded interface as
Generic Bonded Sub-layer (GBS) and to the channel sub-layer as
Bonding Channel Entity (BCE).

A generic G.Bond device can have a number of GBS ports, each
connected to a particular upper layer (e.g., Media Access Control
(MAC) interface for G.998.2 scheme), while simultaneously cross-
connected to a number of underlying BCEs, with a single GBS per BCE
relationship.

A GBS port is represented in the Interface table (ifTable) as a
separate interface with an ifType of g9981(263), g9982(264) or
g9983(265) for a particular bonding scheme.

Each BCE in the aggregated GBS port is represented in the ifTable as
a separate interface with an ifType relevant to a particular xDSL
technology, e.g., shdsl(169) or vdsl(97). The ifType values are
defined in [IANAifType-MIB].

The following figure shows the layering diagram and corresponding use
of ifTable for the bonded xDSL interfaces:

```
.------------------------------.  -
|           GBS                |  ^ 1 ifEntry
|         (TPS-TC)             |  v    ifType: g9981(263), g9982(264)
+----------------+---+-------+  -              or g9983(265)
| TPS-TC \       |   |       |  ^
+---------\      |   |       |  | N ifEntry  (N=1..32)
| PMS-TC   )BCE 1|...| BCE N |  )    ifType: adsl(94), shdsl(169),
+---------/      |   |       |  |             vdsl(97), vdsl2(251),
| PMD    /       |   |       |  v             etc.
'----------------+---+-------'  -
```
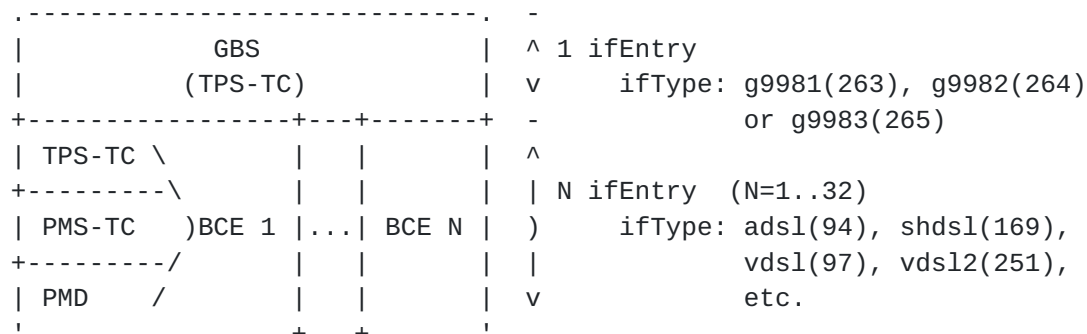
```
 BCE     - Bonding Channel Entity
 GBS     - Generic Bonded Sub-layer
 PMD     - Physical Medium Dependent
 TPS-TC - Transport Protocol Specific - Transmission Convergence
 PMS-TC - Physical Media Specific - Transmission Convergence
```

         Figure 1: Use of ifTable for bonded xDSL interfaces

The ifStackTable is indexed by the ifIndex values of the aggregated
G.Bond port (GBS) and the BCEs connected to it. ifStackTable allows a
Network Management application to determine which BCEs are connected
to a particular GBS and change connections (if supported by the
application). The ifInvStackTable, being an inverted version of the
ifStackTable, provides an efficient means for a Network Management
application to read a subset of the ifStackTable and thereby
determine which GBS runs on top of a particular BCE.

The ifCapStackTable defined in the IF-CAP-STACK-MIB module, specifies
for each higher-layer interface (e.g., GBS port) a list of lower-
layer interfaces (e.g., BCEs), which can possibly be cross-connected
to that higher-layer interface, determined by the cross-connect
capability of the device. This table, modeled after ifStackTable, is
read only, reflecting current cross-connect capability of a stacked
interface, which can be dynamic in some implementations (e.g., if
xDSL lines are located on a pluggable module and the module is pulled
out). Note that BCE availability per GBS, described by
ifCapStackTable, can be constrained by other parameters, for example
by aggregation capacity of a GBS or by the BCE in question being
already connected to another GBS. So, in order to ensure that a
particular BCE can be connected to the GBS, all respective parameters
(e.g., ifCapStackTable, ifStackTable and gBondPortCapCapacity) SHALL
be inspected.

The ifInvCapStackTable, also defined in the IF-CAP-STACK-MIB module,

describes which higher-layer interfaces (e.g., GBS ports) can
possibly be connected to a particular lower-layer interface (e.g.,
BCE), providing inverted mapping of ifCapStackTable. While it
contains no additional information beyond that already contained in
the ifCapStackTable, the ifInvCapStackTable has the ifIndex values in
its INDEX clause in the reverse order, i.e., the lower-layer
interface first, and the higher-layer interface second, providing
efficient means for a Network Management application to read a subset
of the ifCapStackTable and thereby determine which interfaces can be
connected to run on top of a particular interface.

4.1.2. xDSL Bonding

The G.998.x Bonding allows a number of BCEs to be aggregated onto a
single logical GBS port, by splitting the incoming traffic into
multiple streams, transmitting each stream over a specific BCE and
combining the streams at the remote GBS port, preserving the original
traffic order.

The Ethernet frames MAY be fragmented before the transmission and
reassembled at the remote end to minimize transportation delay.

The Bonding is OPTIONAL, meaning that a device with a single BCE MAY
perform fragmentation and re-assembly if this function is supported
by the device. The agent is REQUIRED to indicate the Bonding
capability for all types of G.Bond ports (ATM, Ethernet and TDIM).

The GBOND-MIB module allows a Network Management application to query
Bonding capability and enable/disable it if supported. Note that
enabling Bonding effectively turns on fragmentation and re-assembly
function, even on a single-BCE port.

4.1.3. Discovery Operation

The G.Bond ports may optionally support discovery operation, whereby
BCEs, during initialization, exchange information about their
respective aggregation groups (GBS), via [G.994.1] handshake (G.hs)
protocol. This information can then be used to detect copper
misconnections or for an automatic assignment of the local BCEs into
aggregation groups instead of a fixed pre-configuration.

The MIB module defined in this document allow a Network Management
application to control G.Bond discovery mechanism and query its
results.

Two tables are used by the G.Bond discovery mechanism: ifStackTable
and ifCapStackTable. The following pseudo-code gives an example of
the discovery and automatic BCE assignment for a generic multi-GBS

G.Bond device, located at Central Office (CO), using objects defined
in this MIB module, IF-CAP-STACK-MIB and IF-MIB modules [Note that
automatic BCE assignment is only shown here for the purposes of the
example. Fixed BCE pre-assignment, manual assignment or auto-
assignment using an alternative internal algorithm may be chosen by a
particular implementation]:

```
// Go over all GBS ports in the CO device
FOREACH gbs[i] IN CO_device
{ // Perform discovery and auto-assignment on GBS ports
  // with room for more Channels
  IF ( gbs[i].NumBCEs < gbs[i].BondCapacity )
  { // Assign a unique 6-octets local discovery code to the GBS
    // e.g., MAC address of the associated port or some other
    // unique number specifically allocated for this purpose.
    dc = gbs[i].DiscoveryCode = MAC[i];
    // Go over all disconnected Channels, which can
    // potentially be connected to the GBS
    FOREACH bce[j] IN ifCapStackTable[gbs[i]] AND
                  NOT IN ifStackTable[gbs[i]]  // not connected
    { // Try to grab the remote RT_device, by writing the value
      // of the local 6 Byte discovery code to the remote
      // discovery code register (via handshake mechanism).
      // This operation is atomic Set-if-Clear action, i.e., it
      // would succeed only if the remote discovery register was
      // zero. Read the remote discovery code register via Get
      // operation to see if the RT_device, attached via the BCE
      // is indeed marked as being the CO_device peer.
      bce[j].RemoteDiscoveryCode = dc;          // Set-if-Clear
      r = bce[j].RemoteDiscoveryCode;           // Get
      IF ( r == dc AND gbs[i].NumBCEs < gbs[i].BondCapacity)
      { // Remote RT_device connected via BCE[j] is/was a peer
        // for GBS[i] and there room for another BCE in the
        // GBS[i] aggregation group (max. Bonding capacity is
        // not reached yet).
        // Connect this BCE to the GBS (via ifStackTable,
        // ifInvStackTable being inverse of ifStackTable is
        // updated automatically, i.e., gbs[i] is auto-added
        // to ifInvStackTable[bce[j]])
        ADD bce[j] TO ifStackTable[gbs[i]];
        gbs[i].NumBCEs = gbs[i].NumBCEs + 1;
        // Discover all other disconnected BCEs,
        // attached to the same RT_device and connect them to
        // the GBS provided there is enough room for more BCEs.
        FOREACH bce[k] IN ifCapStackTable[gbs[i]] and
                      NOT IN ifStackTable[gbs[i]]
        { // Get Remote Discovery Code from the BCE to see if
          // it belongs to a connected RT_device "grabbed" by
```

```
            // the CO_device.
            r = bce[k].RemoteDiscoveryCode;
            IF ( r == dc AND gbs[i].NumBCEs < gbs[i].BondCapacity)
            { // Physically connect the BCE to the GBS
              // (gbs[i] is auto-added TO ifInvStackTable[bce[k]])
              ADD bce[k] TO ifStackTable[gbs[i]];
              gbs[i].NumBCEs = gbs[i].NumBCEs + 1;
            }
          }
        }
        // At this point we have discovered all local BCEs which
        // are physically connected to the same remote RT_device
        // and connected them to GBS[i]. Go to the next GBS.
        BREAK;
      }
    }
}
```

An SNMP Agent for a G.Bond device builds ifCapStackTable and its
inverse ifInvCapStackTable on device initialization, according to the
cross-connect capabilities of the device.

Adding a BCE to the ifStackTable row for a specific GBS, involves
actual connection of the BCE to the GBS.

Note that GBS port does not have to be operationally 'down' for the
connection to succeed. In fact, a dynamic BCE addition (and removal)
MAY be implemented with an available BCE being initialized first (by
setting its ifAdminStatus to 'up') and then added to an operationally
'up' GBS port, by modifying a respective ifStackTable (and respective
ifInvStackTable) entry.

It is RECOMMENDED that a removal of the last operationally 'up' BCE
from an operationally 'up' GBS, i.e. modification of a respective
entry in ifStackTable and a corresponding entry in ifInvStackTable,
would be rejected by the implementation (in case of SNMP with the
error inconsistentValue), as this action would completely drop the
link.

In addition to the standard handshake-based discovery described
above, [G.998.2] defines an optional frame-based discovery and pair
management. These frame-based methods are discussed in
[I-D.ietf-adslmib-gbond-eth-mib].

4.1.4. G.Bond ports initialization

G.Bond ports being built on top of xDSL technology, require a lengthy
initialization or 'training' process, before any data can pass.

During this initialization both ends of a link (peers) work
cooperatively to achieve required data rate on a particular copper
pair. Sometimes, when the copper line is too long or the noise on
the line is too high, that 'training' process may fail to achieve a
specific target rate with required characteristics.

The ifAdminStatus object from the IF-MIB, controls the desired state
of a GBS with all the BCEs connected to it or of an individual BCE
port. Setting this object to 'up' instructs a particular GBS or a
BCE to start initialization process, which may take tens of seconds
for G.Bond ports. The ifOperStatus object from the IF-MIB shows the
operational state of an interface for GBS, extended by
gBondPortStatFltStatus object defined in this document, and
corresponding *Status object from a relevant xDSL line MIB for BCE
interfaces.

A disconnected BCE may be initialized by changing the ifAdminState
from 'down' to 'up'. Changing the ifAdminState to 'up' on the GBS
initializes all BCEs connected to that particular GBS. Note that in
case of bonding some interfaces may fail to initialize while others
succeed. The GBS is considered operationally 'up' if at least one
bonded BCE is operationally 'up'. When all BCEs connected to the GBS
are 'down' the GBS SHALL be considered operationally
'lowerLayerDown'. The GBS SHALL be considered operationally
'notPresent' if it is not connected to any BCE. The GBS/BCE
interface SHALL remain operationally 'down' during initialization,
indicated by 'init' value of the gBondPortStatFltStatus object.

4.1.5. Usage of ifTable

Both BCE and GBS interfaces are managed using interface specific
management objects defined in the GBOND-MIB module and generic
interface objects from the ifTable of IF-MIB, with all management
table entries referenced by the interface index ifIndex.

The following table summarizes G.Bond specific interpretations for
some of the ifTable objects specified by the mandatory
ifGeneralInformationGroup:

+---------------+--+
| IF-MIB object | G.Bond interpretation |
+---------------+--+
ifIndex	Interface index. Note that each BCE and each GBS
	in the G.Bond PHY MUST have a unique index, as
	there are some GBS and BCE specific attributes
	accessible only on the GBS or BCE level.
+---------------+--+
ifType	g9981(263), g9982(264) or g9983(265) for the ATM,
	Ethernet or TDIM GBS respectively, shdsl(169) for
	G.SHDSL BCE, vdsl(97) for VDSL BCE, etc.
+---------------+--+
ifSpeed	Operating data rate for the BCE. For the GBS it
	is the sum of the current operating data rates of
	all BCEs in the aggregation group, without the
	encapsulation overhead and G.Bond overhead, but
	accounting for the Inter-Frame Gaps (IFG). When a
	GBS or a BCE is operating in an asymetrical
	fashion (upstream data rate differs from the
	downstream one) the lowest of the values is
	shown.
+---------------+--+
ifAdminStatus	Setting this object to 'up' instructs a
	particular GBS (with all BCEs connected to it) or
	a BCE to start initialization process
+---------------+--+
ifOperStatus	A relevant *Status object from a particular line
	MIB supplements the value of ifOperStatus for
	BCEs. gBondPortStatFltStatus supplements the
	value of ifOperStatus for GBS. Note that both
	relevant objects shall be inspected to determine
	the real operational status of a BCE/GBS port,
	e.g. a GBS port may be operationally 'up' with
	gBondPortStatFltStatus indicating lowRate(4)
	fault condition, or 'down' with no gBond faults.
+---------------+--+

Table 1: G.Bond interpretation of IF-MIB objects

4.2. Relationship to G.Bond ATM, ETH and TDIM MIB modules

The MIB module defined in this document is common to all three G.998
bonding schemes. It MUST be used in conjunction with a bonding
scheme-specific MIB module:

o GBOND-ATM-MIB [I-D.ietf-adslmib-gbond-atm-mib] for a G.998.1
   bonded interface.

o GBOND-ETH-MIB [I-D.ietf-adslmib-gbond-eth-mib] for a G.998.2
   bonded interface.

o GBOND-TDIM-MIB [I-D.ietf-adslmib-gbond-tdim-mib] for a G.998.3
   bonded interface.

4.3. Relationship to xDSL MIB modules

Each xDSL technology is described in a relevant xDSL line MIB module:
e.g., HDSL2-SHDSL-LINE-MIB [RFC4319] for G.SHDSL, ADSL-LINE-EXT-MIB
[RFC3440] for ADSL, ADSL2-LINE-MIB [RFC4706] for ADSL2, VDSL-LINE-MIB
[RFC3728] for VDSL or VDSL2-LINE-MIB [RFC5650] for VDSL2.

These MIB moduless are used to manage individual xDSL lines/channels
(BCEs).

5. MIB Structure

5.1. Overview

The main management objects defined in the GBOND-MIB module are split
into 2 groups, structured as recommended by RFC 4181 [RFC4181]:

o gBondPort - containing objects for configuration, capabilities,
   status, historical performance monitoring and notifications,
   common to all G.Bond ports (GBS).

o gBondBce - containing a single common object for configuration of
   the remote discovery code per BCE. Note that the rest of the
   objects for BCE configuration, capabilities, status and
   notifications, is located in relevant xDSL line MIB modules as
   well as in the bonding scheme specific MIB modules.

5.2. Performance Monitoring

The OPTIONAL performance monitoring counters, thresholds and history
buckets (interval-counters) 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 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 intervals SHOULD be aligned with the start of a day.

The rationale behind it is to simplify collection and analysis of the
PM from multiple agents by a network management system (NMS) - each
PM interval can be "time-stamped" using the gBond*IntervalIndex

object, the fact that 1-day interval starts at 00:00 and 15-min
intervals are aligned with 1/4 hour and the network-wide "wall
clock", typically distributed via NTP or SNTP. If the agent does not
have an access to the wall clock, a local clock can be used. In this
case, as well as when coping with multiple time zones, the NMS would
have to correlate for the difference between the agent's local clock
(available for example via hrSystemDate object from HOST-RESOURCES-
MIB [RFC2790]) and the wall clock.

Counters are not reset when a GBS is reinitialized, but rather only
when the agent is reset or reinitialized.

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

5.3. Mapping of DSL Forum TR-159 Managed Objects

This section contains the mapping between relevant managed objects
(attributes) defined in [TR-159] and managed objects defined in this
document and in associated MIB modules, i.e., the IF-MIB [RFC2863].

G.Bond Managed Object	Corresponding SNMP Object
oBondingGroup - Basic Package (Mandatory)	
aGroupID	ifIndex (IF-MIB)
aGroupBondSchemesSupported	gBondPortCapSchemesSupported
aGroupPeerBondSchemesSupported	gBondPortCapPeerSchemesSupported
aGroupAdminBondScheme	gBondPortConfAdminScheme
aGroupPeerAdminBondScheme	gBondPortConfPeerAdminScheme
aGroupOperBondScheme	gBondPortStatOperScheme
aGroupPeerOperBondScheme	gBondPortStatPeerOperScheme
aGroupEnd	gBondPortStatSide

aGroupOperState	ifOperStatus (IF-MIB)
aGroupAdminState	ifAdminStatus (IF-MIB)
aGroupStatus	gBondPortStatFltStatus
aGroupCapacity	gBondPortCapCapacity
aGroupPeerCapacity	gBondPortCapPeerCapacity
aGroupNumChannels	gBondPortStatNumBCEs
aGroupName	ifName (IF-MIB)
aGroupDiscoveryCode	gBondPortConfDiscoveryCode
aGroupUpRate	gBondPortStatUpDataRate
aGroupDownRate	gBondPortStatDnDataRate
aGroupTargetUpRate	gBondPortConfTargetUpDataRate
aGroupTargetDownRate	gBondPortConfTargetDnDataRate
aGroupThreshLowUpRate	gBondPortConfThreshLowUpRate
aGroupThreshLowDownRate	gBondPortConfThreshLowDnRate
aGroupLowRateCrossingEnable	gBondPortConfLowRateCrossingEnable
nGroupLowUpRateCrossing	gBondLowUpRateCrossing
nGroupLowDownRateCrossing	gBondLowDnRateCrossing
aGroupLinkUpDownEnable	ifLinkUpDownTrapEnable (IF-MIB)
nGroupLinkUp	linkDown (IF-MIB)
nGroupLinkDown	linkUp (IF-MIB)
oBondingGroup - PM Package (Optional)	
aGroupPerfES	gBondPortPmCurES
aGroupPerfSES	gBondPortPmCurSES

aGroupPerfUAS	gBondPortPmCurUAS
aGroupPerf15MinValidIntervals	gBondPortPmCur15MinValidIntervals
aGroupPerf15MinInvalidIntervals	gBondPortPmCur15MinInvalidIntervals
aGroupPerfCurr15MinTimeElapsed	gBondPortPmCur15MinTimeElapsed
aGroupPerfCurr15MinES	gBondPortPmCur15MinES
aGroupPerfCurr15MinSES	gBondPortPmCur15MinSES
aGroupPerfCurr15MinUAS	gBondPortPmCur15MinUAS
aGroupPerfTcaEnable	gBondPortConfPmTcaEnable
aGroupPerfThreshold15MinES	gBondPortPmTcaProfileThresh15MinES
aGroupPerfThreshold15MinSES	gBondPortPmTcaProfileThresh15MinSES
aGroupPerfThreshold15MinUAS	gBondPortPmTcaProfileThresh15MinUAS
nGroupPerfTca15MinES	gBondPmTca15MinESCrossing
nGroupPerfTca15MinSES	gBondPmTca15MinSESCrossing
nGroupPerfTca15MinUAS	gBondPmTca15MinUASCrossing
aGroupPerf1DayValidIntervals	gBondPortPmCur1DayValidIntervals
aGroupPerf1DayInvalidIntervals	gBondPortPmCur1DayInvalidIntervals
aGroupPerfCurr1DayTimeElapsed	gBondPortPmCur1DayTimeElapsed
aGroupPerfCurr1DayES	gBondPortPmCur1DayIntervalES
aGroupPerfCurr1DaySES	gBondPortPmCur1DayIntervalSES
aGroupPerfCurr1DayUAS	gBondPortPmCur1DayIntervalUAS
aGroupPerfThreshold1DayES	gBondPortPmTcaProfileThresh1DayES

aGroupPerfThreshold1DaySES	gBondPortPmTcaProfileThresh1DaySES
aGroupPerfThreshold1DayUAS	gBondPortPmTcaProfileThresh1DayUAS
nGroupPerfTca1DayES	gBondPmTca1DayESCrossing
nGroupPerfTca1DaySES	gBondPmTca1DaySESCrossing
nGroupPerfTca1DayUAS	gBondPmTca1DayUASCrossing
aGroupPerf15MinIntervalNumber	gBondPortPm15MinIntervalIndex
aGroupPerf15MinIntervalValid	gBondPortPm15MinIntervalValid
aGroupPerf15MinIntervalES	gBondPortPm15MinIntervalES
aGroupPerf15MinIntervalSES	gBondPortPm15MinIntervalSES
aGroupPerf15MinIntervalUAS	gBondPortPm15MinIntervalUAS
aGroupPerf1DayIntervalNumber	gBondPortPm1DayIntervalIndex
aGroupPerf1DayIntervalValid	gBondPortPm1DayIntervalValid
aGroupPerf1DayIntervalMoniSecs	gBondPortPm1DayIntervalMoniTime
aGroupPerf1DayIntervalES	gBondPortPm1DayIntervalES
aGroupPerf1DayIntervalSES	gBondPortPm1DayIntervalSES
aGroupPerf1DayIntervalUAS	gBondPortPm1DayIntervalUAS
oLine - Basic Package (Mandatory)	
aLineID	ifIndex (IF-MIB)
aLineType	ifType (IF-MIB)
aLineOperState	ifOperStatus (IF-MIB)
aLineStatus	*dsl*CurrStatus (*DSL-LINE-MIB)
aLineEnd	*dsl*Side (*DSL-LINE-MIB)

```
   | aLineAdminState               | ifAdminStatus (IF-MIB)          |
   +-------------------------------+---------------------------------+
   | aLineRemoteDiscoveryCode      | gBondBceConfRemoteDiscoveryCode |
   +-------------------------------+---------------------------------+
   | aLineUpDownEnable             | ifLinkUpDownTrapEnable (IF-MIB) |
   +-------------------------------+---------------------------------+
   | nLineUp                       | linkUp (IF-MIB)                 |
   +-------------------------------+---------------------------------+
   | nLineDown                     | linkDown (IF-MIB)               |
   +-------------------------------+---------------------------------+
   | oChannel - Basic Package      |                                 |
   | (Mandatory)                   |                                 |
   +-------------------------------+---------------------------------+
   | aChannelID                    | ifIndex (IF-MIB)                |
   +-------------------------------+---------------------------------+
   | aChannelGroupID               |                                 |
   +-------------------------------+---------------------------------+
   | aChannelType                  | ifType (IF-MIB)                 |
   +-------------------------------+---------------------------------+
   | aChannelOperState             | ifOperStatus (IF-MIB)           |
   +-------------------------------+---------------------------------+
   | aChannelStatus                | *dsl*CurrStatus (*DSL-LINE-MIB),|
   |                               | xdsl2ChStatus*Status            |
   |                               | (VDSL2-LINE-MIB)                |
   +-------------------------------+---------------------------------+
```

               Table 2: Mapping of TR-159 Managed Objects

6. xDSL Multi-pair Bonding MIB Definitions

```
GBOND-MIB DEFINITIONS ::= BEGIN

  IMPORTS
    MODULE-IDENTITY,
    OBJECT-TYPE,
    NOTIFICATION-TYPE,
    mib-2,
    Unsigned32,
    Gauge32
      FROM SNMPv2-SMI        -- [RFC2578]
    TEXTUAL-CONVENTION,
    TruthValue,
    RowStatus,
    PhysAddress
      FROM SNMPv2-TC         -- [RFC2579]
    MODULE-COMPLIANCE,
    OBJECT-GROUP,
    NOTIFICATION-GROUP
```

```
      FROM SNMPv2-CONF          -- [RFC2580]
   SnmpAdminString
     FROM SNMP-FRAMEWORK-MIB   -- [RFC3411]
   ifIndex
     FROM IF-MIB               -- [RFC2863]
   HCPerfCurrentCount,
   HCPerfIntervalCount,
   HCPerfIntervalThreshold,
   HCPerfValidIntervals,
   HCPerfInvalidIntervals,
   HCPerfTimeElapsed,
   HCPerfTotalCount
     FROM  HC-PerfHist-TC-MIB  -- [RFC3705]
   ;
-------------------------------------------------------------------------
 gBondMIB MODULE-IDENTITY
   LAST-UPDATED "201202130000Z"  -- Feb 13, 2012
   ORGANIZATION "IETF ADSL MIB Working Group"
   CONTACT-INFO
     "WG charter:
       http://www.ietf.org/html.charters/adslmib-charter.html

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

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             Israel
```

         Phone: +972-3-926-6258
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     DESCRIPTION
       "The objects in this MIB module are used to manage the
       multi-pair bonded xDSL Interfaces, defined in ITU-T
       recommendations G.998.1, G.998.2 and G.998.3.

       This MIB module MUST be used in conjunction with a bonding
       scheme specific MIB module, that is, GBOND-ATM-MIB,
       GBOND-ETH-MIB or GBOND-TDIM-MIB.

       The following references are used throughout this MIB module:

       [G.998.1] refers to:
         ITU-T Recommendation G.998.1: 'ATM-based multi-pair bonding',
         January 2005.

       [G.998.2] refers to:
         ITU-T Recommendation G.998.2: 'Ethernet-based multi-pair
         bonding', January 2005.

       [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 Transmission Unit
         BTU-C - Bonding Transmission Unit, CO side
         BTU-R - Bonding Transmission Unit, Remote Terminal (CPE) side
         CO   - Central Office
         CPE   - Customer Premises Equipment
         GBS   - Generic Bonding Sublayer
         PM   - Performance Monitoring
         SNR   - Signal to Noise Ratio
         TCA   - Threshold Crossing Alert

       Copyright (C) The IETF Trust (2012).
       This version of this MIB module is part of RFC XXXX;
       see the RFC itself for full legal notices."

     REVISION   "201202130000Z" -- Feb 13, 2012
     DESCRIPTION "Initial version, published as RFC XXXX."

```
      -- EdNote: Replace XXXX with the actual RFC number &
      -- remove this note

   ::= { mib-2 ZZZ }

      -- EdNote: Replace ZZZ with a real OID once it is
      -- allocated & remove this note.

   -- Sections of the module
   -- Structured as recommended by [RFC4181], Appendix D

   gBondObjects     OBJECT IDENTIFIER ::= { gBondMIB 1 }

   gBondConformance OBJECT IDENTIFIER ::= { gBondMIB 2 }

   -- Groups in the module

   gBondPort        OBJECT IDENTIFIER ::= { gBondObjects 1 }

   gBondBce         OBJECT IDENTIFIER ::= { gBondObjects 2 }

   -- Textual Conventions

   GBondSchemeList ::= TEXTUAL-CONVENTION
     STATUS        current
     DESCRIPTION
       "This textual convention defines a bitmap of possible ITU-T
       G.998 (G.Bond) bonding schemes. Currently there are 3 bonding
       schemes defined: G.998.1, G.998.2 and G.998.3, identified by
       bit values g9981(1), g9982(2) and g9983(3), respectively.
       An additional value of unknown(0), can be returned as a result
       of GET operation, when an value of the object cannot be
       determined, for example a peer GBS cannot be reached or it
       does not support any kind of bonding."
     SYNTAX        BITS {
       unknown(0),
       g9981(1),
       g9982(2),
       g9983(3)
     }

   GBondScheme ::= TEXTUAL-CONVENTION
     STATUS        current
     DESCRIPTION
       "This textual convention defines ITU-T G.998 bonding scheme
       values. Possible values are:
         unknown(0) - undefined or unknown
         g9981(1)   - G.998.1 (G.Bond/ATM)
```

```
        g9982(2)   - G.998.2 (G.Bond/Ethernet)
        g9983(3)   - G.998.3 (G.Bond/TDIM)."
   SYNTAX        INTEGER {
     unknown(0),
     g9981(1),
     g9982(2),
     g9983(3)
   }

GBondPm1DayIntervalThreshold ::= TEXTUAL-CONVENTION
   DISPLAY-HINT "d"
   STATUS        current
   DESCRIPTION
     "This textual convention defines a range of values that may be
     set in a fault threshold alarm control for a 1-day performance
     monitoring interval.
     As the number of seconds in a 1-day interval numbers at most
     86400, objects of this type may have a range of 0...86400,
     where the value of 0 disables the alarm."
   SYNTAX        Unsigned32 (0..86400)


-- Port Notifications Group

gBondPortNotifications OBJECT IDENTIFIER ::= { gBondPort 0 }

gBondLowUpRateCrossing NOTIFICATION-TYPE
   OBJECTS {
     -- ifIndex is not needed here since we are under specific GBS
     gBondPortStatUpDataRate,
     gBondPortConfThreshLowUpRate
   }
   STATUS      current
   DESCRIPTION
     "This notification indicates that the G.Bond port' upstream
     data rate has reached/dropped below or exceeded the low
     upstream rate threshold, specified by
     gBondPortConfThreshLowUpRate.

     This notification MAY be sent for the -O subtype ports
     while the port is up, on the crossing event in both
     directions: from normal (rate is above the threshold) to low
     (rate equals the threshold or below it) and from low to
     normal. This notification is not applicable to the -R
     subtypes.

     It is RECOMMENDED that a small debouncing period of 2.5 sec,
     between the detection of the condition and notification,
```

        is implemented to prevent simultaneous LinkUp/LinkDown and
        gBondLowUpRateCrossing notifications to be sent.

        The adaptive nature of the G.Bond technology allows the port
        to adapt itself to the changes in the copper environment,
        e.g., an impulse noise, alien crosstalk, or a
        micro-interruption may temporarily drop one or more BCEs in
        the aggregation group, causing a rate degradation of the
        aggregated G.Bond link. The dropped BCEs would then try to
        re-initialize, possibly at a lower rate than before, adjusting
        the rate to provide required target SNR margin.

        Generation of this notification is controlled by the
        gBondPortConfLowRateCrossingEnable object.

        This object maps to the TR-159 notification
        nGroupLowUpRateCrossing."
      REFERENCE
        "[TR-159] 5.5.1.24"
      ::= { gBondPortNotifications 1 }

    gBondLowDnRateCrossing NOTIFICATION-TYPE
      OBJECTS {
        -- ifIndex is not needed here since we are under specific GBS
        gBondPortStatDnDataRate,
        gBondPortConfThreshLowDnRate
      }
      STATUS   current
      DESCRIPTION
        "This notification indicates that the G.Bond port' downstream
        data rate has reached/dropped below or exceeded the low
        downstream rate threshold, specified by
        gBondPortConfThreshLowDnRate.

        This notification MAY be sent for the -O subtype ports
        while the port is up, on the crossing event in both
        directions: from normal (rate is above the threshold) to low
        (rate equals the threshold or below it) and from low to
        normal. This notification is not applicable to the -R
        subtypes.

        It is RECOMMENDED that a small debouncing period of 2.5 sec,
        between the detection of the condition and notification,
        is implemented to prevent simultaneous LinkUp/LinkDown and
        gBondLowDnRateCrossing notifications to be sent.

        The adaptive nature of the G.Bond technology allows the port
        to adapt itself to the changes in the copper environment,

       e.g., an impulse noise, alien crosstalk, or a
       micro-interruption may temporarily drop one or more BCEs in
       the aggregation group, causing a rate degradation of the
       aggregated G.Bond link. The dropped BCEs would then try to
       re-initialize, possibly at a lower rate than before,
       adjusting the rate to provide required target SNR margin.

       Generation of this notification is controlled by the
       gBondPortConfLowRateCrossingEnable object.

       This object maps to the TR-159 notification
       nGroupLowDownRateCrossing."
     REFERENCE
       "[TR-159] 5.5.1.25"
     ::= { gBondPortNotifications 2}

   gBondPmTca15MinESCrossing NOTIFICATION-TYPE
     OBJECTS {
       -- ifIndex is not needed here since we are under specific GBS
       gBondPortPmCur15MinES,
       gBondPortPmTcaProfileThresh15MinES
     }
     STATUS   current
     DESCRIPTION
       "This notification indicates that the Errored Seconds threshold,
       specified by gBondPortPmTcaProfileThresh15MinES, has been
       reached or exceeded for the GPS port.

       Generation of this notification is controlled by
       gBondPortConfPmTcaEnable and
       gBondPortPmTcaProfileThresh15MinES objects.

       This object maps to the TR-159 notification
       nGroupPerfTca15MinES."
     REFERENCE
       "[TR-159] 5.5.1.42"
     ::= { gBondPortNotifications 3}

   gBondPmTca15MinSESCrossing NOTIFICATION-TYPE
     OBJECTS {
       -- ifIndex is not needed here since we are under specific GBS
       gBondPortPmCur15MinSES,
       gBondPortPmTcaProfileThresh15MinSES
     }
     STATUS   current
     DESCRIPTION
       "This notification indicates that the Severely Errored Seconds
       threshold, specified by gBondPortPmTcaProfileThresh15MinSES,

      has been reached or exceeded for the GPS port.

      Generation of this notification is controlled by
      gBondPortConfPmTcaEnable and
      gBondPortPmTcaProfileThresh15MinSES objects.

      This object maps to the TR-159 notification
      nGroupPerfTca15MinSES."
    REFERENCE
      "[TR-159] 5.5.1.43"
    ::= { gBondPortNotifications 4}

  gBondPmTca15MinUASCrossing NOTIFICATION-TYPE
    OBJECTS {
      -- ifIndex is not needed here since we are under specific GBS
      gBondPortPmCur15MinUAS,
      gBondPortPmTcaProfileThresh15MinUAS
    }
    STATUS   current
    DESCRIPTION
      "This notification indicates that the Unavailable Seconds
      threshold, specified by gBondPortPmTcaProfileThresh15MinES,
      has been reached or exceeded for the GPS port.

      Generation of this notification is controlled by
      gBondPortConfPmTcaEnable and
      gBondPortPmTcaProfileThresh15MinUAS objects.

      This object maps to the TR-159 notification
      nGroupPerfTca15MinUAS."
    REFERENCE
      "[TR-159] 5.5.1.44"
    ::= { gBondPortNotifications 5}

  gBondPmTca1DayESCrossing NOTIFICATION-TYPE
    OBJECTS {
      -- ifIndex is not needed here since we are under specific GBS
      gBondPortPmCur1DayES,
      gBondPortPmTcaProfileThresh1DayES
    }
    STATUS   current
    DESCRIPTION
      "This notification indicates that the Errored Seconds threshold,
      specified by gBondPortPmTcaProfileThresh1DayES, has been
      reached or exceeded for the GPS port.

      Generation of this notification is controlled by
      gBondPortConfPmTcaEnable and

         gBondPortPmTcaProfileThresh1DayES objects.

         This object maps to the TR-159 notification
         nGroupPerfTca1DayES."
       REFERENCE
         "[TR-159] 5.5.1.54"
       ::= { gBondPortNotifications 6}

    gBondPmTca1DaySESCrossing NOTIFICATION-TYPE
       OBJECTS {
         -- ifIndex is not needed here since we are under specific GBS
         gBondPortPmCur1DaySES,
         gBondPortPmTcaProfileThresh1DaySES
       }
       STATUS   current
       DESCRIPTION
         "This notification indicates that the Severely Errored Seconds
         threshold, specified by gBondPortPmTcaProfileThresh1DaySES,
         has been reached or exceeded for the GPS port.

         Generation of this notification is controlled by
         gBondPortConfPmTcaEnable and
         gBondPortPmTcaProfileThresh1DaySES objects.

         This object maps to the TR-159 notification
         nGroupPerfTca1DaySES."
       REFERENCE
         "[TR-159] 5.5.1.55"
       ::= { gBondPortNotifications 7}

    gBondPmTca1DayUASCrossing NOTIFICATION-TYPE
       OBJECTS {
         -- ifIndex is not needed here since we are under specific GBS
         gBondPortPmCur1DayUAS,
         gBondPortPmTcaProfileThresh1DayUAS
       }
       STATUS   current
       DESCRIPTION
         "This notification indicates that the Unavailable Seconds
         threshold, specified by gBondPortPmTcaProfileThresh1DayUAS,
         has been reached or exceeded for the GPS port.

         Generation of this notification is controlled by
         gBondPortConfPmTcaEnable and
         gBondPortPmTcaProfileThresh1DayUAS objects.

         This object maps to the TR-159 notification
         nGroupPerfTca1DayUAS."

```
      REFERENCE
        "[TR-159] 5.5.1.56"
      ::= { gBondPortNotifications 8}

   -- G.Bond Port (GBS) group

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

   gBondPortConfEntry OBJECT-TYPE
      SYNTAX      GBondPortConfEntry
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
        "An entry in the G.Bond Port Configuration table.
         Each entry represents a G.Bond 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 ifIndex."
      INDEX  { ifIndex }
      ::= { gBondPortConfTable 1 }

   GBondPortConfEntry ::=
      SEQUENCE {
         gBondPortConfAdminScheme              GBondScheme,
         gBondPortConfPeerAdminScheme          GBondScheme,
         gBondPortConfDiscoveryCode            PhysAddress,
         gBondPortConfTargetUpDataRate         Unsigned32,
         gBondPortConfTargetDnDataRate         Unsigned32,
         gBondPortConfThreshLowUpRate          Unsigned32,
         gBondPortConfThreshLowDnRate          Unsigned32,
         gBondPortConfLowRateCrossingEnable    TruthValue,
         gBondPortConfPmTcaConfProfile         SnmpAdminString,
         gBondPortConfPmTcaEnable              TruthValue
      }

   gBondPortConfAdminScheme  OBJECT-TYPE
      SYNTAX      GBondScheme
      MAX-ACCESS  read-write
      STATUS      current
      DESCRIPTION
        "A desired bonding scheme for a G.Bond GBS port.
         The following values instruct the port to use corresponding
```

      bonding scheme if supported:
        g9981(1)   - instructs the port to use G.998.1 bonding
        g9982(2)   - instructs the port to use G.998.2 bonding
        g9983(3)   - instructs the port to use G.998.3 bonding

      Changing of gBondPortConfAdminScheme MUST be performed when the
      link is administratively 'down', as indicated by the
      ifAdminStatus object in IF-MIB.
      Attempts to change this object MUST be rejected (in case of SNMP
      with the error inconsistentValue), if the link is Up or
      Initializing. Attempts to change this object to an unsupported
      bonding scheme (see gBondPortCapSchemesSupported) SHALL be
      rejected (in case of SNMP with the error wrongValue).

      This object maps to the TR-159 attribute aGroupAdminBondScheme."
    REFERENCE
      "[TR-159] 5.5.1.6; IF-MIB, ifAdminStatus"
    ::= { gBondPortConfEntry 1 }

  gBondPortConfPeerAdminScheme OBJECT-TYPE
    SYNTAX   GBondScheme
    MAX-ACCESS read-write
    STATUS   current
    DESCRIPTION
      "A desired bonding scheme for a peer (link partner) G.Bond
      port (GBS).
      The following values instruct the peer port to use
      corresponding bonding scheme if supported:
        g9981(1)   - instructs the port to use G.998.1 bonding
        g9982(2)   - instructs the port to use G.998.2 bonding
        g9983(3)   - instructs the port to use G.998.3 bonding

      Changing of this object MUST be performed when the link is
      administratively 'down', as indicated by the ifAdminStatus
      object in IF-MIB.
      Attempts to change this object MUST be rejected (in case of SNMP
      with the error inconsistentValue), if the link is Up or
      Initializing. Attempts to change this object to an unsupported
      bonding scheme (see gBondPortCapPeerSchemesSupported) SHALL be
      rejected (in case of SNMP with the error wrongValue).

      This object maps to the TR-159 attribute
      aGroupPeerAdminBondScheme."
    REFERENCE
      "[TR-159] 5.5.1.7; IF-MIB, ifAdminStatus"
    ::= { gBondPortConfEntry 2 }

  gBondPortConfDiscoveryCode OBJECT-TYPE

```
      SYNTAX        PhysAddress (SIZE(6))
      MAX-ACCESS  read-write
      STATUS        current
      DESCRIPTION
        "A Discovery Code of the G.Bond port (GBS).
        A unique 6 octet long code used by the Discovery function.
        This object MUST be instantiated for the -O subtype GBS before
        writing operations on the gBondBceConfRemoteDiscoveryCode
        (Set_if_Clear and Clear_if_Same) are performed by BCEs
        associated with the GBS.
        The initial value of this object for -R subtype ports after
        reset is all zeroes. For -R subtype ports, the value of this
        object cannot be changed directly. This value may be changed
        as a result of writing operation on the
        gBondBceConfRemoteDiscoveryCode object of remote BCE of -O
        subtype, connected to one of the local BCEs associated with
        the GBS.

        Discovery MUST be performed when the link is administratively
        'down', as indicated by the ifAdminStatus object in IF-MIB.
        Attempts to change this object MUST be rejected (in case of
        SNMP with the error inconsistentValue), if the link is Up or
        Initializing.

        This object maps to the TR-159 attribute
        aGroupDiscoveryCode."
      REFERENCE
        "[TR-159] 5.5.1.20; [802.3] 61.2.2.8.3, 61.2.2.8.4,
        45.2.6.6.1, 45.2.6.8, 61A.2; IF-MIB, ifAdminStatus"
      ::= { gBondPortConfEntry 3 }

   gBondPortConfTargetUpDataRate  OBJECT-TYPE
      SYNTAX        Unsigned32(0|1..10000000)
      UNITS         "Kbps"
      MAX-ACCESS  read-write
      STATUS        current
      DESCRIPTION
        "A desired G.Bond port Data Rate in the upstream direction,
        in Kbps, to be achieved during initialization, under
        restrictions placed upon the member BCEs by their respective
        configuration settings.
        This object represents a sum of individual BCE upstream data
        rates, modified to compensate for fragmentation and
        encapsulation overhead (e.g., for an Ethernet service, the
        target data rate of 10Mbps SHALL allow lossless transmission
        of full-duplex 10Mbps Ethernet frame stream with minimal
        inter-frame gap).
        Note that the target upstream data rate may not be achieved
```

during initialization (e.g., due to unavailability of required
BCEs) or the initial bandwidth could deteriorate, so that the
actual upstream data rate (gBondPortStatUpDataRate) could be less
than gBondPortConfTargetUpDataRate.

The value is limited above by 10 Gbps, to accommodate very
high speed bonded xDSL interfaces (e.g. 32 x 100Mbps).

The value between 1 and 10000000 indicates that the total
upstream data rate of the G.Bond port after initialization
SHALL be equal to the target data rate or less, if the target
upstream data rate cannot be achieved under the restrictions
configured for BCEs. In case the copper environment allows to
achieve higher upstream data rate than that specified by this
object, the excess capability SHALL be either converted to
additional SNR margin or reclaimed by minimizing transmit
power.

The value of 0 means that the target data rate is not
fixed and SHALL be set to the maximum attainable rate during
initialization (Best Effort), under specified spectral
restrictions and with desired SNR Margin per BCE.

This object is read-write for the -O subtype G.Bond ports.
It is irrelevant for the -R subtypes - attempts to read or
change this object for such ports MUST be rejected (in case of
SNMP with the error inconsistentValue).

Changing of the Target Upstream Data Rate MUST be performed
when the link is administratively 'down', as indicated by the
ifAdminStatus object in IF-MIB.
Attempts to change this object MUST be rejected (in case of SNMP
with the error inconsistentValue), if the link is Up or
Initializing.

This object maps to the TR-159 attribute aGroupTargetUpRate."
  REFERENCE
    "[TR-159] 5.5.1.17; IF-MIB, ifAdminStatus"
  ::= { gBondPortConfEntry 4 }

gBondPortConfTargetDnDataRate   OBJECT-TYPE
  SYNTAX   Unsigned32(0|1..10000000)
  UNITS   "Kbps"
  MAX-ACCESS   read-write
  STATUS   current
  DESCRIPTION
    "A desired G.Bond port Data Rate in the downstream direction,
    in Kbps, to be achieved during initialization, under

restrictions placed upon the member BCEs by their respective
configuration settings.
This object represents a sum of individual BCE downstream data
rates, modified to compensate for fragmentation and
encapsulation overhead (e.g., for an Ethernet service, the
target data rate of 10Mbps SHALL allow lossless transmission
of full-duplex 10Mbps Ethernet frame stream with minimal
inter-frame gap).
Note that the target downstream data rate may not be achieved
during initialization (e.g., due to unavailability of required
BCEs) or the initial bandwidth could deteriorate, so that the
actual downstream data rate (gBondPortStatDnDataRate) could be
less than gBondPortConfTargetDnDataRate.

The value is limited above by 10 Gbps, to accommodate very
high speed bonded xDSL interfaces (e.g. 32 x 100Mbps).

The value between 1 and 10000000 indicates that the total
downstream data rate of the G.Bond port after initialization
SHALL be equal to the target data rate or less, if the target
downstream data rate cannot be achieved under the restrictions
configured for BCEs. In case the copper environment allows to
achieve higher downstream data rate than that specified by
this object, the excess capability SHALL be either converted
to additional SNR margin or reclaimed by minimizing transmit
power.

The value of 0 means that the target data rate is not
fixed and SHALL be set to the maximum attainable rate during
initialization (Best Effort), under specified spectral
restrictions and with desired SNR Margin per BCE.

This object is read-write for the -O subtype G.Bond ports.
It is irrelevant for the -R subtypes - attempts to read or
change this object for such ports MUST be rejected (in case of
SNMP with the error inconsistentValue).

Changing of the Target Downstream Data Rate MUST be performed
when the link is administratively 'down', as indicated by the
ifAdminStatus object in IF-MIB.
Attempts to change this object MUST be rejected (in case of SNMP
with the error inconsistentValue), if the link is Up or
Initializing.

This object maps to the TR-159 attribute aGroupTargetDownRate."
REFERENCE
   "[TR-159] 5.5.1.18; IF-MIB, ifAdminStatus"
::= { gBondPortConfEntry 5 }

```
   gBondPortConfThreshLowUpRate  OBJECT-TYPE
     SYNTAX      Unsigned32(1..10000000)
     UNITS       "Kbps"
     MAX-ACCESS  read-write
     STATUS      current
     DESCRIPTION
       "This object configures the G.Bond port low upstream rate
       crossing alarm threshold. When the current value of
       gBondPortStatUpDataRate for this port reaches/drops below or
       exceeds this threshold, a gBondLowUpRateCrossing notification
       MAY be generated if enabled by
       gBondPortConfLowRateCrossingEnable.

       This object is read-write for the -O subtype G.Bond ports.
       It is irrelevant for the -R subtypes - attempts to read or
       change this object for such ports MUST be rejected (in case of
       SNMP with the error inconsistentValue).

       This object maps to the TR-159 attribute
       aGroupthreshLowUpRate."
     REFERENCE
       "[TR-159] 5.5.1.21"
     ::= { gBondPortConfEntry 6 }

   gBondPortConfThreshLowDnRate  OBJECT-TYPE
     SYNTAX      Unsigned32(1..10000000)
     UNITS       "Kbps"
     MAX-ACCESS  read-write
     STATUS      current
     DESCRIPTION
       "This object configures the G.Bond port low downstream rate
       crossing alarm threshold. When the current value of
       gBondPortStatDnDataRate for this port reaches/drops below or
       exceeds this threshold, a gBondLowDnRateCrossing notification
       MAY be generated if enabled by
       gBondPortConfLowRateCrossingEnable.

       This object is read-write for the -O subtype G.Bond ports.
       It is irrelevant for the -R subtypes - attempts to read or
       change this object for such ports MUST be rejected (in case of
       SNMP with the error inconsistentValue).

       This object maps to the TR-159 attribute
       aGroupThreshDownUpRate."
     REFERENCE
       "[TR-159] 5.5.1.22"
     ::= { gBondPortConfEntry 7 }
```

    gBondPortConfLowRateCrossingEnable OBJECT-TYPE
      SYNTAX   TruthValue
      MAX-ACCESS read-write
      STATUS   current
      DESCRIPTION
        "Indicates whether gBondLowUpRateCrossing and
        gBondLowDnRateCrossing notifications should be generated
        for this interface.

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

        This object is read-write for the -O subtype G.Bond ports.
        It is irrelevant for the -R subtypes - attempts to read or
        change this object for such ports MUST be rejected (in case of
        SNMP with the error inconsistentValue).

        This object maps to the TR-159 attribute
        aGroupLowRateCrossingEnable."
      REFERENCE
        "[TR-159] 5.5.1.23"
      ::= { gBondPortConfEntry 8 }

    gBondPortConfPmTcaConfProfile OBJECT-TYPE
      SYNTAX   SnmpAdminString (SIZE(1..32))
      MAX-ACCESS read-write
      STATUS   current
      DESCRIPTION
        "The value of this object is the index of the row in the GBS
        port Alarm Configuration Profile Table for Performance Monitoring
        Threshold Crossing Alerts - gBondPortAlarmConfProfileTable,
        which applies to this GBS port."
      DEFVAL { "DEFVAL" }
      ::= { gBondPortConfEntry 9 }

    gBondPortConfPmTcaEnable OBJECT-TYPE
      SYNTAX   TruthValue
      MAX-ACCESS read-write
      STATUS   current
      DESCRIPTION
        "Indicates whether gBondPerfTca*Crossing set of notifications
        should be generated for this interface.

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

        This object maps to the TR-159 attribute aGroupPerfTcaEnable."

```
      REFERENCE
        "[TR-159] 5.5.1.38"
      ::= { gBondPortConfEntry 10 }


   gBondPortCapTable OBJECT-TYPE
      SYNTAX      SEQUENCE OF GBondPortCapEntry
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
        "Table for capabilities of G.Bond Ports. Entries in this table
        MUST be maintained in a persistent manner"
      ::= { gBondPort 2 }

   gBondPortCapEntry OBJECT-TYPE
      SYNTAX      GBondPortCapEntry
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
        "An entry in the G.Bond Port Capability table.
        Each entry represents a G.Bond 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 ifIndex."
      INDEX  { ifIndex }
      ::= { gBondPortCapTable 1 }

   GBondPortCapEntry ::=
      SEQUENCE {
        gBondPortCapSchemesSupported          GBondSchemeList,
        gBondPortCapPeerSchemesSupported      GBondSchemeList,
        gBondPortCapCapacity                  Unsigned32,
        gBondPortCapPeerCapacity              Unsigned32
      }

   gBondPortCapSchemesSupported          OBJECT-TYPE
      SYNTAX      GBondSchemeList
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "Bonding Capability of the G.Bond port (GBS). This is a
        read-only bitmap of the possible bonding schemes supported by
        the GBS. The various bit-positions are:
          g9981(1)      - GBS is capable of G.998.1 bonding
          g9982(2)      - GBS is capable of G.998.2 bonding
          g9983(3)      - GBS is capable of G.998.3 bonding

        Note that for ports supporting multiple bonding schemes the
        actual administrative scheme is set via gBondPortConfAdminScheme
```

      object. The current operating bonding scheme is reflected in
      the gBondPortStatOperScheme.

      This object maps to the TR-159 attribute
      aGroupBondSchemesSupported."
    REFERENCE
      "[TR-159] 5.5.1.2"
    ::= { gBondPortCapEntry 1 }

  gBondPortCapPeerSchemesSupported OBJECT-TYPE
    SYNTAX   GBondSchemeList
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
      "Bonding Capability of the peer G.Bond port (GBS). This is a
      read-only bitmap of the possible bonding schemes supported by
      the link partner GBS. The various bit-positions are:
        unknown(0)   - GBS does not support bonding or
                        the peer unit could not be reached.
        g9981(1)   - GBS is capable of G.998.1 bonding
        g9982(2)   - GBS is capable of G.998.2 bonding
        g9983(3)   - GBS is capable of G.998.3 bonding

      Note that for ports supporting multiple bonding schemes the
      actual administrative scheme is set via
      gBondPortConfPeerAdminScheme object. The current operating
      bonding scheme is reflected in the gBondPortStatPeerOperScheme.

      This object maps to the TR-159 attribute
      aGroupBondPeerSchemesSupported."
    REFERENCE
      "[TR-159] 5.5.1.3"
    ::= { gBondPortCapEntry 2 }

  gBondPortCapCapacity OBJECT-TYPE
    SYNTAX   Unsigned32 (1..32)
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
      "Number of BCEs that can be aggregated by the local GBS.
      The number of BCEs currently assigned to a particular G.Bond
      port (gBondPortStatNumBCEs) is never greater than
      gBondPortCapCapacity.

      This object maps to the TR-159 attribute aGroupCapacity."
    REFERENCE
      "[TR-159] 5.5.1.12"
    ::= { gBondPortCapEntry 3 }

   gBondPortCapPeerCapacity OBJECT-TYPE
     SYNTAX   Unsigned32 (0|1..32)
     MAX-ACCESS   read-only
     STATUS   current
     DESCRIPTION
       "Number of BCEs that can be aggregated by the peer GBS port.
       Value of 0 is returned when peer Bonding Capacity is unknown
       (peer cannot be reached).

       This object maps to the TR-159 attribute aGroupPeerCapacity."
     REFERENCE
       "[TR-159] 5.5.1.13"
     ::= { gBondPortCapEntry 4 }

   gBondPortStatTable OBJECT-TYPE
     SYNTAX   SEQUENCE OF GBondPortStatEntry
     MAX-ACCESS   not-accessible
     STATUS   current
     DESCRIPTION
       "This table provides overall status information of G.Bond
       ports, complementing the generic status information from the
       ifTable of IF-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."
     ::= { gBondPort 3 }

   gBondPortStatEntry OBJECT-TYPE
     SYNTAX   GBondPortStatEntry
     MAX-ACCESS   not-accessible
     STATUS   current
     DESCRIPTION
       "An entry in the G.Bond Port Status table.
       Each entry represents a G.Bond 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 ifIndex."
     INDEX { ifIndex }
     ::= { gBondPortStatTable 1 }

   GBondPortStatEntry ::=
     SEQUENCE {
       gBondPortStatOperScheme   GBondScheme,
       gBondPortStatPeerOperScheme   GBondScheme,
       gBondPortStatUpDataRate   Gauge32,
       gBondPortStatDnDataRate   Gauge32,
       gBondPortStatFltStatus   BITS,

```
        gBondPortStatSide                       INTEGER,
        gBondPortStatNumBCEs                    Unsigned32
      }

   gBondPortStatOperScheme  OBJECT-TYPE
     SYNTAX      GBondScheme
     MAX-ACCESS  read-only
     STATUS      current
     DESCRIPTION
       "Current operating bonding scheme of a G.Bond port.
       The possible values are:
         g9981(1)      - G.998.1 bonding
         g9982(2)      - G.998.2 bonding
         g9983(3)      - G.998.3 bonding

       This object maps to the TR-159 attribute
       aGroupOperBondScheme."
     REFERENCE
       "[TR-159] 5.5.1.4"
     ::= { gBondPortStatEntry 1 }

   gBondPortStatPeerOperScheme  OBJECT-TYPE
     SYNTAX      GBondScheme
     MAX-ACCESS  read-only
     STATUS      current
     DESCRIPTION
       "Current operating bonding scheme of a G.Bond port link partner.
       The possible values are:
         unknown(0)    - peer cannot be reached due to the link state
         g9981(1)      - G.998.1 bonding
         g9982(2)      - G.998.2 bonding
         g9983(3)      - G.998.3 bonding

       This object maps to the TR-159 attribute
       aGroupPeerOperBondScheme."
     REFERENCE
       "[TR-159] 5.5.1.5"
     ::= { gBondPortStatEntry 2 }

   gBondPortStatUpDataRate  OBJECT-TYPE
     SYNTAX      Gauge32
     UNITS       "bps"
     MAX-ACCESS  read-only
     STATUS      current
     DESCRIPTION
       "A current G.Bond port operational Data Rate in the upstream
       direction, in bps.
       This object represents an estimation of the sum of individual
```

      BCE upstream data rates, modified to compensate for
      fragmentation and encapsulation overhead (e.g., for an
      Ethernet service, the target data rate of 10Mbps SHALL allow
      lossless transmission of full-duplex 10Mbps Ethernet frame
      stream with minimal inter-frame gap).

      Note that for symmetrical interfaces gBondPortStatUpDataRate ==
      gBondPortStatDnDataRate == ifSpeed.

      This object maps to the TR-159 attribute aGroupUpRate."
    REFERENCE
      "[TR-159] 5.5.1.15"
    ::= { gBondPortStatEntry 3 }

  gBondPortStatDnDataRate   OBJECT-TYPE
    SYNTAX   Gauge32
    UNITS   "bps"
    MAX-ACCESS   read-only
    STATUS   current
    DESCRIPTION
      "A current G.Bond port operational Data Rate in the downstream
      direction, in bps.
      This object represents an estimation of the sum of individual
      BCE downstream data rates, modified to compensate for
      fragmentation and encapsulation overhead (e.g., for an
      Ethernet service, the target data rate of 10Mbps SHALL allow
      lossless transmission of full-duplex 10Mbps Ethernet frame
      stream with minimal inter-frame gap).

      Note that for symmetrical interfaces gBondPortStatUpDataRate ==
      gBondPortStatDnDataRate == ifSpeed.

      This object maps to the TR-159 attribute aGroupDownRate."
    REFERENCE
      "[TR-159] 5.5.1.16"
    ::= { gBondPortStatEntry 4 }

  gBondPortStatFltStatus   OBJECT-TYPE
    SYNTAX   BITS {
      noPeer(0),
      peerPowerLoss(1),
      peerBondSchemeMismatch(2),
      bceSubTypeMismatch(3),
      lowRate(4),
      init(5),
      ready(6)
    }

```
     MAX-ACCESS  read-only
     STATUS      current
     DESCRIPTION
       "G.Bond (GBS) port Fault Status. This is a bitmap of possible
       conditions. The various bit positions are:
         noPeer                - peer GBS cannot be reached (e.g.,
                                 no BCEs attached, all BCEs are Down
                                 etc.).
         peerPowerLoss         - peer GBS has indicated impending unit
                                 failure due to loss of local power
                                 ('Dying Gasp').
         peerBondSchemeMismatch - operating bonding scheme of a peer
                                 GBS is different from the local one.
         bceSubTypeMismatch    - local BCEs in the aggregation group
                                 are not of the same sub-type, e.g.,
                                 some BCEs in the local device are -O
                                 while others are -R subtype.
         lowRate               - gBondUpRate/gBondDnRate of the port
                                 has reached or dropped below
                                 gBondPortConfThreshLowUpRate/
                                 gBondPortConfThreshLowDnRate.
         init                  - The link is Initializing, as a result of
                                 ifAdminStatus being set to 'up' for a
                                 particular BCE or a GBS to which the BCE
                                 is connected.
         ready                 - at least one BCE in the aggregation
                                 group is detecting handshake tones.

     This object is intended to supplement ifOperStatus object
     in IF-MIB.

     This object maps to the TR-159 attribute aGroupStatus."
     REFERENCE
       "[TR-159] 5.5.1.9; IF-MIB, ifOperStatus"
     ::= { gBondPortStatEntry 5 }

   gBondPortStatSide  OBJECT-TYPE
     SYNTAX       INTEGER {
       subscriber(1),
       office(2),
       unknown(3)
     }
     MAX-ACCESS  read-only
     STATUS      current
     DESCRIPTION
       "G.Bond port mode of operation (subtype).
       The value of 'subscriber' indicates the port is designated as
       '-R' subtype (all BCEs assigned to this port are of subtype
```

```
   '-R').
   The value of the 'office' indicates that the port is
   designated as '-O' subtype (all BCEs assigned to this port are
   of subtype '-O').
   The value of 'unknown' indicates that the port has no assigned
   BCEs yet or that the assigned BCEs are not of the same side
   (subTypeBCEMismatch).

   This object maps to the TR-159 attribute aGroupEnd."
 REFERENCE
   "[TR-159] 5.5.1.11"
 ::= { gBondPortStatEntry 6 }

gBondPortStatNumBCEs  OBJECT-TYPE
 SYNTAX       Unsigned32 (0..32)
 MAX-ACCESS   read-only
 STATUS       current
 DESCRIPTION
   "Number of BCEs that is currently aggregated by the local GBS
   (assigned to the G.Bond port using ifStackTable).
   This number is never greater than gBondPortCapCapacity.

   This object SHALL be automatically incremented or decremented
   when a BCE is added or deleted to/from the G.Bond port using
   ifStackTable.

   This object maps to the TR-159 attribute aGroupNumChannels"
 REFERENCE
   "[TR-159] 5.5.1.14"
 ::= { gBondPortStatEntry 7 }


-- Performance Monitoring group

gBondPortPM   OBJECT IDENTIFIER ::= { gBondPort 4 }

gBondPortPmCurTable OBJECT-TYPE
 SYNTAX       SEQUENCE OF GBondPortPmCurEntry
 MAX-ACCESS   not-accessible
 STATUS       current
 DESCRIPTION
   "This table contains current Performance Monitoring (PM)
   information for a GBS port. This table contains live data from
   the equipment and as such is NOT persistent."
 ::= { gBondPortPM 1 }

gBondPortPmCurEntry OBJECT-TYPE
 SYNTAX       GBondPortPmCurEntry
```

```
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
        "An entry in the G.Bond Port PM table.
        Each entry represents a G.Bond 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 ifIndex."
      INDEX  { ifIndex }
      ::= { gBondPortPmCurTable 1 }

   GBondPortPmCurEntry ::=
      SEQUENCE {
        gBondPortPmCurES                    HCPerfTotalCount,
        gBondPortPmCurSES                   HCPerfTotalCount,
        gBondPortPmCurUAS                   HCPerfTotalCount,
        gBondPortPmCur15MinValidIntervals   HCPerfValidIntervals,
        gBondPortPmCur15MinInvalidIntervals HCPerfInvalidIntervals,
        gBondPortPmCur15MinTimeElapsed      HCPerfTimeElapsed,
        gBondPortPmCur15MinES               HCPerfCurrentCount,
        gBondPortPmCur15MinSES              HCPerfCurrentCount,
        gBondPortPmCur15MinUAS              HCPerfCurrentCount,
        gBondPortPmCur1DayValidIntervals    Unsigned32,
        gBondPortPmCur1DayInvalidIntervals  Unsigned32,
        gBondPortPmCur1DayTimeElapsed       HCPerfTimeElapsed,
        gBondPortPmCur1DayES                HCPerfCurrentCount,
        gBondPortPmCur1DaySES               HCPerfCurrentCount,
        gBondPortPmCur1DayUAS               HCPerfCurrentCount
      }

   gBondPortPmCurES  OBJECT-TYPE
      SYNTAX      HCPerfTotalCount
      UNITS       "seconds"
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
        "A count of Errored Seconds (ES) on the GBS since the BTU was
        last restarted.

        An Errored Second for a G.998.x interface is defined as a count
        of 1-second intervals during which one or more GBS errors are
        declared. The errors are specific for each bonding scheme, e.g.
           - lost cells for the ATM bonding;
           - lost or discarded (due to an error or a buffer overflow)
             fragments for the Ethernet bonding;
           - CRC4, CRC6 or CRC8 errors for the TDIM bonding
        This object is inhibited during Unavailable Seconds (UAS).

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

       REFERENCE
         "[TR-159] 5.5.1.29"
       ::= { gBondPortPmCurEntry 1 }

    gBondPortPmCurSES OBJECT-TYPE
       SYNTAX   HCPerfTotalCount
       UNITS   "seconds"
       MAX-ACCESS   read-only
       STATUS   current
       DESCRIPTION
         "A count of Severely Errored Seconds (SES) on the GBS since the
         BTU was last restarted.

         A Severely Errored Second for a G.998.x interface is defined as
         a count of 1-second intervals during which GBS errors cause at
         least 1% traffic loss of the nominal bonded link rate or at
         least 12ms for the TDM traffic. The exact definition is specific
         for each bonding scheme, e.g.
            - 234 lost cells for the ATM bonding with 10Mbps nominal link
              rate
            - 60 lost/discarded fragments for the Ethernet bonding with
              10Mbps nominal link rate and fixed 192 Byte-long fragment
              size.
            - 6 or more CRC4, one or more CRC6 or one or more CRC8 errors
              for the TDM bonding
         This object is inhibited during Unavailable Seconds (UAS).

         This object maps to the TR-159 attribute aGroupPerfSES."
       REFERENCE
         "[TR-159] 5.5.1.30"
       ::= { gBondPortPmCurEntry 2 }

    gBondPortPmCurUAS OBJECT-TYPE
       SYNTAX   HCPerfTotalCount
       UNITS   "seconds"
       MAX-ACCESS   read-only
       STATUS   current
       DESCRIPTION
         "A count of Unavailable Seconds (UAS) on the GBS since the BTU
         was last restarted.

         An Unavailable Second for a G.998.x interface is defined as a
         count of 1-second intervals during which the bonded link is
         unavailable. The G.998.x link becomes unavailable at the onset
         of 10 contiguous SESs. The 10 SESs are included in the
         unavailable time. Once unavailable, the G.998.x line becomes
         available at the onset of 10 contiguous seconds with no SESs.
         The 10 seconds with no SESs are excluded from unavailable time.

       This object maps to the TR-159 attribute aGroupPerfUAS."
     REFERENCE
       "[TR-159] 5.5.1.31"
     ::= { gBondPortPmCurEntry 3 }

   gBondPortPmCur15MinValidIntervals OBJECT-TYPE
     SYNTAX   HCPerfValidIntervals
     MAX-ACCESS read-only
     STATUS   current
     DESCRIPTION
       "A number of 15-minute intervals for which 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 minutes 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 maps to the TR-159 attribute
       aGroupPerf15MinValidIntervals."
     REFERENCE
       "[TR-159] 5.5.1.32"
     ::= { gBondPortPmCurEntry 4 }

   gBondPortPmCur15MinInvalidIntervals OBJECT-TYPE
     SYNTAX   HCPerfInvalidIntervals
     MAX-ACCESS read-only
     STATUS   current
     DESCRIPTION
       "A number of 15-minute 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.

       This object maps to the TR-159 attribute
       aGroupPerf15MinInvalidIntervals."
     REFERENCE
       "[TR-159] 5.5.1.33"
     ::= { gBondPortPmCurEntry 5 }

   gBondPortPmCur15MinTimeElapsed OBJECT-TYPE
     SYNTAX   HCPerfTimeElapsed
     UNITS   "seconds"
     MAX-ACCESS read-only
     STATUS   current
     DESCRIPTION
       "A count of seconds that have elapsed since the beginning of the

      current 15-minute performance interval.

      This object maps to the TR-159 attribute
      aGroupPerfCurr15MinTimeElapsed."
    REFERENCE
      "[TR-159] 5.5.1.34"
    ::= { gBondPortPmCurEntry 6 }

  gBondPortPmCur15MinES OBJECT-TYPE
    SYNTAX   HCPerfCurrentCount
    UNITS   "seconds"
    MAX-ACCESS   read-only
    STATUS   current
    DESCRIPTION
      "A count of Errored Seconds (ES) on the GBS in the current
      15-minute performance interval.

      This object maps to the TR-159 attribute aGroupPerfCurr15MinES."
    REFERENCE
      "[TR-159] 5.5.1.35"
    ::= { gBondPortPmCurEntry 7 }

  gBondPortPmCur15MinSES OBJECT-TYPE
    SYNTAX   HCPerfCurrentCount
    UNITS   "seconds"
    MAX-ACCESS   read-only
    STATUS   current
    DESCRIPTION
      "A count of Severely Errored Seconds (ES) on the GBS in the
      current 15-minute performance interval.

      This object maps to the TR-159 attribute aGroupPerfCurr15MinSES."
    REFERENCE
      "[TR-159] 5.5.1.36"
    ::= { gBondPortPmCurEntry 8 }

  gBondPortPmCur15MinUAS OBJECT-TYPE
    SYNTAX   HCPerfCurrentCount
    UNITS   "seconds"
    MAX-ACCESS   read-only
    STATUS   current
    DESCRIPTION
      "A count of Unavailable Seconds (UAS) on the GBS in the current
      15-minute performance interval.

      This object maps to the TR-159 attribute aGroupPerfCurr15MinUAS."
    REFERENCE
      "[TR-159] 5.5.1.37"

```
      ::= { gBondPortPmCurEntry 9 }

   gBondPortPmCur1DayValidIntervals  OBJECT-TYPE
     SYNTAX       Unsigned32 (0..7)
     UNITS        "days"
     MAX-ACCESS   read-only
     STATUS       current
     DESCRIPTION
       "A 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.

       This object maps to the TR-159 attribute
       aGroupPerf1DayValidIntervals."
     REFERENCE
       "[TR-159] 5.5.1.45"
     ::= { gBondPortPmCurEntry 10 }

   gBondPortPmCur1DayInvalidIntervals  OBJECT-TYPE
     SYNTAX       Unsigned32 (0..7)
     UNITS        "days"
     MAX-ACCESS   read-only
     STATUS       current
     DESCRIPTION
       "A 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.

       This object maps to the TR-159 attribute
       aGroupPerf1DayInvalidIntervals."
     REFERENCE
       "[TR-159] 5.5.1.46"
     ::= { gBondPortPmCurEntry 11 }

   gBondPortPmCur1DayTimeElapsed  OBJECT-TYPE
     SYNTAX       HCPerfTimeElapsed
     UNITS        "seconds"
     MAX-ACCESS   read-only
     STATUS       current
     DESCRIPTION
       "A count of seconds that have elapsed since the beginning of
       the current 1-day performance interval.
```

      This object maps to the TR-159 attribute
      aGroupPerfCurr1DayTimeElapsed."
    REFERENCE
      "[TR-159] 5.5.1.47"
    ::= { gBondPortPmCurEntry 12 }

  gBondPortPmCur1DayES OBJECT-TYPE
    SYNTAX   HCPerfCurrentCount
    UNITS   "seconds"
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
      "A count of Errored Seconds (ES) on the GBS in the current 1-day
      performance interval.

      This object maps to the TR-159 attribute aGroupPerfCurr1DayES."
    REFERENCE
      "[TR-159] 5.5.1.48"
    ::= { gBondPortPmCurEntry 13 }

  gBondPortPmCur1DaySES OBJECT-TYPE
    SYNTAX   HCPerfCurrentCount
    UNITS   "seconds"
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
      "A count of Severely Errored Seconds (ES) on the GBS in the
      current 1-day performance interval.

      This object maps to the TR-159 attribute aGroupPerfCurr1DaySES."
    REFERENCE
      "[TR-159] 5.5.1.49"
    ::= { gBondPortPmCurEntry 14 }

  gBondPortPmCur1DayUAS OBJECT-TYPE
    SYNTAX   HCPerfCurrentCount
    UNITS   "seconds"
    MAX-ACCESS read-only
    STATUS   current
    DESCRIPTION
      "A count of Unavailable Seconds (UAS) on the GBS in the current
      1-day performance interval.

      This object maps to the TR-159 attribute aGroupPerfCurr1DayUAS."
    REFERENCE
      "[TR-159] 5.5.1.50"
    ::= { gBondPortPmCurEntry 15 }

    -- PM history: 15-min buckets

    gBondPortPm15MinTable OBJECT-TYPE
      SYNTAX   SEQUENCE OF GBondPortPm15MinEntry
      MAX-ACCESS not-accessible
      STATUS   current
      DESCRIPTION
        "This table contains historical 15-minute buckets of Performance
        Monitoring information for a GBS port (a row for each 15-minute
        interval, up to 96 intervals).
        Entries in this table MUST be maintained in a persistent manner."
      ::= { gBondPortPM 2 }

    gBondPortPm15MinEntry OBJECT-TYPE
      SYNTAX   GBondPortPm15MinEntry
      MAX-ACCESS not-accessible
      STATUS   current
      DESCRIPTION
        "An entry in the G.Bond Port historical 15-minute PM table.
        Each entry represents performance monitoring data for a GBS port,
        indexed by ifIndex, collected during a particular 15-minute
        interval, indexed by gBondPortPm15MinIntervalIndex."
      INDEX { ifIndex, gBondPortPm15MinIntervalIndex }
      ::= { gBondPortPm15MinTable 1 }

    GBondPortPm15MinEntry ::=
      SEQUENCE {
        gBondPortPm15MinIntervalIndex   Unsigned32,
        gBondPortPm15MinIntervalMoniTime   HCPerfTimeElapsed,
        gBondPortPm15MinIntervalES   HCPerfIntervalCount,
        gBondPortPm15MinIntervalSES   HCPerfIntervalCount,
        gBondPortPm15MinIntervalUAS   HCPerfIntervalCount,
        gBondPortPm15MinIntervalValid   TruthValue
      }

    gBondPortPm15MinIntervalIndex 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 maps to the TR-159 attribute
        aGroupPerf15MinIntervalNumber."
      REFERENCE
        "[TR-159] 5.5.1.57"

```
     ::= { gBondPortPm15MinEntry 1 }

  gBondPortPm15MinIntervalMoniTime  OBJECT-TYPE
    SYNTAX       HCPerfTimeElapsed
    UNITS        "seconds"
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
      "A 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."
    ::= { gBondPortPm15MinEntry 2 }

  gBondPortPm15MinIntervalES  OBJECT-TYPE
    SYNTAX       HCPerfIntervalCount
    UNITS        "seconds"
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
      "A count of Errored Seconds (ES) on the GBS in the 15-minute
      performance history interval.

      This object maps to the TR-159 attribute
      aGroupPerf15MinIntervalES."
    REFERENCE
      "[TR-159] 5.5.1.59"
    ::= { gBondPortPm15MinEntry 3 }

  gBondPortPm15MinIntervalSES  OBJECT-TYPE
    SYNTAX       HCPerfIntervalCount
    UNITS        "seconds"
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
      "A count of Severely Errored Seconds (ES) on the GBS in the
      15-minute performance history interval.

      This object maps to the TR-159 attribute
      aGroupPerf15MinIntervalSES."
    REFERENCE
      "[TR-159] 5.5.1.60"
    ::= { gBondPortPm15MinEntry 4 }

  gBondPortPm15MinIntervalUAS  OBJECT-TYPE
    SYNTAX       HCPerfIntervalCount
    UNITS        "seconds"
    MAX-ACCESS   read-only
```

```
         STATUS       current
         DESCRIPTION
           "A count of Unavailable Seconds (UAS) on the GBS in the current
           15-minute performance interval.

           This object maps to the TR-159 attribute aGroupPerfCurr15MinUAS."
         REFERENCE
           "[TR-159] 5.5.1.61"
         ::= { gBondPortPm15MinEntry 5 }

      gBondPortPm15MinIntervalValid  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. Valid bucket is reported as true(1)
           and 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 data base. In such case this object is
           not required as only valid history buckets are available while
           invalid history buckets are simply not in the data base.

           This object maps to the TR-159 attribute
           aGroupPerf15MinIntervalValid."
         REFERENCE
           "[TR-159] 5.5.1.58"
         ::= { gBondPortPm15MinEntry 6 }

      -- PM history: 1-day buckets

      gBondPortPm1DayTable OBJECT-TYPE
         SYNTAX       SEQUENCE OF GBondPortPm1DayEntry
         MAX-ACCESS  not-accessible
         STATUS       current
         DESCRIPTION
           "This table contains historical 1-day buckets of Performance
           Monitoring information for a GBS port (a row for each 1-day
           interval, up to 7 intervals).
           Entries in this table MUST be maintained in a persistent manner."
         ::= { gBondPortPM 3 }

      gBondPortPm1DayEntry OBJECT-TYPE
         SYNTAX       GBondPortPm1DayEntry
         MAX-ACCESS  not-accessible
```

```
      STATUS       current
      DESCRIPTION
        "An entry in the G.Bond Port historical 1-day PM table.
        Each entry represents performance monitoring data for a GBS port,
        indexed by ifIndex, collected during a particular 1-day
        interval, indexed by gBondPortPm1DayIntervalIndex."
      INDEX  { ifIndex, gBondPortPm1DayIntervalIndex }
      ::= { gBondPortPm1DayTable 1 }

   GBondPortPm1DayEntry ::=
     SEQUENCE {
       gBondPortPm1DayIntervalIndex         Unsigned32,
       gBondPortPm1DayIntervalMoniTime      HCPerfTimeElapsed,
       gBondPortPm1DayIntervalES            HCPerfIntervalCount,
       gBondPortPm1DayIntervalSES           HCPerfIntervalCount,
       gBondPortPm1DayIntervalUAS           HCPerfIntervalCount,
       gBondPortPm1DayIntervalValid         TruthValue
     }

   gBondPortPm1DayIntervalIndex  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 maps to the TR-159 attribute
       aGroupPerf1DayIntervalNumber."
     REFERENCE
       "[TR-159] 5.5.1.62"
     ::= { gBondPortPm1DayEntry 1 }

   gBondPortPm1DayIntervalMoniTime  OBJECT-TYPE
     SYNTAX       HCPerfTimeElapsed
     UNITS        "seconds"
     MAX-ACCESS  read-only
     STATUS       current
     DESCRIPTION
       "A 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 maps to the TR-159 attribute
       aGroupPerf1DayIntervalMoniSecs."
     REFERENCE
```

         "[TR-159] 5.5.1.64"
       ::= { gBondPortPm1DayEntry 2 }

    gBondPortPm1DayIntervalES OBJECT-TYPE
       SYNTAX   HCPerfIntervalCount
       UNITS   "seconds"
       MAX-ACCESS   read-only
       STATUS   current
       DESCRIPTION
         "A count of Errored Seconds (ES) on the GBS in the 1-day
         performance history interval.

         This object maps to the TR-159 attribute
         aGroupPerf1DayIntervalES."
       REFERENCE
         "[TR-159] 5.5.1.65"
       ::= { gBondPortPm1DayEntry 3 }

    gBondPortPm1DayIntervalSES OBJECT-TYPE
       SYNTAX   HCPerfIntervalCount
       UNITS   "seconds"
       MAX-ACCESS   read-only
       STATUS   current
       DESCRIPTION
         "A count of Severely Errored Seconds (ES) on the GBS in the
         1-day performance history interval.

         This object maps to the TR-159 attribute
         aGroupPerf1DayIntervalSES."
       REFERENCE
         "[TR-159] 5.5.1.66"
       ::= { gBondPortPm1DayEntry 4 }

    gBondPortPm1DayIntervalUAS OBJECT-TYPE
       SYNTAX   HCPerfIntervalCount
       UNITS   "seconds"
       MAX-ACCESS   read-only
       STATUS   current
       DESCRIPTION
         "A count of Unavailable Seconds (UAS) on the GBS in the current
         1-day performance interval.

         This object maps to the TR-159 attribute aGroupPerfCurr1DayUAS."
       REFERENCE
         "[TR-159] 5.5.1.67"
       ::= { gBondPortPm1DayEntry 5 }

    gBondPortPm1DayIntervalValid 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. Valid bucket is reported as true(1)
     and 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 data base. In such case this object is
     not required as only valid history buckets are available while
     invalid history buckets are simply not in the data base.

     This object maps to the TR-159 attribute
     aGroupPerf1DayIntervalValid."
   REFERENCE
     "[TR-159] 5.5.1.63"
   ::= { gBondPortPm1DayEntry 6 }


-- Performance Monitoring TCA Configuration profile

gBondPortPmTcaProfileTable OBJECT-TYPE
   SYNTAX       SEQUENCE OF GBondPortPmTcaProfileEntry
   MAX-ACCESS   not-accessible
   STATUS       current
   DESCRIPTION
     "This table supports definitions of Performance Monitoring (PM)
     Threshold Crossing Alerts (TCA) configuration profiles for GBS
     ports.
     Entries in this table MUST be maintained in a persistent manner."
   ::= { gBondPortPM 4 }

gBondPortPmTcaProfileEntry OBJECT-TYPE
   SYNTAX       GBondPortPmTcaProfileEntry
   MAX-ACCESS   not-accessible
   STATUS       current
   DESCRIPTION
     "An entry in the GBS PM TCA Configuration table.
      Each entry corresponds to a single TCA configuration profile.
      Each profile contains a set of parameters for setting alarm
      thresholds for various performance attributes monitored at GBS
      ports.  Profiles may be created/deleted using the row
      creation/deletion mechanism via
      gBondPortPmTcaProfileRowStatus. If an active entry is
      referenced via gBondPortConfPmTcaConfProfile, the entry MUST
```

```
      remain active until all references are removed.
      A default profile with an index of 'DEFVAL', will always exist
      and its parameters will be set to vendor specific values,
      unless otherwise specified in this document."
   INDEX  { gBondPortPmTcaProfileName }
   ::= { gBondPortPmTcaProfileTable 1 }

GBondPortPmTcaProfileEntry ::=
  SEQUENCE {
    gBondPortPmTcaProfileName           SnmpAdminString,
    gBondPortPmTcaProfileThresh15MinES  HCPerfIntervalThreshold,
    gBondPortPmTcaProfileThresh15MinSES HCPerfIntervalThreshold,
    gBondPortPmTcaProfileThresh15MinUAS HCPerfIntervalThreshold,
    gBondPortPmTcaProfileThresh1DayES   GBondPm1DayIntervalThreshold,
    gBondPortPmTcaProfileThresh1DaySES  GBondPm1DayIntervalThreshold,
    gBondPortPmTcaProfileThresh1DayUAS  GBondPm1DayIntervalThreshold,
    gBondPortPmTcaProfileRowStatus      RowStatus
  }

gBondPortPmTcaProfileName  OBJECT-TYPE
  SYNTAX      SnmpAdminString (SIZE(1..32))
  MAX-ACCESS  not-accessible
  STATUS      current
  DESCRIPTION
    "This object is a unique index (name) associated with this
    GBS PM TCA profile."
  ::= { gBondPortPmTcaProfileEntry 1 }

gBondPortPmTcaProfileThresh15MinES  OBJECT-TYPE
  SYNTAX      HCPerfIntervalThreshold
  UNITS       "seconds"
  MAX-ACCESS  read-create
  STATUS      current
  DESCRIPTION
    "A desired threshold for the number of Errored Seconds (ES)
    within any given 15-minute performance data collection interval.
    If the number of ESs in a particular 15-minute collection
    interval reaches or exceeds this value, a
    gBondPmTca15MinESCrossing notification MAY be generated if
    enabled by gBondPortConfPmTcaEnable.
    At most one notification can be sent per interval.
    Setting this attribute to zero (default) effectively disables
    gBondPmTca15MinESCrossing notification.

    This object maps to the TR-159 attribute
    aGroupPerfThreshold15MinES."
  REFERENCE
    "[TR-159] 5.5.1.39"
```

```
   ::= { gBondPortPmTcaProfileEntry 2 }

gBondPortPmTcaProfileThresh15MinSES  OBJECT-TYPE
  SYNTAX      HCPerfIntervalThreshold
  UNITS       "seconds"
  MAX-ACCESS  read-create
  STATUS      current
  DESCRIPTION
    "A desired threshold for the number of Severely Errored Seconds
    (SES) within any given 15-minute performance data collection
    interval.
    If the number of SESs in a particular 15-minute collection
    interval reaches or exceeds this value, a
    gBondPmTca15MinSESCrossing notification MAY be generated if
    enabled by gBondPortConfPmTcaEnable.
    At most one notification can be sent per interval.
    Setting this attribute to zero (default) effectively disables
    gBondPmTca15MinSESCrossing notification.

    This object maps to the TR-159 attribute
    aGroupPerfThreshold15MinSES."
  REFERENCE
    "[TR-159] 5.5.1.40"
  ::= { gBondPortPmTcaProfileEntry 3 }

gBondPortPmTcaProfileThresh15MinUAS  OBJECT-TYPE
  SYNTAX      HCPerfIntervalThreshold
  UNITS       "seconds"
  MAX-ACCESS  read-create
  STATUS      current
  DESCRIPTION
    "A desired threshold for the number of Unavailable Seconds (UAS)
    within any given 15-minute performance data collection interval.
    If the number of UASs in a particular 15-minute collection
    interval reaches or exceeds this value, a
    gBondPmTca15MinUASCrossing notification MAY be generated if
    enabled by gBondPortConfPmTcaEnable.
    At most one notification can be sent per interval.
    Setting this attribute to zero (default) effectively disables
    gBondPmTca15MinUASCrossing notification.

    This object maps to the TR-159 attribute
    aGroupPerfThreshold15MinUAS."
  REFERENCE
    "[TR-159] 5.5.1.41"
  ::= { gBondPortPmTcaProfileEntry 4 }

gBondPortPmTcaProfileThresh1DayES  OBJECT-TYPE
```

```
     SYNTAX       GBondPm1DayIntervalThreshold
     UNITS        "seconds"
     MAX-ACCESS   read-create
     STATUS       current
     DESCRIPTION
       "A desired threshold for the number of Errored Seconds (ES)
       within any given 1-day performance data collection interval.
       If the number of ESs in a particular 1-day collection interval
       reaches or exceeds this value, a gBondPmTca1DayESCrossing
       notification MAY be generated if enabled by
       gBondPortConfPmTcaEnable.
       At most one notification can be sent per interval.
       Setting this attribute to zero (default) effectively disables
       gBondPmTca1DayESCrossing notification.

       This object maps to the TR-159 attribute
       aGroupPerfThreshold1DayES."
     REFERENCE
       "[TR-159] 5.5.1.51"
     ::= { gBondPortPmTcaProfileEntry 5 }

  gBondPortPmTcaProfileThresh1DaySES  OBJECT-TYPE
     SYNTAX       GBondPm1DayIntervalThreshold
     UNITS        "seconds"
     MAX-ACCESS   read-create
     STATUS       current
     DESCRIPTION
       "A desired threshold for the number of Severely Errored Seconds
       (SES) within any given 1-day performance data collection
       interval.
       If the number of SESs in a particular 1-day collection interval
       reaches or exceeds this value, a gBondPmTca1DaySESCrossing
       notification MAY be generated if enabled by
       gBondPortConfPmTcaEnable.
       At most one notification can be sent per interval.
       Setting this attribute to zero (default) effectively disables
       gBondPmTca1DaySESCrossing notification.

       This object maps to the TR-159 attribute
       aGroupPerfThreshold1DaySES."
     REFERENCE
       "[TR-159] 5.5.1.52"
     ::= { gBondPortPmTcaProfileEntry 6 }

  gBondPortPmTcaProfileThresh1DayUAS  OBJECT-TYPE
     SYNTAX       GBondPm1DayIntervalThreshold
     UNITS        "seconds"
     MAX-ACCESS   read-create
```

```
   STATUS       current
   DESCRIPTION
     "A desired threshold for the number of Unavailable Seconds (UAS)
      within any given 1-day performance data collection interval.
      If the number of UASs in a particular 1-day collection interval
      reaches or exceeds this value, a gBondPmTca1DayUASCrossing
      notification MAY be generated if enabled by
      gBondPortConfPmTcaEnable.
      At most one notification can be sent per interval.
      Setting this attribute to zero (default) effectively disables
      gBondPmTca1DayUASCrossing notification.

      This object maps to the TR-159 attribute
      aGroupPerfThreshold1DayUAS."
   REFERENCE
     "[TR-159] 5.5.1.53"
   ::= { gBondPortPmTcaProfileEntry 7 }

 gBondPortPmTcaProfileRowStatus  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 gBondPortPmTcaProfileTable
      per the semantics of RowStatus.

      If an 'active' entry is referenced via
      gBondPortConfPmTcaConfProfile instance(s), 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 'active'
      again."
   ::= { gBondPortPmTcaProfileEntry 8 }


 -- The BCE group

 gBondBceConfTable OBJECT-TYPE
   SYNTAX       SEQUENCE OF GBondBceConfEntry
   MAX-ACCESS  not-accessible
   STATUS       current
   DESCRIPTION
     "Table for Configuration of G.Bond common aspects for the
      Bonding Channel Entity (BCE) ports (modems/channels).
```

        Entries in this table MUST be maintained in a persistent
        manner."
     ::= { gBondBce 1 }

   gBondBceConfEntry OBJECT-TYPE
     SYNTAX   GBondBceConfEntry
     MAX-ACCESS   not-accessible
     STATUS   current
     DESCRIPTION
       "An entry in the G.Bond BCE Configuration table.
       Each entry represents common aspects of a G.Bond BCE port
       indexed by the ifIndex. Note that a G.Bond BCE port can be
       stacked below a single GBS port, also indexed by ifIndex,
       possibly together with other BCE ports if GAF is enabled."
     INDEX { ifIndex }
     ::= { gBondBceConfTable 1 }

   GBondBceConfEntry ::=
     SEQUENCE {
       gBondBceConfRemoteDiscoveryCode   PhysAddress
     }

   gBondBceConfRemoteDiscoveryCode OBJECT-TYPE
     SYNTAX   PhysAddress (SIZE(0|6))
     MAX-ACCESS   read-write
     STATUS   current
     DESCRIPTION
       "A Remote Discovery Code of the BCE port at CO.
       A 6 octet long Discovery Code of the peer GBS connected via
       the BCE.
       Reading this object results in a Discovery Get operation.
       Setting this object to all zeroes results in a Discovery
       Clear_if_Same operation (the value of gBondPortConfDiscoveryCode
       at the peer GBS SHALL be the same as gBondPortConfDiscoveryCode
       of the local GBS associated with the BCE for the operation to
       succeed).
       Writing a non-zero value to this object results in a
       Discovery Set_if_Clear operation.
       A zero-length octet string SHALL be returned on an attempt to
       read this object when GAF aggregation is not enabled.

       This object is irrelevant in BCE-R port subtypes (CPE side):
       in this case a zero length octet string SHALL be returned on
       an attempt to read this object, an attempt to change this object
       MUST be rejected (in case of SNMP with the error
       inconsistentValue).

       Discovery MUST be performed when the link is Down.

         Attempts to change this object MUST be rejected (in case of
         SNMP with the error inconsistentValue), If the link is Up or
         Initializing.

         This object maps to the TR-159 attribute
         aLineRemoteDiscoveryCode."
      REFERENCE
         "[TR-159] 5.5.6.7"
      ::= { gBondBceConfEntry 1 }

  --
  -- Conformance Statements
  --

   gBondGroups   OBJECT IDENTIFIER ::= { gBondConformance 1 }

   gBondCompliances OBJECT IDENTIFIER ::= { gBondConformance 2 }

   -- Object Groups

   gBondBasicGroup OBJECT-GROUP
      OBJECTS {
        gBondPortStatOperScheme,
        gBondPortStatUpDataRate,
        gBondPortStatDnDataRate,
        gBondPortConfTargetUpDataRate,
        gBondPortConfTargetDnDataRate,
        gBondPortCapCapacity,
        gBondPortStatNumBCEs,
        gBondPortStatSide,
        gBondPortStatFltStatus
      }
      STATUS   current
      DESCRIPTION
        "A collection of objects representing management information
        common to all types of G.Bond ports."
      ::= { gBondGroups 1 }

   gBondDiscoveryGroup OBJECT-GROUP
      OBJECTS {
        gBondPortStatPeerOperScheme,
        gBondPortCapPeerCapacity,
        gBondPortConfDiscoveryCode,
        gBondBceConfRemoteDiscoveryCode
      }
      STATUS   current
      DESCRIPTION
        "A collection of objects supporting OPTIONAL G.Bond discovery

```
      in G.Bond ports."
    ::= { gBondGroups 2 }

  gBondMultiSchemeGroup OBJECT-GROUP
    OBJECTS {
      gBondPortCapSchemesSupported,
      gBondPortCapPeerSchemesSupported,
      gBondPortConfAdminScheme,
      gBondPortConfPeerAdminScheme
    }
    STATUS      current
    DESCRIPTION
      "A collection of objects providing OPTIONAL management
      information for G.Bond ports supporting multiple bonding
      schemes."
    ::= { gBondGroups 3 }

  gBondTcaConfGroup OBJECT-GROUP
    OBJECTS {
      gBondPortConfThreshLowUpRate,
      gBondPortConfThreshLowDnRate,
      gBondPortConfLowRateCrossingEnable
    }
    STATUS      current
    DESCRIPTION
      "A collection of objects required for configuration of alarm
      thresholds and notifications in G.Bond ports."
    ::= { gBondGroups 4 }

  gBondTcaNotificationGroup NOTIFICATION-GROUP
    NOTIFICATIONS {
      gBondLowUpRateCrossing,
      gBondLowDnRateCrossing
    }
    STATUS      current
    DESCRIPTION
      "This group supports notifications of significant conditions
      (non-PM threshold crossing alerts) associated with G.Bond ports."
    ::= { gBondGroups 5 }

  gBondPmCurGroup OBJECT-GROUP
    OBJECTS {
      gBondPortPmCurES,
      gBondPortPmCurSES,
      gBondPortPmCurUAS,
      gBondPortPmCur15MinValidIntervals,
      gBondPortPmCur15MinInvalidIntervals,
      gBondPortPmCur15MinTimeElapsed,
```

```
      gBondPortPmCur15MinES,
      gBondPortPmCur15MinSES,
      gBondPortPmCur15MinUAS,
      gBondPortPmCur1DayValidIntervals,
      gBondPortPmCur1DayInvalidIntervals,
      gBondPortPmCur1DayTimeElapsed,
      gBondPortPmCur1DayES,
      gBondPortPmCur1DaySES,
      gBondPortPmCur1DayUAS
    }
    STATUS      current
    DESCRIPTION
      "A collection of objects supporting OPTIONAL current Performance
      Monitoring information for G.Bond ports."
    ::= { gBondGroups 6 }

  gBondPm15MinGroup OBJECT-GROUP
    OBJECTS {
      gBondPortPm15MinIntervalMoniTime,
      gBondPortPm15MinIntervalES,
      gBondPortPm15MinIntervalSES,
      gBondPortPm15MinIntervalUAS,
      gBondPortPm15MinIntervalValid
    }
    STATUS      current
    DESCRIPTION
      "A collection of objects supporting OPTIONAL historical
      Performance Monitoring information for G.Bond ports, during
      previous 15-minute intervals ."
    ::= { gBondGroups 7 }

  gBondPm1DayGroup OBJECT-GROUP
    OBJECTS {
      gBondPortPm1DayIntervalMoniTime,
      gBondPortPm1DayIntervalES,
      gBondPortPm1DayIntervalSES,
      gBondPortPm1DayIntervalUAS,
      gBondPortPm1DayIntervalValid
    }
    STATUS      current
    DESCRIPTION
      "A collection of objects supporting OPTIONAL historical
      Performance Monitoring information for G.Bond ports, during
      previous 1-day intervals ."
    ::= { gBondGroups 8 }

  gBondPmTcaConfGroup OBJECT-GROUP
    OBJECTS {
```

```
      gBondPortConfPmTcaConfProfile,
      gBondPortConfPmTcaEnable,
      gBondPortPmTcaProfileThresh15MinES,
      gBondPortPmTcaProfileThresh15MinSES,
      gBondPortPmTcaProfileThresh15MinUAS,
      gBondPortPmTcaProfileThresh1DayES,
      gBondPortPmTcaProfileThresh1DaySES,
      gBondPortPmTcaProfileThresh1DayUAS,
      gBondPortPmTcaProfileRowStatus
    }
   STATUS      current
   DESCRIPTION
     "A collection of objects required for configuration of
     Performance Monitoring Threshold Crossing Alert notifications
     in G.Bond ports."
   ::= { gBondGroups 9 }

  gBondPmTcaNotificationGroup NOTIFICATION-GROUP
    NOTIFICATIONS {
      gBondPmTca15MinESCrossing,
      gBondPmTca15MinSESCrossing,
      gBondPmTca15MinUASCrossing,
      gBondPmTca1DayESCrossing,
      gBondPmTca1DaySESCrossing,
      gBondPmTca1DayUASCrossing
    }
   STATUS      current
   DESCRIPTION
     "This group supports notifications of performance monitoring
     thresholds crossing alerts associated with G.Bond ports."
   ::= { gBondGroups 10 }

 -- Compliance Statements

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

     MIB Module              Compliance Statement
     ----------              --------------------
     IF-MIB                  ifCompliance3

     Compliance with the following external compliance statements
     is OPTIONAL for implementations supporting bonding with
     flexible cross-connect between the GBS and BCE ports:
```

```
     MIB Module                Compliance Statement
     ----------                --------------------
     IF-INVERTED-STACK-MIB  ifInvCompliance
     IF-CAP-STACK-MIB       ifCapStackCompliance"

 MODULE  -- this module
   MANDATORY-GROUPS {
     gBondBasicGroup,
     gBondTcaConfGroup,
     gBondTcaNotificationGroup
   }

   GROUP       gBondDiscoveryGroup
   DESCRIPTION
     "Support for this group is only required for implementations
     supporting G.Bond Discovery function."

   GROUP       gBondMultiSchemeGroup
   DESCRIPTION
     "Support for this group is only required for implementations
     supporting multiple bonding schemes."

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

   GROUP       gBondPm15MinGroup
   DESCRIPTION
     "Support for this group is only required for implementations
     supporting 15-min historical Performance Monitoring."

   GROUP       gBondPm1DayGroup
   DESCRIPTION
     "Support for this group is only required for implementations
     supporting 1-day historical Performance Monitoring."

   GROUP       gBondPmTcaConfGroup
   DESCRIPTION
     "Support for this group is only required for implementations
     supporting Performance Monitoring Threshold Crossing Alert
     notifications."

   GROUP       gBondPmTcaNotificationGroup
   DESCRIPTION
     "Support for this group is only required for implementations
     supporting Performance Monitoring Threshold Crossing Alert
     notifications."
```

```
     ::= { gBondCompliances 1 }
END
```

7. **Security Considerations**

   There is 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:

   o Changing of gBondPortConfAdminScheme may lead to a potential
      locking of the link, if the peer device does not support desired
      bonding scheme.

   o Changing of gBondPortConfDiscoveryCode, before the discovery
      operation, may lead to a wrongful discovery, for example when two
      CO ports are connected to the same multi-channel RT port, while
      both CO ports have the same discovery register value.

   o Changing of target upstream/downstream data rate via
      gBondPortConfTargetUpDataRate/gBondPortConfTargetDnDataRate may
      lead to anything from link quality and rate degradation to a
      complete link initialization failure, as ability of a G.Bond port
      to support a particular configuration depends on the copper
      environment.

   o Activation of a specific line/channel may cause a severe
      degradation of service for another G.Bond port, whose channel(s)
      may be affected by the cross-talk from the newly activated
      channel.

   o Removal of a channel from an operationally 'up' G.Bond port,
      aggregating several channels, may cause port's rate degradation

   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 to a G.Bond transmission, simply
   by "listening" to a 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 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:

o gBondPortStatTable - objects in this table provide status
   information for the G.Bond port, which may aid in identification
   of the pairs belonging to the bonded port and eavesdroping to the
   traffic over that port.

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 MUST provide the security features described by the
SNMPv3 framework (see [RFC3410]), including 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

Three new values of IANAifType: g9981(263), g9982(264) and g9983(265)
have been allocated by IANA [1] in the IANAifType-MIB module
[IANAifType-MIB].

An object identifier for gBondMIB MODULE-IDENTITY SHALL be allocated
by IANA in the MIB-2 transmission sub-tree, before this document is
published.

9. Acknowledgments

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