Internet Engineering Task Force
Internet-Draft
Intended status: Standards Track
Expires: January 7, 2016

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July 6, 2015

An SNMP MIB extension to RFC3591 to manage optical interface parameters of "G.698.2 single channel" in DWDM applications

draft-galikunze-ccamp-g-698-2-snmp-mib-12

Abstract

This memo defines a module of the Management Information Base (MIB) used by Simple Network Management Protocol (SNMP) in TCP/IP- based internet. In particular, it defines objects for managing single channel optical interface parameters of DWDM applications, using the approach specified in G.698.2 [ITU.G698.2] . This interface, described in ITU-T G.872, G.709 and G.798, is one type of OTN multi-vendor Intra-Domain Interface (IaDI). This RFC is an extension of RFC3591 to support the optical parameters specified in ITU-T G.698.2 and application identifiers specified in ITU-T G.874.1 [ITU.G874.1]. Note that G.874.1 encompasses vendor-specific codes, which if used would make the interface a single vendor IaDI and could still be managed.

The MIB module defined in this memo can be used for Optical Parameters monitoring and/or configuration of the endpoints of the multi-vendor IaDI based on the Black Link approach.

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Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

This Internet-Draft will expire on January 7, 2016.

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1. Introduction

This memo defines a portion of the Management Information Base (MIB) used by Simple Network Management Protocol (SNMP)in TCP/IP-based internets. In particular, it defines objects for managing single channel optical interface parameters of DWDM applications, using the approach specified in G.698.2. This RFC is an extension of RFC3591 to support the optical parameters specified in ITU-T G.698.2 [ITU.G698.2] and application identifiers specified in ITU-T G.874.1 [ITU.G874.1] . Note that G.874.1 encompasses vendor-specific codes, which if used would make the interface a single vendor IaDI and could still be managed.

The Black Link approach allows supporting an optical transmitter/ receiver pair of one vendor to inject an optical tributary signal and run it over an optical network composed of amplifiers, filters, add-drop multiplexers from a different vendor. In the OTN architecture, the 'black-link' represents a pre-certified network media channel conforming to G.698.2 specifications at the S and R reference points.

[Editor's note: In G.698.2 this corresponds to the optical path from point S to R; network media channel is also used and explained in draft-ietf-ccamp-flexi-grid-fwk-02]

Management will be performed at the edges of the network media channel (i.e., at the transmitters and receivers attached to the S and R reference points respectively) for the relevant parameters specified in G.698.2 [ITU.G698.2], G.798 [ITU.G798], G.874 [ITU.G874], and the performance parameters specified in G.7710/Y.1701 [ITU-T G.7710] and G.874.1 [ITU.G874.1].

G.698.2 [ITU.G698.2] is primarily intended for metro applications that include optical amplifiers. Applications are defined in G.698.2 [ITU.G698.2] using optical interface parameters at the single-channel connection points between optical transmitters and the optical multiplexer, as well as between optical receivers and the optical demultiplexer in the DWDM system. This Recommendation uses a methodology which does not explicitly specify the details of the optical network between reference point Ss and Rs, e.g., the passive

and active elements or details of the design. The Recommendation currently includes unidirectional DWDM applications at 2.5 and 10 Gbit/s (with 100 GHz and 50 GHz channel frequency spacing). Work is still under way for 40 and 100 Gbit/s interfaces. There is possibility for extensions to a lower channel frequency spacing. This document specifically refers to the "application code" defined in the G.698.2 [ITU.G698.2] and included in the Application Identifier defined in G.874.1 [ITU.G874.1] and G.872 [ITU.G872], plus a few optical parameters not included in the G.698.2 application code specification.

This draft refers and supports also the draft-kunze-g-698-2-management-control-framework

The building of an SNMP MIB describing the optical parameters defined in G.698.2 [ITU.G698.2], and reflected in G.874.1 [ITU.G874], allows the different vendors and operator to retrieve, provision and exchange information across the G.698.2 multi-vendor IaDI in a standardized way.

The MIB, reporting the Optical parameters and their values, characterizes the features and the performances of the optical components and allow a reliable black link design in case of multi vendor optical networks.

Although RFC 3591 [RFC3591] describes and defines the SNMP MIB of a number of key optical parameters, alarms and Performance Monitoring, as this RFC is over a decade old, it is primarily pre-OTN, and a more complete and up-to-date description of optical parameters and processes can be found in the relevant ITU-T Recommendations. The same considerations can be applied to the RFC 4054 [RFC4054]

2. The Internet-Standard Management Framework

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

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. MIB objects are generally accessed through the Simple Network Management Protocol (SNMP). Objects in the MIB are defined using the mechanisms defined in the Structure of Management Information (SMI). This memo specifies a MIB module that is compliant to the SMIv2, which is described in STD 58, RFC 2578 [RFC2578], STD 58, RFC 2579 [RFC2579] and STD 58, RFC 2580 [RFC2580].

3. Conventions

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119] In the description of OIDs the convention: Set (S) Get (G) and Trap (T) conventions will describe the action allowed by the parameter.

4. Overview

Figure 1 shows a set of reference points, for the linear "black link" approach, for single-channel connection (Ss and Rs) between transmitters (Tx) and receivers (Rx). Here the DWDM network elements include an OM and an OD (which are used as a pair with the opposing element), one or more optical amplifiers and may also include one or more OADMs.

```
          +---------------------------------------------------+
      Ss  |               DWDM Network Elements               | Rs
 +---+ |  |  | \                                       / |  |  | +--+
 Tx L1----|->|   \    +-------+            +-------+   /   |--|-->Rx L1
 +---+    |  |    |   |       |  +-------+  |       |  |    |  |    +--+
 +---+    |  |    |   |       |  |       |  |       |  |    |  |    +--+
 Tx L2----|->| OM |-->|------|->| OADM |--|------|->| OD |--|-->Rx L2
 +---+    |  |    |   |       |  |       |  |       |  |    |  |    +--+
 +---+    |  |    |   |       |  +-------+  |       |  |    |  |    +--+
 Tx L3----|->|   /    | DWDM |     |  ^     | DWDM |   \   |--|-->Rx L3
 +---+    |  | /      | Link +----|--|----+ Link |     \ |  |    +--+
          +-----------+           |  |           +----------+
                               +--+  +--+
                               |        |
                            Rs v        | Ss
                            +-----+  +-----+
                            |RxLx |  |TxLx |
                            +-----+  +-----+
   Ss = reference point at the DWDM network element tributary output
   Rs = reference point at the DWDM network element tributary input
   Lx = Lambda x
   OM = Optical Mux
   OD = Optical Demux
   OADM = Optical Add Drop Mux


from Fig. 5.1/G.698.2
```

Figure 1: Linear Black Link approach

G.698.2 [ITU.G698.2] defines also Ring "Black Link" approach configurations [Fig. 5.2/G.698.2] and Linear "black link" approach for Bidirectional applications[Fig. 5.3/G.698.2]

4.1. Use Cases

The use cases described below are assuming that power monitoring functions are available in the ingress and egress network element of the DWDM network, respectively. By performing link property correlation it would be beneficial to include the current transmit power value at reference point Ss and the current received power value at reference point Rs. For example if the Client transmitter power (OXC1) has a value of 0dBm and the ROADM interface measured power (at OLS1) is -6dBm the fiber patch cord connecting the two nodes may be pinched or the connectors are dirty. More, the interface characteristics can be used by the OLS network Control Plane in order to check the Optical Channels feasibility. Finally the OXC1 transceivers parameters (Application Code) can be shared with OXC2 using the LMP protocol to verify the Transceivers compatibility. The actual route selection of a specific wavelength within the allowed set is outside the scope of LMP. In GMPLS, the parameter selection (e.g. central frequency) is performed by RSVP-TE.

G.698.2 defines a single channel optical interface for DWDM systems that allows interconnecting network-external optical transponders across a DWDM network. The optical transponders are considered to be external to the DWDM network. This so-called 'black link' approach illustrated in Figure 5-1 of G.698.2 and a copy of this figure is provided below. The single channel fiber link between the Ss/Rs reference points and the ingress/egress port of the network element on the domain boundary of the DWDM network (DWDM border NE) is called access link in this contribution. Based on the definition in G.698.2 it is considered to be part of the DWDM network. The access link typically is realized as a passive fiber link that has a specific optical attenuation (insertion loss). As the access link is an integral part of the DWDM network, it is desirable to monitor its attenuation. Therefore, it is useful to detect an increase of the access link attenuation, for example, when the access link fiber has been disconnected and reconnected (maintenance) and a bad patch panel connection (connector) resulted in a significantly higher access link attenuation (loss of signal in the extreme case of an open connector or a fiber cut). In the following section, two use cases are presented and discussed:

1) pure access link monitoring
2) access link monitoring with a power control loop

These use cases require a power monitor as described in G.697 (see section 6.1.2), that is capable to measure the optical power of the incoming or outgoing single channel signal. The use case where a power control loop is in place could even be used to compensate an increased attenuation as long as the optical transmitter can still be operated within its output power range defined by its application code.

   Figure 2 Access Link Power Monitoring

```
                                      +--------------------------+
                                      |    P(in) = P(Tx) - a(Tx) |
                                      |    ___                   |
      +----------+                    |    \ /  Power Monitor    |
      |          | P(Tx)              |     V                    |
      |  +----+  | Ss    //\\         |     |    |\              |
      |  | TX |----|-----\\//------------------->| \             |
      |  +----+  | Access Link (AL-T) |       .  |  |            |
      |          | attenuation a(Tx)  |       .  |  |===============>
      |          |                    |       .  |  |            |
      | External |                    |      --->| /             |
      | Optical  |                    |          |/              |
      |Transpond.|                    |    P(out)                |
      |          |                    |    ___                   |
      |          |                    |    \ /  Power Monitor    |
      |          | P(Rx)              |     V                    |
      |  +----+  | Rs    //\\         |     |    |\              |
      |  | RX |<---|-----\\//--------------------| \             |
      |  +----+  | Access Link (AL-R) |       .  |  |            |
      |          | Attenuation a(Rx)  |       .  |  |<===============
      +----------+                    |       .  |  |            |
                                      |      <---| /             |
      P(Rx) = P(out) - a(Rx)          |          |/              |
                                      |                          |
                                      |          ROADM           |
                                      +--------------------------+
```

   - For AL-T monitoring: P(Tx) and a(Tx) must be known
   - For AL-R monitoring: P(RX) and a(Rx) must be known

An alarm shall be raised if P(in) or P(Rx) drops below a configured threshold (t [dB]):

- P(in) < P(Tx) - a(Tx) - t (Tx direction)
- P(Rx) < P(out) - a(Rx) - t (Rx direction)
- a(Tx) =| a(Rx)

Figure 2: Extended LMP Model

Pure Access Link (AL) Monitoring Use Case

Figure 4 illustrates the access link monitoring use case and the different physical properties involved that are defined below:

- Ss, Rs: G.698.2 reference points
- P(Tx): current optical output power of transmitter Tx
- a(Tx): access link attenuation in Tx direction (external transponder point of view)
- P(in): measured current optical input power at the input port of border DWDM NE
- t: user defined threshold (tolerance)
- P(out): measured current optical output power at the output port of border DWDM NE
- a(Rx): access link attenuation in Rx direction (external transponder point of view)
- P(Rx): current optical input power of receiver Rx

Assumptions:

- The access link attenuation in both directions (a(Tx), a(Rx)) is known or can be determined as part of the commissioning process. Typically, both values are the same.
- A threshold value t has been configured by the operator. This should also be done during commissioning.
- A control plane protocol is in place that allows to periodically send the optical power values P(Tx) and P(Rx) to the control plane protocol instance on the DWDM border NE. This is llustrated in Figure 3.
- The DWDM border NE is capable to periodically measure the optical power Pin and Pout as defined in G.697 by power monitoring points depicted as yellow triangles in the figures below.

AL monitoring process:

- Tx direction: the measured optical input power Pin is compared with the expected optical input power P(Tx) - a(Tx). If the measured optical input power P(in) drops below the value (P(Tx) - a(Tx) - t) a low power alarm shall be raised indicating that the access link attenuation has exceeded a(Tx) + t.
- Rx direction: the measured optical input power P(Rx) is compared with the expected optical input power P(out) - a(Rx). If the measured optical input power P(Rx) drops below the value (P(out) - a(Rx) - t) a low power alarm shall be raised indicating that the access link attenuation has exceeded a(Rx) + t.

Figure 3 Use case 1: Access Link power monitoring

```
+----------+                    +--------------------------+
| +------+ |    P(Tx), P(Rx)    |  +-------+               |
| |      | | =================> |  |       |               |
| | LMP  | |    P(in), P(out)   |  |  LMP  |               |
| |      | | <================= |  |       |               |
| +------+ |                    |  +-------+               |
|          |                    |                          |
|          |                    |    P(in) - P(Tx) - a(Tx) |
|          |                    |    ___                   |
|          |                    |    \ /  Power Monitor    |
|          | P(Tx)              |     V                    |
|  +----+  | Ss    //\\         |     |    |\              |
|  | TX |----|-----\\//------------------->| \             |
|  +----+  | Access Link (AL-T) |       .  |  |            |
|          | attenuation a(Tx)  |       .  |  |==============>
|          |                    |       .  |  |            |
| External |                    |      --->| /             |
| Optical  |                    |          |/              |
|Transpond.|                    |    P(out)                |
|          |                    |    ___                   |
|          |                    |    \ /  Power Monitor    |
|          | P(Rx)              |     V                    |
|  +----+  | Rs    //\\         |     |    |\              |
|  | RX |<---|-----\\//--------------------| \             |
|  +----+  | Access Link (AL-R) |       .  |  |            |
|          | Attenuation a(Rx)  |       .  |  |<==============
+----------+                    |       .  |  |            |
                                |      <---| /             |
P(Rx) = P(out) - a(Rx)          |          |/              |
                                |                          |
                                |          ROADM           |
                                +--------------------------+
```

- For AL-T monitoring: P(Tx) and a(Tx) must be known
- For AL-R monitoring: P(RX) and a(Rx) must be known

An alarm shall be raised if P(in) or P(Rx) drops below a configured threshold (t [dB]):

- P(in) < P(Tx) - a(Tx) - t (Tx direction)
- P(Rx) < P(out) - a(Rx) - t (Rx direction)
- a(Tx) = a(Rx)

Figure 3: Extended LMP Model

Power Control Loop Use Case

This use case is based on the access link monitoring use case as described above. In addition, the border NE is running a power control application that is capable to control the optical output power of the single channel tributary signal at the output port of the border DWDM NE (towards the external receiver Rx) and the optical output power of the single channel tributary signal at the external transmitter Tx within their known operating range. The time scale of this control loop is typically relatively slow (e.g. some 10s or minutes) because the access link attenuation is not expected to vary much over time (the attenuation only changes when re-cabling occurs).
From a data plane perspective, this use case does not require additional data plane extensions. It does only require a protocol extension in the control plane (e.g. this LMP draft) that allows the power control application residing in the DWDM border NE to modify the optical output power of the DWDM domain-external transmitter Tx within the range of the currently used application code. Figure 5 below illustrates this use case utilizing the LMP protocol with extensions defined in this draft.

Figure 4 Use case 2: Power Control Loop

```
+----------+                       +--------------------------+
| +------+ | P(Tx),P(Rx),Set(Pout) |  +--------+  +---------+ |
| |      | | ====================> |  |        |  | Power   | |
| | LMP  | | P(in),P(out),Set(PTx) |  |  LMP   |  |Control  | |
| |      | | <==================== |  |        |  | Loop    | |
| +------+ |                       |  +--------+  +---------+ |
|     |    |                       |                          |
| +------+ |                       |    P(in) = P(Tx) - a(Tx) |
| |C.Loop| |                       |    ___                   |
| +------+ |                       |    \ /  Power Monitor    |
|     |    | P(Tx)                 |     V                    |
| +------+ | Ss    //\\            |     |    |\              |
| | TX  |>---|-----\\//---------------------->| \             |
| +------+ | Access Link (AL-T)    |       .  |  |            |
|  VOA(Tx) | attenuation a(Tx)     |       .  |  |==============>
|          |                       |       .  |  |            |
| External |                       |      --->| /             |
| Optical  |                       |          |/              |
|Transpond.|                       |    P(out)                |
|          |                       |    ___                   |
|          |                       |    \ /  Power Monitor    |
|          | P(Rx)                 |     V                    |
|  +----+  | Rs    //\\            |     |  VOA(out) |\       |
|  | RX |<---|-----\\//---------------------<|-------| \      |
|  +----+  | Access Link (AL-R)    |             .   |  |     |
|          | attenuation a(Rx)     |             .   |  |<=======
+----------+                       |        VOA(out) |  |     |
                                   |     <--<|-------| /      |
P(Rx) = P(out) - a(Rx)             |                 |/       |
                                   |                          |
                                   |            ROADM         |
                                   +--------------------------+
```

The Power Control Loops in Transponder and ROADM regulate
the Variable Optical Attenuators (VOA) to adjust the
proper power in base of the ROADM and Receiver
caracteristics and the Access Link attenuation

Figure 4: Extended LMP Model

4.2. Optical Parameters Description

The G.698.2 pre-certified network media channels are managed at the edges, i.e. at the transmitters (Tx) and receivers (Rx) attached to the S and R reference points respectively. The set of parameters that could be managed are specified in G.698.2 [ITU.G698.2] section 5.3 referring the "application code" notation

The definitions of the optical parameters are provided below to increase the readability of the document, where the definition is ended by (G) the parameter can be retrieve with a GET, when (S) it can be provisioned by a SET, (G,S) can be either GET and SET.

To support the management of these parameters, the SNMP MIB in RFC 3591 [RFC3591] is extended with a new MIB module defined in section 6 of this document. This new MIB module includes the definition of new configuration table of the OCh Layer for the parameters at Tx (S) and Rx (R).

4.2.1. Rs-Ss Configuration

The Rs-Ss configuration table allows configuration of Central Frequency, Power and Application identifiers as described in [ITU.G698.2] and G.694.1 [ITU.G694.1]
This parameter report the current Transceiver Output power, it can be either a setting and measured value (G, S).

Central frequency (see G.694.1 Table 1):
   This parameter indicates the central frequency value that Ss and Rs will be set, to work (in THz), in particular Section 6/G.694.1 (G, S).

Single-channel application identifiers (see G.698.2):
   This parameter indicates the transceiver application identifier at Ss and Rs as defined in [ITU.G698.2] Chapter 5.4 - this parameter can be called Optical Interface Identifier OII as per [draft-martinelli-wson-interface-class] (G).

Number of Single-channel application identifiers Supported
   This parameter indicates the number of Single-channel application codes supported by this interface (G).

Current Laser Output power:
   This parameter report the current Transceiver Output power, see RFC3591.

Current Laser Input power:

This parameter report the current Transceiver Input power see RFC3591.

PARAMETERS	Get/Set	Reference
Central Frequency	G,S	G.694.1 S.6
Single-channel Application Identifier number in use	G	G.874.1
Single-channel Application Identifier Type in use	G	G.874.1
Single-channel Application Identifier in use	G	G.874.1
Number of Single-channel Application Identifiers Supported	G	N.A.
Current Output Power	G,S	RFC3591
Current Input Power	G	RFC3591

Table 1: Rs-Ss Configuration

4.2.2. Table of Application Identifiers

This table has a list of Application Identifiers supported by this interface at point R are defined in G.698.2.

Application Identifier Number:
The number that uniquely identifies the Application Identifier.

Application Identifier Type:
Type of application Identifier: STANDARD / PROPRIETARY in G.874.1

Note: if the A.I. type = PROPRIETARY, the first 6 Octets of the Application Identifier (PrintableString) must contain the Hexadecimal representation of an OUI (organizationally unique identifier) assigned to the vendor whose implementation generated the Application Identifier; the remaining octets of the PrintableString are unspecified.

Application Identifier:
This is the application Identifier that is defined in G.874.1.

4.3. Use of ifTable

This section specifies how the MIB II interfaces group, as defined in RFC 2863 [RFC2863], is used for the link ends of a black link. Only the ifGeneralInformationGroup will be supported for the ifTable and the ifStackTable to maintain the relationship between the OCh and OPS layers. The OCh and OPS layers are managed in the ifTable using IfEntries that correlate to the layers depicted in Figure 1.

For example, a device with TX and/or RX will have an Optical Physical Section (OPS) layer, and an OCh layer. There is a one to n relationship between the OPS and OCh layers.

EDITOR NOTE: Reason for changing from OChr to OCh: Edition 3 of G.872 removed OChr from the architecture and G.709 was subsequently updated to account for this architectural change.

Figure 5 In the following figures, opticalPhysicalSection are abbreviated as OPS.

```
      _____________________
                           \
         Path Data Unit    |\
             (ODUk)        | \
      _____________________|  \ ___________________
                           |   |                   |  >
        Tandem Data Unit   |   |                   |  |
             (ODUkT)       |   |    OCh  Layer     |   > n och IfEntries
      _____________________|   |                   |  |
                           |   |___________________|  >
              Optical      |  /|                   |  >
          Transport Unit   | / |                   |  |
              (OTUk)       |/  |    OPSn Layer     |   > m ops IfEntries
      _____________________/   |                   |  |
                               |___________________|  >
```

Figure 5: OTN Layers for OPS and OCh

Each opticalChannel IfEntry is mapped to one of the m opticalPhysicalSection IfEntries, where m is greater than or equal to 1. Conversely, each opticalTransPhysicalSection port entry is mapped to one of the n opticalChannel IfEntries, where n is greater than or equal to 1.

The design of the Optical Interface MIB provides the option to model an interface either as a single bidirectional object containing both sink and source functions or as a pair of unidirectional objects, one containing sink functions and the other containing source functions.

If the sink and source for a given protocol layer are to be modelled as separate objects, then there need to be two ifTable entries, one that corresponds to the sink and one that corresponds to the source, where the directionality information is provided in the configuration tables for that layer via the associated Directionality objects. The agent is expected to maintain consistent directionality values between ifStackTable layers (e.g., a sink must not be stacked in a 1:1 manner on top of a source, or vice-versa), and all protocol layers that are represented by a given ifTable entry are expected to have the same directionality.

When separate ifTable entries are used for the source and sink functions of a given physical interface, association between the two uni-directional ifTable entries (one for the source function and the other for the sink functions) should be provided. It is recommended that identical ifName values are used for the two ifTable entries to indicate such association. An implementation shall explicitly state what mechanism is used to indicate the association, if ifName is not used.

4.3.1. **Use of ifTable for OPS Layer**

Only the ifGeneralInformationGroup needs to be supported.

```
    ifTable Object      Use for OTN OPS Layer
==================================================================


  ifIndex           The interface index.

  ifDescr           Optical Transport Network (OTN) Optical
                    Physical Section (OPS)

  ifType            opticalPhysicalSection (xxx)

<<<Editor Note: Need new IANA registration value for xxx. >>>

  ifSpeed           Actual bandwidth of the interface in bits per
                    second.  If the bandwidth of the interface is
                    greater than the maximum value of 4,294,967,295
                    then the maximum value is reported and
                    ifHighSpeed must be used to report the
                    interface's speed.
```

```
      ifPhysAddress     An octet string with zero length.  (There is
                        no specific address associated with the
                        interface.)

      ifAdminStatus     The desired administrative state of the
                        interface.  Supports read-only access.

      ifOperStatus      The operational state of the interface.  The
                        value lowerLayerDown(7) is not used, since
                        there is no lower layer interface.  This object
                        is set to notPresent(6) if a component is
                        missing, otherwise it is set to down(2) if
                        either of the objects optIfOPSnCurrentStatus
                        indicates that any defect is present.

      ifLastChange      The value of sysUpTime at the last change in
                        ifOperStatus.

      ifName            Enterprise-specific convention (e.g., TL-1 AID)
                        to identify the physical or data entity
                        associated with this interface or an
                        OCTET STRING of zero length.  The
                        enterprise-specific convention is intended to
                        provide the means to reference one or more
                        enterprise-specific tables.

      ifLinkUpDownTrapEnable  Default value is enabled(1).  Supports
                              read-only access.

      ifHighSpeed       Actual bandwidth of the interface in Mega-bits
                        per second.  A value of n represents a range of
                        'n-0.5' to 'n+0.499999'.

      ifConnectorPresent Set to true(1).

      ifAlias           The (non-volatile) alias name for this interface
                        as assigned by the network manager.
```

4.3.2. Use of ifTable for OCh Layer

Use of ifTable for OCh Layer See RFC 3591 [RFC3591] section 2.4

4.3.3. Use of ifStackTable

Use of the ifStackTable and ifInvStackTable to associate the opticalPhysicalSection and opticalChannel interface entries is best illustrated by the example shown in Figure 3. The example assumes an

ops interface with ifIndex i that carries two multiplexed OCh interfaces with ifIndex values of j and k, respectively. The example shows that j and k are stacked above (i.e., multiplexed into) i. Furthermore, it shows that there is no layer lower than i and no layer higher than j and/or k.

Figure 6

```
                        HigherLayer   LowerLayer
                      --------------------------
                           0             j
                           0             k
                           j             i
                           k             i
                           i             0
```

Figure 6: Use of ifStackTable for an OTN port

For the inverse stack table, it provides the same information as the interface stack table, with the order of the Higher and Lower layer interfaces reversed.

5. Structure of the MIB Module

EDITOR NOTE:text will be provided based on the MIB module in Section 6

6. Object Definitions

EDITOR NOTE: Once the scope in Section 1 and the parameters in Section 4 are finalized, a MIB module will be defined. It could be an extension to the OPT-IF-MIB module of RFC 3591. >>>

```
OPT-IF-698-MIB DEFINITIONS ::= BEGIN

   IMPORTS
           MODULE-IDENTITY,
           OBJECT-TYPE,
           Gauge32,
           Integer32,
           Unsigned32,
           Counter64,
           transmission,
           NOTIFICATION-TYPE
                   FROM SNMPv2-SMI
           TEXTUAL-CONVENTION,
           RowPointer,
           RowStatus,
           TruthValue,
           DisplayString,
           DateAndTime
                   FROM SNMPv2-TC
           SnmpAdminString
                   FROM SNMP-FRAMEWORK-MIB
           MODULE-COMPLIANCE, OBJECT-GROUP
                   FROM SNMPv2-CONF
           ifIndex
                   FROM IF-MIB
           optIfMibModule
                  FROM OPT-IF-MIB;


--  This is the MIB module for the optical parameters -
--  Application codes associated with the black link end points.




optIfXcvrMibModule MODULE-IDENTITY
    LAST-UPDATED "201401270000Z"
    ORGANIZATION "IETF Ops/Camp MIB Working Group"
    CONTACT-INFO
       "WG charter:
          http://www.ietf.org/html.charters/

        Mailing Lists:
        Editor: Gabriele Galimberti
        Email:  ggalimbe@cisco.com"
    DESCRIPTION
       "The MIB module to describe Black Link tranceiver
        characteristics to rfc3591.
```

```
           Copyright (C) The Internet Society (2014).  This version
           of this MIB module is an extension to rfc3591;  see the RFC
           itself for full legal notices."
       REVISION  "201305050000Z"
       DESCRIPTION
          "Draft version 1.0"
       REVISION  "201305050000Z"
       DESCRIPTION
          "Draft version 2.0"
       REVISION  "201302270000Z"
       DESCRIPTION
          "Draft version 3.0"
       REVISION  "201307020000Z"
       DESCRIPTION
          "Draft version 4.0
           Changed the draft to include only the G.698 parameters."
       REVISION  "201311020000Z"
       DESCRIPTION
          "Draft version 5.0
           Mib has a table of application code/vendor
           transcievercode G.698"
       REVISION  "201401270000Z"
       DESCRIPTION
          "Draft version 6.0"
       REVISION  "201407220000Z"
       DESCRIPTION
          "Draft version 8.0
          Removed Vendor transceiver code"
       REVISION  "201502220000Z"
       DESCRIPTION
          "Draft version 11.0
           Added reference to OUI in the first 6 Octets of a
           proprietary Application code
           Added a Length field for the Application code
           Changed some names"
       REVISION  "201507060000Z"
       DESCRIPTION
          "Draft version 12.0
          Added Power Measurement Use Cases
          and ITU description" "
          ::= { optIfMibModule 4 }


       ::= { optIfMibModule 4 }

   -- Addition to the RFC 3591 objects
   optIfOChSsRsGroup   OBJECT IDENTIFIER  ::= { optIfXcvrMibModule 1 }
```

```
   -- OCh Ss/Rs config table
   -- The application code/vendor tranceiver class for the Black Link
   -- Ss-Rs will be added to the OchConfigTable

   optIfOChSsRsConfigTable OBJECT-TYPE
       SYNTAX  SEQUENCE OF OptIfOChSsRsConfigEntry
       MAX-ACCESS  not-accessible
       STATUS  current
       DESCRIPTION
           "A table of Och General config extension parameters"
       ::= {  optIfOChSsRsGroup 1 }

   optIfOChSsRsConfigEntry OBJECT-TYPE
       SYNTAX      OptIfOChSsRsConfigEntry
       MAX-ACCESS  not-accessible
       STATUS  current
       DESCRIPTION
           "A conceptual row that contains G.698 parameters for an
           interface."
       INDEX   { ifIndex }
       ::= { optIfOChSsRsConfigTable 1 }

   OptIfOChSsRsConfigEntry ::=
       SEQUENCE {
           optIfOChCentralFrequency                     Unsigned32,
           optIfOChCfgApplicationIdentifierNumber       Unsigned32,
           optIfOChCfgApplicationIdentifierType         Unsigned32,
           optIfOChCfgApplicationIdentifierLength       Unsigned32,
           optIfOChCfgApplicationIdentifier             DisplayString,
           optIfOChNumberApplicationCodesSupported      Unsigned32
      }

   optIfOChCentralFrequency  OBJECT-TYPE
       SYNTAX  Unsigned32
       MAX-ACCESS  read-write
       UNITS "THz"
       STATUS  current
       DESCRIPTION
           " This parameter indicates the frequency of this interface.
           "
       ::= { optIfOChSsRsConfigEntry  1 }

   optIfOChCfgApplicationIdentifierNumber  OBJECT-TYPE
       SYNTAX Unsigned32
       MAX-ACCESS  read-write
       STATUS  current
       DESCRIPTION
           "This parameter uniquely indicates the transceiver
```

```
          application code at Ss and Rs as defined in [ITU.G874.1],
          that is used by this interface.
          The optIfOChSrcApplicationIdentifierTable has all the
          application codes supported by this interface. "
     ::= { optIfOChSsRsConfigEntry  2 }

 optIfOChCfgApplicationIdentifierType  OBJECT-TYPE
     SYNTAX Unsigned32
     MAX-ACCESS  read-write
     STATUS  current
     DESCRIPTION
         "This parameter indicates the transceiver type of
          application code at Ss and Rs as defined in [ITU.G874.1],
          that is used by this interface.
          The optIfOChSrcApplicationIdentifierTable has all the
          application codes supported by this interface
          Standard = 0, PROPRIETARY = 1. "
     ::= { optIfOChSsRsConfigEntry  3 }

 optIfOChCfgApplicationIdentifierLenght  OBJECT-TYPE
     SYNTAX Unsigned32
     MAX-ACCESS  read-write
     STATUS  current
     DESCRIPTION
         "This parameter indicates the number of octets in the
          Application Identifier.
          "
     ::= { optIfOChSsRsConfigEntry  4 }


 optIfOChCfgApplicationIdentifier  OBJECT-TYPE
     SYNTAX DisplayString
     MAX-ACCESS  read-write
     STATUS  current
     DESCRIPTION
         "This parameter indicates the transceiver application code
          at Ss and Rs as defined in [ITU.G698.2] Chapter 5.3, that
          is used by this interface. The
          optIfOChSrcApplicationCodeTable has all the application
          codes supported by this interface.
          If the optIfOChCfgApplicationIdentifierType is 1
          (Proprietary), then the first 6 octets of the printable
          string will be the OUI (organizationally unique identifier)
          assigned to the vendor whose implementation generated the
          Application Identifier."
     ::= { optIfOChSsRsConfigEntry  5 }

 optIfOChNumberApplicationIdentifiersSupported  OBJECT-TYPE
```

```
       SYNTAX Unsigned32
       MAX-ACCESS  read-only
       STATUS  current
       DESCRIPTION
          " Number of Application codes supported by this interface."
       ::= { optIfOChSsRsConfigEntry  6 }

   -- Table of Application codes supported by the interface
   --  OptIfOChSrcApplicationCodeEntry

   optIfOChSrcApplicationIdentifierTable  OBJECT-TYPE
       SYNTAX  SEQUENCE OF OptIfOChSrcApplicationIdentifierEntry
       MAX-ACCESS  not-accessible
       STATUS  current
       DESCRIPTION
           "A Table of Application codes supported by this interface."
       ::= { optIfOChSsRsGroup 2 }

   optIfOChSrcApplicationIdentifierEntry OBJECT-TYPE
       SYNTAX      OptIfOChSrcApplicationIdentifierEntry
       MAX-ACCESS  not-accessible
       STATUS  current
       DESCRIPTION
           "A conceptual row that contains the Application code for
            this interface."
       INDEX  { ifIndex, optIfOChApplicationIdentiferNumber  }
       ::= { optIfOChSrcApplicationIdentifierTable 1 }

   OptIfOChSrcApplicationIdentifierEntry ::=
       SEQUENCE {
           optIfOChApplicationIdentiferNumber            Integer32,
           optIfOChApplicationIdentiferType              Integer32,
           optIfOChApplicationIdentiferLength            Integer32,
           optIfOChApplicationIdentifier                 DisplayString
        }


   optIfOChApplicationIdentiferNumber  OBJECT-TYPE
       SYNTAX  Integer32 (1..255)
       MAX-ACCESS  not-accessible
       STATUS  current
       DESCRIPTION
         " The number/identifier of the application code supported at
           this interface. The interface can support more than one
           application codes.
         "
       ::= { optIfOChSrcApplicationIdentifierEntry  1}
```

```
   optIfOChApplicationIdentiferType  OBJECT-TYPE
       SYNTAX  Integer32 (1..255)
       MAX-ACCESS  read-only
       STATUS  current
       DESCRIPTION
         " The type of identifier of the application code supported at
           this interface. The interface can support more than one
           application codes.
           Standard = 0, PROPRIETARY = 1
         "
       ::= { optIfOChSrcApplicationIdentifierEntry  2}


   optIfOChApplicationIdentiferLength  OBJECT-TYPE
       SYNTAX  Integer32 (1..255)
       MAX-ACCESS  read-only
       STATUS  current
       DESCRIPTION
         " This parameter indicates the number of octets in the
           Application Identifier.
         "
       ::= { optIfOChSrcApplicationIdentifierEntry  3}

   optIfOChApplicationIdentifier  OBJECT-TYPE
       SYNTAX DisplayString
       MAX-ACCESS  read-only
       STATUS  current
       DESCRIPTION
           " The application code supported by this interface DWDM
             link.
             If the optIfOChApplicationIdentiferType is 1 (Proprietary),
             then the first 6 octets of the printable string will be
             the OUI (organizationally unique identifier) assigned to
             the vendor whose implementation generated the Application
             Identifier."
       ::= { optIfOChSrcApplicationIdentifierEntry  4}




   -- Notifications

   -- Central Frequency Change Notification
   optIfOChCentralFrequencyChange NOTIFICATION-TYPE
       OBJECTS { optIfOChCentralFrequency }
       STATUS  current
       DESCRIPTION
           "Notification of a change in the central frequency."
```

```
    ::= { optIfXcvrMibModule 1 }

END
```

7. Relationship to Other MIB Modules

7.1. Relationship to the [TEMPLATE TODO] MIB

7.2. MIB modules required for IMPORTS

8. Definitions

[TEMPLATE TODO]: put your valid MIB module here.
A list of tools that can help automate the process of
checking MIB definitions can be found at
http://www.ops.ietf.org/mib-review-tools.html

9. Security Considerations

There are a number of management 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

Some of the readable objects in this MIB module (i.e., objects with a MAX-ACCESS other than not-accessible) may be considered sensitive or vulnerable in some network environments. It is thus important to control even GET and/or NOTIFY access to these objects and possibly to even encrypt the values of these objects when sending them over the network via SNMP.

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

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

Further, deployment of SNMP versions prior to SNMPv3 is NOT RECOMMENDED. Instead, it is RECOMMENDED to deploy SNMPv3 and to enable cryptographic security. It is then a customer/operator responsibility to ensure that 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.

10. IANA Considerations

Option #1:

The MIB module in this document uses the following IANA-assigned OBJECT IDENTIFIER values recorded in the SMI Numbers registry:

```
Descriptor        OBJECT IDENTIFIER value
----------        -----------------------

sampleMIB  { mib-2 XXX }
```

Option #2:

Editor's Note (to be removed prior to publication): the IANA is requested to assign a value for "XXX" under the 'mib-2' subtree and to record the assignment in the SMI Numbers registry. When the assignment has been made, the RFC Editor is asked to replace "XXX" (here and in the MIB module) with the assigned value and to remove this note.

Note well: prior to official assignment by the IANA, an internet draft MUST use place holders (such as "XXX" above) rather than actual numbers. See RFC4181 Section 4.5 for an example of how this is done in an internet draft MIB module.

Option #3:

This memo includes no request to IANA.

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Appendix A. Change Log

This optional section should be removed before the internet draft is submitted to the IESG for publication as an RFC.

Note to RFC Editor: please remove this appendix before publication as an RFC.

Appendix B. Open Issues

Note to RFC Editor: please remove this appendix before publication as an RFC.

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