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A YANG model to manage the optical interface parameters of "G.698.2 single channel" in DWDM applications
draft-dharini-netmod-g-698-2-yang-04

Abstract

This memo defines a Yang model that translates the SNMP mib module defined in draft-galikunze-ccamp-g-698-2-snmp-mib for managing single channel optical interface parameters of DWDM applications, using the approach specified in G.698.2. This model is 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 Yang model 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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1. Introduction

This memo defines a Yang model that translates the SNMP mib module defined in draft-galikunze-ccamp-g-698-2-snmp-mib for managing single channel optical interface parameters of DWDM applications, using the approach specified in G.698.2. This model is to support the optical parameters specified in ITU-T G.698.2 [ITU.G698.2], application identifiers specified in ITU-T G.874.1 [ITU.G874.1] and the Optical Power at Transmitter and Receiver side. 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 the draft-kunze-g-698-2-management-control-framework

The building of a yang model describing the optical parameters defined in G.698.2 [ITU.G698.2], and reflected in G.874.1 [ITU.G874.1], allows the different vendors and operator to retrieve, provision and exchange information across the G.698.2 multi-vendor IaDI in a standardized way. In addition to the parameters specified in ITU recommendations the Yang models support also the "vendor specifica application identifier", the Tx and Rx power at the Ss and Rs points and the channel frequency.

The Yang Model, 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], which draft-galikunze-ccamp-g-698-2-snmp-mib is extending, 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].

This memo specifies a Yang model for optical interfaces.

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. 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 (R) the parameter can be retrieve with a read, when (W) it can be provisioned by a write, (R,W) can be either read or written.

4.1.1. Rs-Ss Configuration

The Rs-Ss configuration table allows configuration of Central Frequency, Power and Application codes 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) (see G.694.1 Table 1):
   This parameter indicates the Central frequency value that Ss and Rs will be set to work (in THz). See the details in Section 6/ G.694.1 (G, S).

Single-channel application codes(see G.698.2):
   This parameter indicates the transceiver application code 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 codes 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, it can be either a setting and measured value (G, S).

Current Laser Input power:
   This parameter report the current Transceiver Input power (G).

PARAMETERS	Get/Set	Reference
Central frequency Value	G,S	G.694.1 S.6
Single-channel application codes	G	G.698.2 S.5.3
Number of Single-channel application codes Supported	G	N.A.
Current Output Power	G,S	N.A.
Current Input Power	G	N.A.

Table 1: Rs-Ss Configuration

4.1.2. Table of Application Codes

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

Application code Identifier:
The Identifier for the Application code.

Application code Type:
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 Standard = 0, PROPRIETARY = 1
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 Code.

Application code Length:
The number of octets in the Application Code.

Application code:
This is the application code that is defined in G.698.2 or the vendor generated code which has the OUI.

4.2. 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 (e.g. this draft) 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

4.3. Optical Interface for G.698.2

The ietf-opt-if-g698-2 is an augment to the ietf-interface. It allows the user to set the application code/vendor transceiver class/ Central frequency and the output power. The module can also be used to get the list of supported application codes/transceiver class and also the Central frequency/output power/input power of the interface.

```
module: ietf-opt-if-g698-2
augment /if:interfaces/if:interface:
    +--rw optIfOChRsSs
          +--rw ifCurrentApplicationCode
          |  +--rw applicationCodeId    uint8
          |  +--rw applicationCodeType  uint8
          |  +--rw applicationCodeLength uint8
          |  +--rw applicationCode?     string
          +--ro ifSupportedApplicationCodes
          |  +--ro numberApplicationCodesSupported?   uint32
          |  +--ro applicationCodesList* [applicationCodeId]
          |     +--ro applicationCodeId   uint8
          |     +--rw applicationCodeType  uint8
          |     +--rw applicationCodeLength uint8
          |     +--ro applicationCode?    string
          +--rw outputPower?                     int32
          +--ro inputPower?                      int32
          +--rw centralFrequency?                uint32


 notifications:
+---n optIfOChCentralFrequencyChange
|  +--ro if-name?      leafref
|  +--ro newCentralFrequency
|     +--ro centralFrequency?   uint32
+---n optIfOChApplicationCodeChange
|  +--ro if-name?              leafref
|  +--ro newApplicationCode
|     +--ro applicationCodeId?   uint8
|     +--rw applicationCodeType  uint8
|     +--rw applicationCodeLength uint8
|     +--ro applicationCode?     string
```

5. Structure of the Yang Module

ietf-opt-if-g698-2 is a top level model for the support of this feature.

6. Yang Module

The ietf-opt-if-g698-2 is defined as an extension to ietf interfaces.

```
<CODE BEGINS> file "ietf-opt-if-g698-2.yang"

module ietf-opt-if-g698-2 {
     namespace "urn:ietf:params:xml:ns:yang:ietf-opt-if-g698-2";
     prefix ietf-opt-if-g698-2;

     import ietf-interfaces {
       prefix if;
     }

     organization
       "IETF NETMOD (NETCONF Data Modelling Language)
       Working Group";

     contact
       "WG Web:   <http://tools.ietf.org/wg/netmod/>
        WG List:  <mailto:netmod@ietf.org>

        WG Chair: Thomas Nadeau
                  <mailto:tnadeau@lucidvision.com>

        WG Chair: Juergen Schoenwaelder
                  <mailto:j.schoenwaelder@jacobs-university.de>

        Editor:   Dharini Hiremagalur
                  <mailto:dharinih@juniper.net>";

     description
       "This module contains a collection of YANG definitions for
        configuring Optical interfaces.

        Copyright (c) 2013 IETF Trust and the persons identified
        as authors of the code.  All rights reserved.

        Redistribution and use in source and binary forms, with or
        without modification, is permitted pursuant to, and
        subject to the license terms contained in, the Simplified
        BSD License set forth in Section 4.c of the IETF Trust's
        Legal Provisions Relating to IETF Documents
        (http://trustee.ietf.org/license-info).";

    revision "2015-06-24" {
           description
```

```
                  "Revision 4.0";

               reference
                  " draft-dharini-netmod-dwdm-if-yang 3.0";
        }
        revision "2015-02-24" {
               description
                  "Revision 3.0";

               reference
                  " draft-dharini-netmod-dwdm-if-yang 3.0";
        }
        revision "2014-11-10" {
               description
                  "Revision 2.0";
               reference
                  " ";
        }
        revision "2014-10-14" {
               description
                  "Revision 1.0";
                reference
                  " ";
        }
        revision "2014-05-10" {
               description
                   "Initial revision.";
               reference
                   "RFC XXXX: A YANG Data Model for Optical
                    Management of an Interface for g.698.2
                    support";
        }




          grouping optIfOChApplicationCode  {
                 description "Application code entity.";
                 leaf applicationCodeId {
                    type uint8 {
                          range "1..255";
                    }
                    description
                          "Id for the Application code";
                 }
                 leaf applicationCodeType {
                    type uint8 {
```

```
                  range "0..1";
         }
           description
                  "Type for the Application code
                    0 - Standard, 1 - Proprietory
                    When the Type is Proprietory, then the
                    first 6 octets of the applicationCode
                    will be the OUI (organizationally unique
                    identifier)";

         }
         leaf applicationCodeLength {
            type uint8 {
                  range "1..255";
            }
            description
                  "Number of octets in the Application code";

         }
         leaf applicationCode {
            type string {
                  length "1..255";
            }
            description "This parameter indicates the
                 transceiver application code at Ss and Rs as
                 defined in [ITU.G698.2] Chapter 5.3, that
                 is/should be used by this interface.
                 The optIfOChApplicationsCodeList has all the
                 application codes supported by this
                 interface.";

         }
  }


  grouping optIfOChApplicationCodeList {
    description "List of Application codes group.";
    leaf numberApplicationCodesSupported {
        type uint32;
        description "Number of Application codes
                     supported by this interface";
     }
    list applicationCodeList {
        key "applicationCodeId";
        description "List of the application codes";
        uses optIfOChApplicationCode;
    }
  }
```

```
        grouping optIfOChPower {
           description "Interface optical Power";
           leaf outputPower {
               type int32;
               units ".01dbm";
               description "The output power for this interface in
                            .01 dBm.";
           }

           leaf inputPower {
                type int32;
                units ".01dbm";
                config false;
                description "The current input power of this
                      interface";
           }
        }

         grouping optIfOChCentralFrequency {
           description "Interface Central Frequency";
             leaf  centralFrequency {
               type uint32;
               description "This parameter indicate This parameter
                       indicates the frequency of this interface ";

              }
        }

         notification optIfOChCentralFrequencyChange {
            description "A change of Central Frequency has been
                         detected.";
            leaf "if-name" {
                type leafref {
                    path "/if:interfaces/if:interface/if:name";
                }
                description "Interface name";
            }
            container newCentralFrequency {
                   description "The new Central Frequency of the
                                interface";
                   uses optIfOChCentralFrequency;
            }
         }

         notification optIfOChApplicationCodeChange {
            description "A change of Application code has been
                         detected.";
            leaf "if-name" {
```

```
                type leafref {
                    path "/if:interfaces/if:interface/if:name";
                }
                description "Interface name";
            }
            container newApplicationCode {
               description "The new application code for the
                   interface";
               uses optIfOChApplicationCode;
            }
         }



         augment "/if:interfaces/if:interface" {
           description "Parameters for an optical interface";
           container optIfOChRsSs {
              description "RsSs path configuration for an interface";
              container ifCurrentApplicationCode {
                  description "Current Application code of the
                               interface";
                  uses optIfOChApplicationCode;
               }

               container ifSupportedApplicationCodes {
                  config false;
                  description "Supported Application codes of
                               the interface";
                  uses optIfOChApplicationCodeList;
               }

               uses optIfOChPower;

               uses optIfOChCentralFrequency;

            }
         }
      }

   <CODE ENDS>
```

7. Security Considerations

The YANG module defined in this memo is designed to be accessed via the NETCONF protocol [RFC6241]. he lowest NETCONF layer is the secure transport layer and the mandatory-to-implement secure transport is SSH [RFC6242]. The NETCONF access control model [RFC6536] provides

the means to restrict access for particular NETCONF users to a pre-configured subset of all available NETCONF protocol operation and content.

8. IANA Considerations

This document registers a URI in the IETF XML registry [RFC3688]. Following the format in [RFC3688], the following registration is requested to be made:

URI: urn:ietf:params:xml:ns:yang:ietf-interfaces:ietf-opt-if-g698-2

Registrant Contact: The IESG.

XML: N/A, the requested URI is an XML namespace.

This document registers a YANG module in the YANG Module Names registry [RFC6020].

This document registers a YANG module in the YANG Module Names registry [RFC6020].

prefix: ietf-opt-if-g698-2 reference: RFC XXXX

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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

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