Internet Engineering Task Force D. Hiremagalur, Ed.
Internet-Draft G. Grammel, Ed.
Intended status: Standards Track Juniper
Expires: January 7, 2016 G. Galimberti, Ed.
Z. Ali, Ed.
Cisco
R. Kunze, Ed.
Deutsche Telekom
D. Beller, Ed.
ALU
July 6, 2015

Extension to the Link Management Protocol (LMP/DWDM -rfc4209) for Dense Wavelength Division Multiplexing (DWDM) Optical Line Systems to manage the application code of optical interface parameters in DWDM application

draft-dharinigert-ccamp-g-698-2-lmp-10

Abstract

This memo defines extensions to LMP(rfc4209) for managing Optical parameters associated with Wavelength Division Multiplexing (WDM) systems or characterized by the Optical Transport Network (OTN) in accordance with the Interface Application Code approach defined in ITU-T Recommendation G.698.2.[ITU.G698.2], G.694.1.[ITU.G694.1] and its extensions.

Copyright Notice

Table of Contents

1. Introduction

This extension is based on "draft-galikunze-ccamp-g-698-2-snmp-mib-10", for the relevant interface optical parameters described in recommendations like ITU-T G.698.2 [ITU.G698.2] and G.694.1.[ITU.G694.1]. The LMP Model from RFC4902 provides link property correlation between a client and an OLS device. LMP link property correlation, exchanges the capabilities of either end of the link where the term 'link' refers to the attachment link between OXC and OLS (see Figure 1). By performing link property correlation, both ends of the link exchange link properties, such as application identifiers. This allows either end to operate within a commonly understood parameter window. Based on known parameter limits, each device can supervise the received signal for conformance using mechanisms defined in RFC3591. 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.

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

Figure 2 Extended LMP Model (from [RFC4209])

```
          +------+ Ss    +------+       +------+    Rs +------+
          |      | ----- |      |       |      | ----- |      |
          | OXC1 | ----- | OLS1 | ===== | OLS2 | ----- | OXC2 |
          |      | ----- |      |       |      | ----- |      |
          +------+       +------+       +------+       +------+
            ^  ^             ^              ^             ^  ^
            |  |             |              |             |  |
            |  +-----LMP-----+              +-----LMP-----+  |
            |                                                |
            +----------------------LMP-----------------------+
```

```
OXC        : is an entity that contains transponders
OLS        : generic optical system, it can be -
             Optical Mux, Optical Demux, Optical Add
             Drop Mux, etc.
OLS to OLS : represents the black-Link itself
Rs/Ss      : in between the OXC and the OLS
```

Figure 2: Extended LMP Model

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 3 Access Link Power Monitoring

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

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 4 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 4: 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 5 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 5: Extended LMP Model

3. Extensions to LMP-WDM Protocol

This document defines extensions to [RFC4209] to allow the Black Link (BL) parameters of G.698.2, to be exchanged between a router or optical switch and the optical line system to which it is attached. In particular, this document defines additional Data Link sub-objects to be carried in the LinkSummary message defined in [RFC4204] and [RFC6205]. The OXC and OLS systems may be managed by different Network management systems and hence may not know the capability and status of their peer. The intent of this draft is to enable the OXC and OLS systems to exchange this information. These messages and their usage are defined in subsequent sections of this document.

The following new messages are defined for the WDM extension for ITU-T G.698.2 [ITU.G698.2]/ITU-T G.698.1 [ITU.G698.1]/ ITU-T G.959.1 [ITU.G959.1]

```
  - OCh_General                  (sub-object Type = TBA)
  - OCh_ApplicationIdentier      (sub-object Type = TBA)
  - OCh_Ss                       (sub-object Type = TBA)
  - OCh_Rs                       (sub-object Type = TBA)
```

4. General Parameters - OCh_General

These are the general parameters as described in [G698.2] and [G.694.1]. Please refer to the "draft-galikunze-ccamp-g-698-2-snmp-mib-12" for more details about these parameters and the [RFC6205] for the wavelength definition.

The general parameters are
1. Central Frequency - (Tera Hz) 4 bytes (see RFC6205 sec.3.2)
2. Number of Application Identifiers (A.I.) Supported
3. Single-channel Application Identifier in use
4. Application Identifier Type in use
5. Application Identifier in use

Figure 6: The format of the this sub-object (Type = TBA, Length = TBA) is as follows:

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|    Type       |     Length    |         (Reserved)            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                      Central Frequency                        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|   Number of Application               |                       |
|   Identifiers Supported               |     (Reserved)        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

```
| Single-channel|  A.I. Type    |         A.I. length           |
| Application   |   in use      |                               |
| Identifier    |               |                               |
| Number in use |               |                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|           Single-channel Application Identifier in use        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|           Single-channel Application Identifier in use        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|           Single-channel Application Identifier in use        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

A.I. Type in use: STANDARD, PROPRIETARY

A.I. Type in use: STANDARD

Refer to G.698.2 recommendation : B-DScW-ytz(v)

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                Single-channel Application Code                |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                Single-channel Application Code                |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                Single-channel Application Code                |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

A.I. Type in use: PROPRIETARY

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

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        OUI                                    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|              OUI cont.        |           Vendor value        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                            Vendor Value                       |
```

```
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 6: OCh_General

5. ApplicationIdentifier - OCh_ApplicationIdentifier

This message is to exchange the application identifiers supported as described in [G698.2]. Please refer to the "draft-galikunze-ccamp-g-698-2-snmp-mib-10". For more details about these parameters. There can be more than one Application Identifier supported by the OXC/OLS. The number of application identifiers supported is exchanged in the "OCh_General" message. (from [G698.1]/[G698.2]/[G959.1] and G.874.1)

The parameters are

1. Number of Application Identifiers (A.I.) Supported

2. Single-channel application identifier Number
   uniquely identifiers this entry - 8 bits

3. Application Indentifier Type (A.I.) (STANDARD/PROPRIETARY)

4. Single-channel application identifier -- 96 bits
   (from [G698.1]/[G698.2]/[G959.1]

- this parameter can have
  multiple instances as the transceiver can support multiple
  application identifiers.

Figure 7: The format of the this sub-object (Type = TBA, Length = TBA) is as follows:

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|    Type       |    Length     |         (Reserved)            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|   Number of Application                 |                     |
|   Identifiers Supported                 |     (Reserved)      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| Single-channel|  A.I. Type    |         A.I. length           |
| Application   |               |                               |
| Identifier    |               |                               |
| Number        |               |                               |
```

```
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|               Single-channel Application Identifier           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|               Single-channel Application Identifier           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|               Single-channel Application Identifier           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
//              ....                                            //
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| Single-channel|               |         A.I. length           |
| Application   |   A.I. Type   |                               |
| Identifier    |               |                               |
| Number        |               |                               |
|               |               |                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|               Single-channel Application Identifier           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|               Single-channel Application Identifier           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|               Single-channel Application Identifier           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

A.I. Type in use: STANDARD, PROPRIETARY

A.I. Type in use: STANDARD
Refer to G.698.2 recommendation : B-DScW-ytz(v)

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                Single-channel Application Code                |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                Single-channel Application Code                |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                Single-channel Application Code                |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

A.I. Type in use: PROPRIETARY

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

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        OUI                                    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|              OUI cont.        |           Vendor value        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                           Vendor Value                        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 7: OCh_ApplicationIdentifier

6. OCh_Ss - OCh transmit parameters

These are the G.698.2 parameters at the Source(Ss reference points). Please refer to "draft-galikunze-ccamp-g-698-2-snmp-mib-10" for more details about these parameters.

1. Output power

Figure 8: The format of the OCh sub-object (Type = TBA, Length = TBA) is as follows:

```
 0                   1                   2                  3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|    Type       |    Length     |         (Reserved)            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                      Output Power                             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 8: OCh_Ss transmit parameters

7. OCh_Rs - receive parameters

These are the G.698.2 parameters at the Sink (Rs reference points). Please refer to the "draft-galikunze-ccamp-g-698-2-snmp-mib-10" for more details about these parameters.

1. Current Input Power   - (0.1dbm) 4bytes

Figure 9: The format of the OCh receive sub-object (Type = TBA, Length = TBA) is as follows:

The format of the OCh receive/OLS Sink sub-object (Type = TBA, Length = TBA) is as follows:

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|    Type       |    Length     |                   (Reserved)  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                   Current Input Power                         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 9: OCh_Rs receive parameters

8. Security Considerations

LMP message security uses IPsec, as described in [RFC4204]. This document only defines new LMP objects that are carried in existing LMP messages, similar to the LMP objects in [RFC:4209]. This document does not introduce new security considerations.

9. IANA Considerations

LMP <xref target="RFC4204"/> defines the following name spaces and the ways in which IANA can make assignments to these namespaces:

- LMP Message Type
- LMP Object Class
- LMP Object Class type (C-Type) unique within the Object Class
- LMP Sub-object Class type (Type) unique within the Object Class

This memo introduces the following new assignments:

LMP Sub-Object Class names:

under DATA_LINK Class name (as defined in <xref target="RFC4204"/>)

- OCh_General (sub-object Type = TBA)
- OCh_ApplicationIdentifier (sub-object Type = TBA)
- OCh_Ss (sub-object Type = TBA)
- OCh_Rs (sub-object Type = TBA)

10. Contributors

Arnold Mattheus
Deutsche Telekom
Darmstadt
Germany
email a.mattheus@telekom.de

John E. Drake
Juniper
1194 N Mathilda Avenue
HW-US,Pennsylvania
USA
jdrake@juniper.net

11. References

11.1. Normative References

[RFC4204] Lang, J., "Link Management Protocol (LMP)", RFC 4204, October 2005.

[RFC4209] Fredette, A. and J. Lang, "Link Management Protocol (LMP) for Dense Wavelength Division Multiplexing (DWDM) Optical Line Systems", RFC 4209, October 2005.

[RFC6205] Otani, T. and D. Li, "Generalized Labels for Lambda-Switch-Capable (LSC) Label Switching Routers", RFC 6205, March 2011.

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

[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.G694.1] International Telecommunications Union, ""Spectral grids for WDM applications: DWDM frequency grid"", ITU-T Recommendation G.698.2, February 2012.

[ITU.G709]
International Telecommunications Union, "Interface for the Optical Transport Network (OTN)", ITU-T Recommendation G.709, February 2012.

[ITU.G872]
International Telecommunications Union, "Architecture of optical transport networks", ITU-T Recommendation G.872, October 2012.

[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, October 2012.

11.2. 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.

[I-D.kunze-g-698-2-management-control-framework]
Kunze, R., "A framework for Management and Control of optical interfaces supporting G.698.2", draft-kunze-g-698-2-management-control-framework-00 (work in progress), July 2011.

Authors' Addresses

Dharini Hiremagalur (editor)
Juniper
1194 N Mathilda Avenue
Sunnyvale - 94089 California
USA

Phone: +1408
Email: dharinih@juniper.net

Gert Grammel (editor)
Juniper
Oskar-Schlemmer Str. 15
80807 Muenchen
Germany

Phone: +49 1725186386
Email: ggrammel@juniper.net

Gabriele Galimberti (editor)
Cisco
Via S. Maria Molgora, 48
20871 - Vimercate
Italy

Phone: +390392091462
Email: ggalimbe@cisco.com

Zafar Ali (editor)
Cisco
3000 Innovation Drive
KANATA
ONTARIO K2K 3E8

Email: zali@cisco.com

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

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

Dieter Beller (editor)
ALU
Lorenzstrasse, 10
70435 Stuttgart
Germany

Phone: +4971182143125
Email: Dieter.Beller@alcatel-lucent.com