Internet Engineering Task Force
Internet-Draft
Intended status: Standards Track
Expires: August 22, 2011

GMG. G.Galimberti, Ed.
Cisco
RK. R.Kunze, Ed.
Deutsche Telekom
February 18, 2011

A SNMP MIB to manage the optical parameters caracteristic of a DWDM Black-Link
draft-galimbe-kunze-black-link-mib-00

Abstract

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 Interfaces associated with Wavelength Division Multiplexing (WDM) systems or characterized by the Optical Transport Network (OTN) in accordance with the Black-Link approach defined in ITU-T Recommendation G.698. [ITU.G698.2]

The MIB module defined in this memo can be used for Optical Parameters monitoring and/or configuration of such optical interface.

Note to RFC Editor re: [TEMPLATE TODO] markers

Note to RFC Editor: When a document is developed using this template, the editor of the document should replace or remove all the places marked [TEMPLATE TODO] before submitting the document. If there are still [TEMPLATE TODO] markers, please send the document back to the editor.

Status of This Memo

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

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at http://datatracker.ietf.org/drafts/current/.

Internet-Drafts are draft documents valid for a maximum of six months

and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on August 22, 2011.

Copyright Notice

Table of Contents

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 Interfaces associated with Wavelength Division Multiplexing (WDM) systems or characterized by the Optical Transport Network (OTN) in accordance with the Black-Link approach 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. Whereas the standardization of black link for 2.5 and 10G is settled for 40G and 100G interfaces and Black Link extensions are still in progress. For carrier network deployments, interoperability is a key requirement. Today it is state-of-the-art to interconnect IP Routers from different vendors and WDM transport systems using short-reach, grey interfaces. Applying the Black Link (BL) concept, routers now get directly connected to each via transport interfaces which must be interoperable to each other.

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 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 channel frequency spacing and may be extended to 40 and 100 Gbit/s channels with a lower channel frequency spacing.

The Building a SNMP MIB describing the optical parameters defined in G.698 [ITU.G698.2] allow the different vendors and operator to retrieve, provision and exchange information related to Optical Networks in a standardized way. This ensures interworking in case of using optical interfaces from different vendors at the end of the link. Decoupling DWDM layer from the optical layer The Optical Parameters and their values characterize the features and the performances of the Network optical components and allow a reliable network design in case of Multivendor Optical Networks.

Although RFC 3591 [RFC3591] describe and define 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].

4. Overview

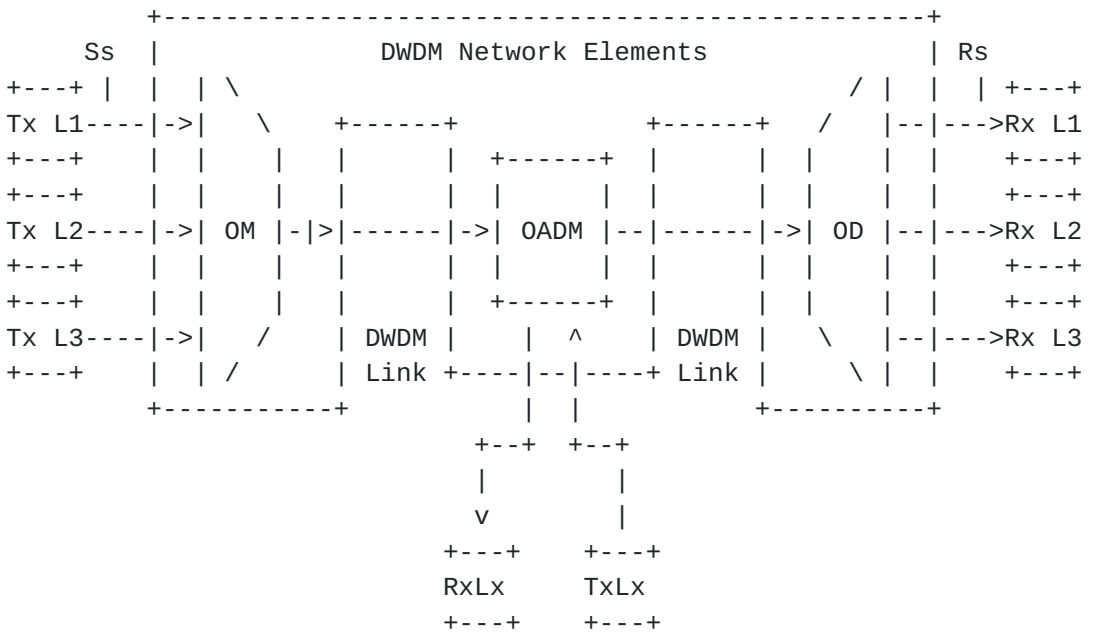
In this document, the term OTN (Optical Transport Network) system is used to describe devices that are compliant with the requirements specified in the ITU-T Recommendations G.872 [ITU.G872], G.709 [ITU.G709] , G.798 [ITU.G798], G.874 [ITU.G874], and G.874.1 [ITU.G874.1] while refer to [ITU.G698.2] for the Black Link and DWDM parameter description.

The optical objects will be managed using the MIB II ifTable and ifStackTable. Additional tables will also be supported to monitor layer specific status and provide performance monitoring data. In the tables, some entries are required for OTN systems only. A Configuration (Config) table, Current Performance Monitoring (PM) table, and Interval PM table will be maintained for the OTSn, OMSn, OChGroup, and OCh layers on a source and sink trail termination basis. These tables will be linked to the ifTable by using the ifIndex that is associated with that layer.

An Alarm (Aalarm) table will be maintained for the OTSn, OMSn,

OChGroup, and OCh layers on a source and sink trail termination basis. These tables will be linked to the ifTable by using the ifIndex that is associated with that layer.

Figure ADD-REFERENCE 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]

These objects are used when the particular media being used to realize an interface is an Optical Transport interface. At present,

this applies to these values of the ifType variable in the Internet-standard MIB:

opticalChannel (195), opticalChannelGroup (219), opticalTransport (196).

The definitions contained herein are based on the OTN specifications in ITU-T G.872 [ITU.G872], G.709 [ITU.G709], G.798 [ITU.G798], G.874 [ITU.G874], and G.874.1 [ITU.G874.1].

4.1. Optical Parameters Description

The terminology used in this document describes the optical parameters, the states and the Alarms at the points Ss, Rs and DWDM depicted in fig.1. The terms are defined in ITU-T Recommendations G.698.2 [ITU.G698.2]. Those definitions are made to increase the readability of the document.

4.1.1. General

Minimum channel spacing:
This is the minimum nominal difference in frequency between two adjacent channels (G).

Bit rate/line coding of optical tributary signals:
Optical tributary signal class NRZ 2.5G or NRZ 10G nominally 2.4 Gbit/s to nominally 10.71 Gbit/s. 40Gbit/s and 100Gbit/s are under definition (G, S).

Channel Modulation Format:
This parameter indicate what kind of modulation format is used at Ss (G).

FEC Coding:
This parameter indicate what Forward Error Correction (FEC) code is used at Ss and Rs (G, S).

Wavelenght Range (see G.694.1): [ITU.G694.1]
This parameter indicate minimum and maximum wavelength spectrum (G) in a definite wavelenght Band (L, C and S).

Wavelength Value (see G.694.1):
This parameter indicates the wavelenght value that Ss and Rs will be set to work (G, S).

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, 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.

4.1.2. Parameters at Ss

Maximum and minimum mean channel output power:
The mean launched power at Ss is the average power of a pseudo-random data sequence coupled into the DWDM link It is defined the thange (Max and Min) of the parameter (G, S)

Minimum and maximum central frequency:
The central frequency is the nominal single-channel frequency on which the digital coded information of the particular optical channel is modulated by use of the NRZ line code. The central frequencies of all channels within an application lie on the frequency grid for the minimum channel spacing of the application given in ITU-T Rec. G.694.1. This parameter give the Maximum and minimum frequency interval the channel must be modulated (G)

Maximum spectral excursion:
This is the maximum acceptable difference between the nominal central frequency of the channel and the minus 15 dB points of the transmitter spectrum furthest from the nominal central frequency measured at point Ss. (G)

Maximum transmitter (residual) dispersion OSNR penalty (B.3/G.959.1) [ITU.G959.1]
Lowest OSNR at Ss with worst case (residual) dispersion. Lowest OSNR at Ss with no dispersion (G)

Electrical Signal Framing:
This is the indication of what framing (GE, Sonet/SDH, OTN) the Ss and Rs ports are set (G, S)

4.1.3. Optical path from point Ss to Rs

Maximum and minimum (residual) chromatic dispersion:
These parameters define the maximum and minimum value of the optical path "end to end chromatic dispersion" that the system shall be able to tolerate. (G)

Minimum optical return loss at Ss:
These parameter defines minimum optical return loss of the cable plant at the source reference point (Ss), including any connectors (G)

Maximum discrete reflectance between SS and RS:
Optical reflectance is defined to be the ratio of the reflected optical power present at a point, to the optical power incident to that point. Control of reflections is discussed extensively in ITU-T Rec. G.957 (G)

Maximum differential group delay:
Differential group delay (DGD) is the time difference between the fractions of a pulse that are transmitted in the two principal states of polarization of an optical signal. For distances greater than several kilometres, and assuming random (strong) polarization mode coupling, DGD in a fibre can be statistically modelled as having a Maxwellian distribution. (G)

Maximum polarisation dependent loss:
The polarisation dependent loss (PDL) is the difference (in dB) between the maximum and minimum values of the channel insertion loss (or gain) of the black-link from point SS to RS due to a variation of the state of polarization (SOP) over all SOPs. (G)

Maximum inter-channel crosstalk:
Inter-channel crosstalk is defined as the ratio of total power in all of the disturbing channels to that in the wanted channel, where the wanted and disturbing channels are at different wavelengths. The parameter specify the isolation of a link conforming to the "black-link" approach such that under the worst-case operating conditions the inter-channel crosstalk at any reference point RS is less than the maximum inter-channel crosstalk value (G)

Maximum interferometric crosstalk:
This parameter places a requirement on the isolation of a link conforming to the "black-link" approach such that under the worst case operating conditions the interferometric crosstalk at any reference point RS is less than the maximum interferometric crosstalk value. (G)

Maximum optical path OSNR penalty:
The optical path OSNR penalty is defined as the difference between the Lowest OSNR at Rs and Lowest OSNR at Ss (G)

4.1.4. Interface at point Rs

Maximum and minimum mean input power:
The maximum and minimum values of the average received power at point Rs. (G)

Minimum optical signal-to-noise ratio (OSNR):
The minimum optical signal-to-noise ratio (OSNR) is the minimum value of the ratio of the signal power in the wanted channel to the highest noise power density in the range of the central frequency plus and minus the maximum spectral excursion (G)

Receiver OSNR tolerance:
The receiver OSNR tolerance is defined as the minimum value of OSNR at point Rs that can be tolerated while maintaining the maximum BER of the application. (G)

Minimum maximum Chromatic Disperion (CD) :
This parameter define the CD range a Receiver (Rs) can tolerate in order to decode the received signal (G)

Maximum Polarization Mode Dispersion (PMD) :
This parameter define the maximum PMD value a Receiver (Rs) can tolerate in order to decode the received signal (G)

4.1.5. Alarms and Threshold definition

This section describes the Alarms and the Thresholds at Ss and Rs points according to ITU-T Recommendations G.872 [ITU.G872], G.709 [ITU.G709], G.798 [ITU.G798], G.874 [ITU.G874], and G.874.1 [ITU.G874.1]. The SNMP MIB of the above list is already defined and specified by the RFC3591

OTN alarms defined in RFC3591:

Threshold Crossing Alert (TCA Alarm)

LOW-TXPOWER

HIGH-TXPOWER

LOW-RXPOWER

HIGH-RXPOWER

OTUk-LOF or more generic LOF

Backward Defect Indication (BDI)

Trace Identifier Mismatch (tim)

Signal Degrade (sd)

Server Signal Failure (SSF)

Alarm Indication Signal (AIS)

Loss of Multiframe (lom)

OTN Thresholds (for TCA) defined in RFC3591

LOW-TXPOWER

HIGH-TXPOWER

LOW-RXPOWER

HIGH-RXPOWER

The list below reports the new Alarms and Thresholds not managed in RFC3591

Laser Bias Current:
This parameter report the Bias current of the Laser Transmitter (G)

Laser Bias Current Threshold:
This parameter is to set the Bias current Threshold of the Laser Transmitter used ri rise the related Alarm (G, S)

Forward Defect Indication (FDI):
This parameter indicates a notification to the receiver that a failure occurred in the network (G)

Backward Error Indication (BEI):
This parameter indicates the number of Errors occurred in the opposite line direction (G)

4.1.6. Performance Monitoring (PM) description

This section describes the Performance Monitoring parameters at Ss and Rs points (Near -End and Far-End)according to ITU-T Recommendations G.826 [ITU.G826], G.8201 [ITU.G8201], G.709 [ITU.G709], G.798 [ITU.G798], G.874 [ITU.G874], and G.874.1 [ITU.G874.1].

Failure Counts (fc) :
Number of Failures occurred in an observation periond (G)

Errored Seconds (es) :
It is a one-second period in which one or more bits are in error or during which Loss of Signal (LOS) or Alarm Indication Signal (AIS) is detected (G)

Severely Errored Seconds (ses) :
It is a one-second period which has a bit-error ratio = 1x10Eminus3 or during which Loss of Signal (LOS) or Alarm Indication Signal (AIS) is detected (G)

Unavailable Seconds (uas) :
A period of unavailable time begins at the onset of ten consecutive SES events. These ten seconds are considered to be part of unavailable time. A new period of available time begins at the onset of ten consecutive non-SES events. These ten seconds are considered to be part of available time (G)

Background Block Errors (bbe) :
An errored block not occurring as part of an SES(G)

Error Seconds Ratio (esr) :
The ratio of ES in available time to total seconds in available time during a fixed measurement interval(G)

Severely Errored Seconds Ratio (sesr) :
The ratio of SES in available time to total seconds in available time during a fixed measurement interval(G)

Background Block Errored Seconds Ratio (bber) :
The ratio of Background Block Errors (BBE) to total blocks in available time during a fixed measurement interval. The count of total blocks excludes all blocks during SESs.(G)

FEC corrected Bit Error (FECcorrErr):
The number of bits corrected by the FEC are counted over one second (G)

FEC un-corrected Bit Error :
The number of bits un-corrected by the FEC are counted over one second (G)

Pre-FEC Bit Error :
The number of Errored bits at receiving side before the FEC function counted over one second (G)

OTN Valid Intervals :
The number of contiguous 15 minute intervals for which valid OTN performance monitoring data is available for the particular interface (G)

FEC Valid Intervals :
The number of contiguous 15 minute intervals for which valid FEC PM data is available for the particular interface.(G)

4.1.7. Generic Parameter description

This section describes the Generic Parameters at Ss and Rs points according to ITU-T Recommendations G.872 [ITU.G872], G.709 [ITU.G709], G.798 [ITU.G798], G.874 [ITU.G874], and G.874.1 [ITU.G874.1].

Interface Admin Status :
The Administrative Status of an Interface: Up/Down - In Service/ Out of Service (can be Automatic in Service) (G/S)

Interface Operational Status :
The Operational Status of an Interface: Up/Down - In Service/Out of Service (G)

Loopbacks :
The Interface loopbacks used for maintenance purposes, they are Terminal or Line (may be with send AIS)(G/S)

Pre-FEC BER (Mantissa + Exponent) :
Bit Error Rate at the Rs interface before error correction (G/S)

Q factor :
(G)

Q margin :
(G)

4.2. Use of ifTable

This section specifies how the MIB II interfaces group, as defined in RFC 2863 [RFC2863], is used for optical interfaces. As described in the RFC 3591 figure 1 [RFC3591] Only the ifGeneralInformationGroup will be supported for the ifTable and the ifStackTable to maintain the relationship between the various layers. The OTN layers are managed in the ifTable using IfEntries that correlate to the layers depicted in Figure 1. For example, a DWDM device with an Optical Network Node Interface (ONNI) will have an Optical Transmission Section (OTS) physical layer, an Optical Multiplex Section (OMS) layer (transports multiple optical channels), and an Optical Channel (OCh) layer. There is a one to one relationship between the OMS and OTS layers. The OMS layer has fixed connectivity via the OTS and thus no connectivity flexibility at the OMS layer is supported. This draft extend the RFC 3591 [RFC3591] as far as the OMSn and OTSn are concerned. The sections 2.5 and 2.6 of RFC 3591 [RFC3591] must be considered as a reference for the ifStackTable use and Optical Network Terminology.

5. Structure of the MIB Module

The managed Optical Networking interface objects are arranged into the following groups of tables:

The optIfOTMn group handles the OTM information structure of an optical interface.

optIfOTMnTable

The optIfPerfMon group handles the current 15-minute and 24-hour interval elapsed time, as well as the number of 15-minute intervals for all layers

optIfPerfMonIntervalTable

The optIfOTSn groups handle the configuration and performance monitoring information for OTS layers.

optIfOTSnConfigTable

optIfOTSnSinkCurrentTable

optIfOTSnSinkIntervalTable

optIfOTSnSinkCurDayTable

optIfOTSnSinkPrevDayTable

optIfOTSnSrcCurrentTable

optIfOTSnSrcIntervalTable

optIfOTSnSrcCurDayTable

optIfOTSnSrcPrevDayTable

5.1. The optIfOTMn group

5.1.1. optIfOTMnTable

This table contains the OTM structure information of an optical interface.

5.2. The optIfOTSn groups

5.2.1. optIfOTSn Configuration group

5.2.1.1. optIfOTSn Configuration Table

This table contains information on configuration of optIfOTSn interfaces, in addition to the information on such interfaces contained in the ifTable.

5.3. The [TEMPLATE TODO] Subtree

5.4. The Notifications Subtree

6. Object Definitions

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

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

```
   --  This is the MIB module for the OTN Interface objects.

   optIfMibModule MODULE-IDENTITY
       LAST-UPDATED "200308130000Z"
       ORGANIZATION "IETF AToM MIB Working Group"
       CONTACT-INFO
          "WG charter:
             http://www.ietf.org/html.charters/atommib-charter.html

           Mailing Lists:
              General Discussion: atommib@research.telcordia.com
              To Subscribe: atommib-request@research.telcordia.com
           Editor: Hing-Kam Lam
           Postal: Lucent Technologies, Room 4C-616
                   101 Crawfords Corner Road
                   Holmdel, NJ 07733
              Tel: +1 732 949 8338
            Email: hklam@lucent.com"
       DESCRIPTION
          "The MIB module to describe pre-OTN and OTN interfaces.

           Copyright (C) The Internet Society (2003).  This version
           of this MIB module is part of RFC 3591;  see the RFC
           itself for full legal notices."
       REVISION  "200308130000Z"
       DESCRIPTION
          "Initial version, published as RFC 3591."
       ::={ transmission 133 }



   OptIfBitRateK ::= TEXTUAL-CONVENTION
     STATUS  current
     DESCRIPTION
       "Indicates the index 'k' that is used to
        represent a supported bit rate and the different
        versions of OPUk, ODUk and OTUk.
        Allowed values of k are defined in ITU-T G.709.
        Currently allowed values in G.709 are:
           k=1 represents an approximate bit rate of 2.5 Gbit/s,
           k=2 represents an approximate bit rate of 10 Gbit/s,
           k=3 represents an approximate bit rate of 40 Gbit/s."
     SYNTAX  Integer32
```

```
optIfOTMnBitRates OBJECT-TYPE
  SYNTAX  BITS { bitRateK1(0), bitRateK2(1), bitRateK3(2) }
  MAX-ACCESS  read-only
  STATUS  current
  DESCRIPTION
    "This attribute is a bit map representing the bit
     rate or set of bit rates supported on the interface.
     The meaning of each bit position is as follows:
       bitRateK1(0) is set if the 2.5 Gbit/s rate is supported
       bitRateK2(1) is set if the 10 Gbit/s rate is supported
       bitRateK3(2) is set if the 40 Gbit/s rate is supported
     Note that each bit position corresponds to one possible
     value of the type OptIfBitRateK.
     The default value of this attribute is system specific."
  ::= { optIfOTMnEntry 3 }
```

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

There are no management objects defined in this MIB module that have a MAX-ACCESS clause of read-write and/or read-create. So, if this MIB module is implemented correctly, then there is no risk that an intruder can alter or create any management objects of this MIB module via direct SNMP SET operations.

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. These are the tables and objects and their sensitivity/vulnerability:

o

o

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.

11. Contributors

Arnold Mattheus
Deutsche Telekom
Darmstadt
Germany
Phone +49xxxxxxxxxx
email arnold.Mattheus@telekom.de

Manuel Paul
Deutsche Telekom
Berlin
Germany
phone +49xxxxxxxxxx
email Manuel.Paul@telekom.de

Frank Luennemann
T-Com TE14
Germany
phone +49xxxxxxxxxx
email Frank.Luennemann@telekom.de

Najam Saquib
Cisco
Ludwig-Erhard-Strasse 3
ESCHBORN, HESSEN 65760
GERMANY
phone +49 619 6773 9041
email nasaquib@cisco.com

Walid Wakim
Cisco
9501 Technology Blvd
ROSEMONT, ILLINOIS 60018
UNITED STATES
phone +1 847 678 5681
email wwakim@cisco.com

Ori Gerstel
Cisco
32 HaMelacha St., (HaSharon Bldg)
SOUTH NETANYA, HAMERKAZ 42504
ISRAEL
phone +972 9 864 6292
email ogerstel@cisco.com

12. References

12.1. Normative References

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

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

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

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

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

[RFC3591] Lam, H-K., Stewart, M., and A. Huynh, "Definitions of Managed Objects for the Optical Interface Type", RFC 3591, September 2003.

[ITU.G698.2] International Telecommunications Union, "Amplified multichannel dense wavelength division multiplexing applications with single channel optical interfaces", ITU-T Recommendation G.698.2, November 2009.

[ITU.G709] International Telecommunications Union, "Interface for the Optical Transport Network (OTN)", ITU-T Recommendation G.709, March 2003.

[ITU.G872] International Telecommunications Union, "Architecture of optical transport networks", ITU-T Recommendation G.872, November 2001.

[ITU.G798] International Telecommunications Union, "Characteristics of optical transport network hierarchy equipment functional blocks", ITU-T Recommendation G.798, October 2010.

[ITU.G874] International Telecommunications Union, "Management aspects of optical transport network elements", ITU-T Recommendation G.874, July 2010.

[ITU.G874.1] International Telecommunications Union, "Optical

transport network (OTN): Protocol-neutral management information model for the network element view", ITU-T Recommendation G.874.1, January 2002.

[ITU.G959.1] International Telecommunications Union, "Optical transport network physical layer interfaces", ITU-T Recommendation G.959.1, November 2009.

[ITU.G826] International Telecommunications Union, "End-to-end error performance parameters and objectives for international, constant bit-rate digital paths and connections", ITU-T Recommendation G.826, November 2009.

[ITU.G8201] International Telecommunications Union, "Error performance parameters and objectives for multi-operator international paths within the Optical Transport Network (OTN)", ITU-T Recommendation G.8201, September 2003.

[ITU.G694.1] International Telecommunications Union, "Spectral grids for WDM applications: DWDM frequency grid", ITU-T Recommendation G.694.1, June 2002.

12.2. Informative References

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

[RFC2629] Rose, M., "Writing I-Ds and RFCs using XML", RFC 2629, June 1999.

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

[RFC4054] Strand, J. and A. Chiu, "Impairments and Other Constraints on Optical Layer Routing", RFC 4054, May 2005.

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.

Authors' Addresses

Gabriele Galimberti (editor)
Cisco
Via Philips,12
20052 - Monza
Italy

Phone: +390392091462
EMail: ggalimbe@cisco.com

Ruediger Kunze (editor)
Deutsche Telekom
Dddd, xx
Berlin
Germany

Phone: +49xxxxxxxxxx
EMail: RKunze@telekom.de