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An SNMP MIB extension to RFC3591 to manage optical interface parameters of DWDM applications

draft-galikunze-ccamp-g-698-2-snmp-mib-04

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 Optical parameters associated with Dense Wavelength Division Multiplexing (DWDM) interfaces. This is an extension of the RFC3591 to support the optical parameters described in ITU-T G.698.2. [ITU.G698.2]

The MIB module defined in this memo can be used for Optical Parameters monitoring and/or configuration of the endpoints of Black Links.

Status of This Memo

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

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This Internet-Draft will expire on April 23, 2014.

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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 Optical parameters associated with Wavelength Division Multiplexing (WDM) systems in accordance with the optical interface defined in G.698.2 [ITU.G698.2]

Black Link approach allows supporting an optical transmitter/receiver pair of one vendor to inject a DWDM channel and run it over an optical network composed of amplifiers, filters, add-drop multiplexers from a different vendor. From architectural point of view, the "Black Link" is a set of pre-configured/qualified network connections between the G.698.2 reference points S and R. The black links will be managed at the edges (i.e. 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 G.7710/Y.1701 [ITU-T G.7710] and and G.874.1 [ITU.G874.1].

The G.698.2 [ITU.G698.2] provides optical parameter values for physical layer interfaces of Dense Wavelength Division Multiplexing (DWDM) systems primarily intended for metro applications which 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 specify the details of the optical link, e.g. the maximum fibre length, explicitly. 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 underway 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] plus few optical paramenter not included in the application code definition.

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] G.798 [ITU.G798], G.874 [ITU.G874], parameters specified G.7710/Y.1701 [ITU-T G.7710] allows the different vendors and operator to retrieve, provision and exchange information related to Optical blak links in a standardized way. This facilitates interworking in case of using optical interfaces from different vendors at the end of the link.

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 multivendor optical networks.

Although RFC 3591 [RFC3591] describes and defines the SNMP MIB of a number of key optical parameters, alarms and Performance Monitoring, a more complete description of optical parameters and processes can be found in the ITU-T Recommendations. Appendix A of this document provides an overview about the extensive ITU-T documentation in this area. 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].

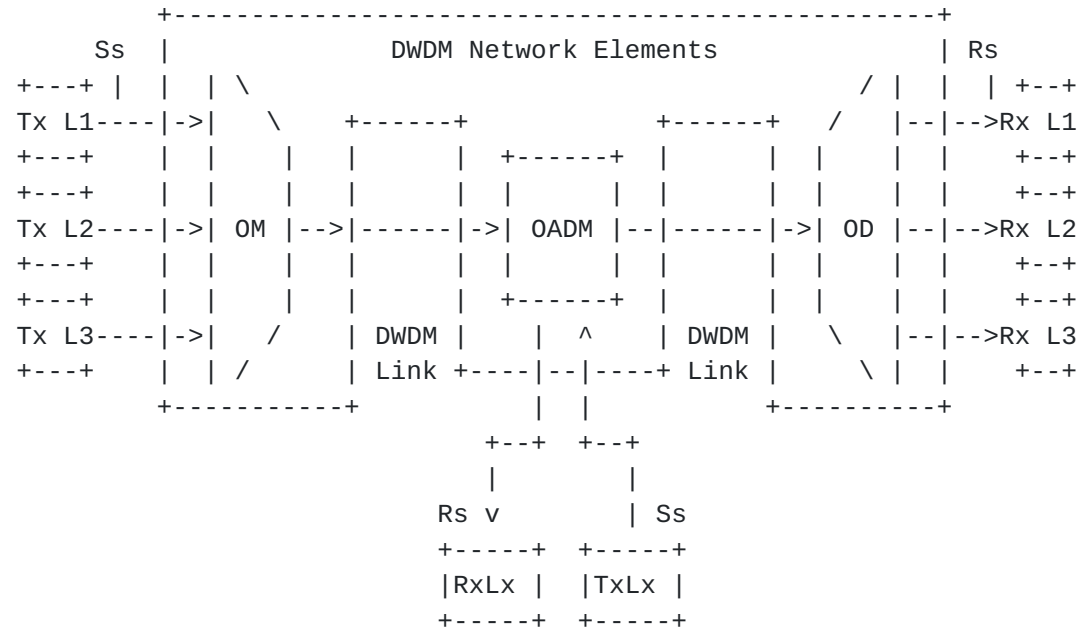
3. Conventions

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 = 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

G.698.2 [ITU.G698.2] defines also Ring Black Link configurations [Fig. 5.2/G.698.2] and Bidirectional Black Link configurations [Fig. 5.3/G.698.2]

4.1. Optical Parameters Description

The black links are managed at the edges, i.e. at the transmitters (Tx) and receivers (Rx) attached to the S and R reference points respectively. The parameters that could be managed at the black link edges 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).

4.1.1. Rs-Ss Configuration

The Rs-Ss configuration table allows configuration of Wavelength, 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) NEED TO DISCUSS ON THIS.

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

Number of Vendor Transceiver Class Supported
This parameter indicates the number of Vendor Transceiver codes supported by this interface (G).

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).

Minimum Laser Output power:
This parameter report the minimum Transceiver Output power supported by this interface (G).

Maximum Laser Output power:
This parameter report the maximum Transceiver Output power supported by this interface (G).

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

Minimum Laser Intput power:
This parameter report the minimum Transceiver Input power supported by this interface (G).

Maximum Laser Intput power:
This parameter report the maximum Transceiver Input power supported by this interface (G).

PARAMETERS	Get/Set	Reference
Wavelength Value	G,S	G.694.1 S.6
Vendor Transceiver Class	G	N.A.
Number of Vendor Transceiver Class Supported	G	N.A.
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.
Minimum Output Power	G	N.A.
Maximum Output Power	G	N.A.
Current Input Power	G	N.A.
Minimum Input Power	G	N.A.
Maximum 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:
This is the application code that is defined in G.698.2.

4.1.3. Table of Vendor Application Codes

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

Vendor Transceiver Class::
The Identifier for the vendor transceiver class.

Vendor Transceiver Class:
Other than specifying all the Transceiver parameter, it might be convenient for the vendors to summarize a set of parameters in a single proprietary parameter: the Class of transceiver. The Transceiver classification will be based on the Vendor Name and the main TX and RX parameters (i.e. Trunk Mode, Framing, Bit rate, Trunk Type, Channel Band, Channel Grid, Modulation Format, Channel Modulation Format, FEC Coding, Electrical Signal Framing at Tx, Minimum maximum Chromatic Disperion (CD) at Rx, Maximum Polarization Mode Dispersion (PMD) at Rx, Maximum differential group delay at Rx, Loopbacks, TDC, Pre-FEC BER, Q-factor, Q-margin,etc.). If this parameter is used, the MIB parameters specifying the Transceiver characteristics may not be significant and the vendor will be responsible to specify the Class contents and values. The Vendor can publish the parameters of its Classes or declare to be compatible with published Classes.(G) Optional for compliance. (not mentioned in G.698)

4.2. 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 Optical Channel (OCh) layer. There is a one to n relationship between the OPS and OCh layers.

EDITOR NOTE: Reason for changing from OChr to OCh: Work on revised G.872 in the SG15 December 2011 meeting agreed to remove OChr from the architecture and to update G.709 to account for this architectural change. The meeting also agreed to consent the revised text of G.872 and G.709 at the September 2012 SG15 meeting.

Figure 2 In the following figures, opticalChannel and opticalPhysicalSection are abbreviated as och and ops respectively.

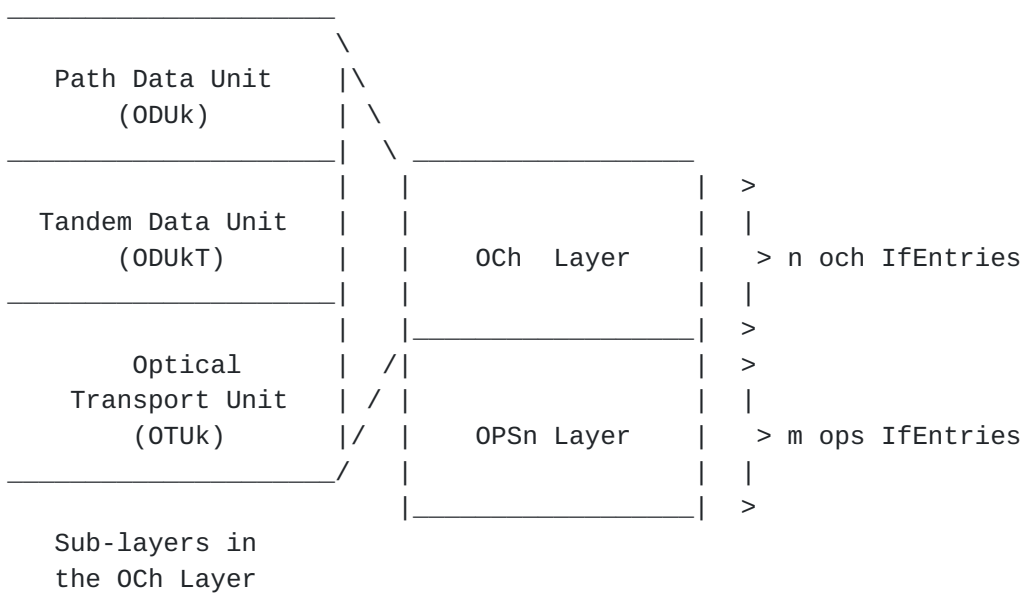


Figure 2: OTN Layers for OPS and OCh

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.

4.2.1. 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.

4.2.2. Use of ifTable for OCh Layer

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

4.2.3. 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 3

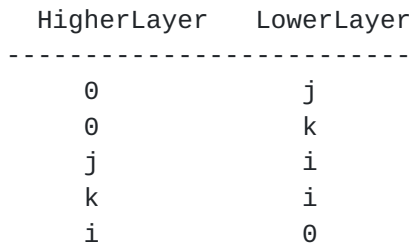


Figure 3: Use of ifStackTable for an OTN port

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 "201204250000Z"
    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 (2012).  This version
        of this MIB module is part of ;  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
       "Mib has in application code/vendor transcievercode G.698."
    ::= { 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 {
           optIfOChWavelengthn                          Unsigned32,
           optIfOChInterfaceVendorTransceiverClass      DisplayString,
           optIfOChNumberVendorClassesSupported         Unsigned32,
           optIfOChInterfaceApplicationCode             DisplayString,
           optIfOChNumberApplicationCodesSupported      Unsigned32,
           optIfOChOutputPower                          Integer32,
           optIfOChMinOutputPower                       Integer32,
           optIfOChMaxOutputPower                       Integer32,
           optIfOChInputPower                           Integer32,
           optIfOChMinInputPower                        Integer32,
           optIfOChMaxInputPower                        Integer32
```

```
        }

    optIfOChWavelengthn  OBJECT-TYPE
        SYNTAX  Unsigned32
        MAX-ACCESS  read-write
        STATUS  current
        DESCRIPTION
            " This parameter indicate minimum wavelength spectrum - n, in
             a definite wavelength Band (L, C and S) as represented in
             [RFC6205] by the formula -
             Wavelength (nm ) = 1471nm + n* optIfOChMiminumChannelSpacing
                                                  (converted to nm)
             Eg - optIfOChMiminumChannelSpacing in nm
             'Wavelength (nm ) = 1471nm + n* 20nm  (20nm is the spacing
              for CWDM)'
            "
        ::= { optIfOChSsRsConfigEntry  1 }

    optIfOChInterfaceVendorTransceiverClass  OBJECT-TYPE
        SYNTAX DisplayString
        MAX-ACCESS  read-write
        STATUS  current
        DESCRIPTION
           "As defined in G.698
            Vendors can summarize a set of parameters in a
            single proprietary parameter: the Class of transceiver.  The
            Transceiver classification will be based on the Vendor Name
            and the main TX and RX parameters (i.e.  Trunk Mode, Framing,
            Bit rate, Trunk Type etc).
            This defines the tranceiver class that is/should be used by
            this interface. The optIfOChSrcVendorTranscieverClassTable
            has all the vendor classes supported by this interface."

        ::= { optIfOChSsRsConfigEntry  2 }

    optIfOChNumberVendorClassesSupported  OBJECT-TYPE
        SYNTAX Unsigned32
        MAX-ACCESS  read-only
        STATUS  current
        DESCRIPTION
           " Number of Vedor classes supported by this interface."
        ::= { optIfOChSsRsConfigEntry  3 }

    optIfOChInterfaceApplicationCode  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/should be used by this interface. The
             optIfOChSrcApplicationCodeTable  has all the application
             codes supported by this interface. "
        ::= { optIfOChSsRsConfigEntry  4 }

    optIfOChNumberApplicationCodesSupported  OBJECT-TYPE
        SYNTAX Unsigned32
        MAX-ACCESS  read-only
        STATUS  current
        DESCRIPTION
           " Number of Application codes supported by this interface."
        ::= { optIfOChSsRsConfigEntry  5 }

    optIfOChOutputPower  OBJECT-TYPE
        SYNTAX  Integer32
        UNITS   "0.01dbm"
        MAX-ACCESS  read-write
        STATUS  current
        DESCRIPTION
            " The output power for this interface in .01 dbm "
        ::= { optIfOChSsRsConfigEntry  6 }

    optIfOChMinOutputPower  OBJECT-TYPE
        SYNTAX  Integer32
        UNITS   "0.01dbm"
        MAX-ACCESS  read-only
        STATUS  current
        DESCRIPTION
            " The minimum output power for this interface in .01 dbm "
        ::= { optIfOChSsRsConfigEntry  7 }

    optIfOChInputPower  OBJECT-TYPE
        SYNTAX  Integer32
        UNITS   "0.01dbm"
        MAX-ACCESS  read-only
        STATUS  current
        DESCRIPTION
            " The input power for this interface in .01 dbm "
        ::= { optIfOChSsRsConfigEntry  8 }

    optIfOChMinInputPower  OBJECT-TYPE
        SYNTAX  Integer32
        UNITS   "0.01dbm"
        MAX-ACCESS  read-only
        STATUS  current
        DESCRIPTION
```

```
            " The minimum input power for this interface in .01 dbm "
        ::= { optIfOChSsRsConfigEntry  9 }

    optIfOChMaxInputPower  OBJECT-TYPE
        SYNTAX  Integer32
        UNITS   "0.01dbm"
        MAX-ACCESS  read-only
        STATUS  current
        DESCRIPTION
            " The maximum input power for this interface in .01 dbm "
        ::= { optIfOChSsRsConfigEntry  10 }

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

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

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

    OptIfOChSrcApplicationCodeEntry ::=
        SEQUENCE {
            optIfOChApplicationCodeNumber               Integer32,
            optIfOChApplicationCode                     DisplayString
         }


    optIfOChApplicationCodeNumber  OBJECT-TYPE
        SYNTAX  Integer32 (1..255)
        MAX-ACCESS  not-accessible
        STATUS  current
        DESCRIPTION
          " The number of the application code supported at this
            interface. The interface can support more than one
            application codes.
```

```
        "
      ::= { optIfOChSrcApplicationCodeEntry  1}

  optIfOChApplicationCode  OBJECT-TYPE
      SYNTAX DisplayString
      MAX-ACCESS  read-only
      STATUS  current
      DESCRIPTION
          " The application code supported by this interface DWDM
            link."
      ::= { optIfOChSrcApplicationCodeEntry  2}

  -- Table of Vendor Transceiver class supported by the interface
  --  OptIfOChSrcVendorTranscieverClassEntry

  optIfOChSrcVendorTranscieverClassTable  OBJECT-TYPE
      SYNTAX  SEQUENCE OF OptIfOChSrcVendorTranscieverClassEntry
      MAX-ACCESS  not-accessible
      STATUS  current
      DESCRIPTION
          "A  table of OCh Src (Ss) tranceiver classes supported by
           this interface."
      ::= { optIfOChSsRsGroup 3 }

  optIfOChSrcVendorTranscieverClassEntry OBJECT-TYPE
      SYNTAX      OptIfOChSrcVendorTranscieverClassEntry
      MAX-ACCESS  not-accessible
      STATUS  current
      DESCRIPTION
          "A conceptual row that contains the tranceiver classes
           supported by this interface."
      INDEX  { ifIndex, optIfOChTranscieverClassNumber  }
      ::= { optIfOChSrcVendorTranscieverClassTable 1 }

  OptIfOChSrcVendorTranscieverClassEntry ::=
      SEQUENCE {
          optIfOChTranscieverClassNumber              Integer32,
          optIfOChTranscieverClass                    DisplayString
       }

  optIfOChTranscieverClassNumber  OBJECT-TYPE
      SYNTAX  Integer32 (1..255)
      MAX-ACCESS  not-accessible
      STATUS  current
      DESCRIPTION
        " The number of the application code supported at this
          interface. The interface can support more than one
          application codes.
```

```
        "
      ::= { optIfOChSrcVendorTranscieverClassEntry  1}

   optIfOChTranscieverClass  OBJECT-TYPE
       SYNTAX DisplayString
       MAX-ACCESS  read-only
       STATUS  current
       DESCRIPTION
           " Vendor tranceiver class supported by this interface."
       ::= { optIfOChSrcVendorTranscieverClassEntry  2}


   -- Notifications

   -- Wavelength Change Notification
   optIfOChWavelengthChange NOTIFICATION-TYPE
       OBJECTS { optIfOChWavelengthn }
       STATUS  current
       DESCRIPTION
           "Notification of a change in the wavelength."
       ::= { 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:

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 placeholders (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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