Internet Engineering Task Force   D. Hiremagalur, Ed.
Internet-Draft   G. Grammel, Ed.
Intended status: Experimental   Juniper
Expires: January 1, 2018   G. Galimberti, Ed.
                                                               Cisco
                                                            R. Kunze
                                                     Deutsche Telekom
                                                        June 30, 2017

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-ggalimbe-ccamp-flex-if-lmp-02

Abstract

   This experimental memo defines extensions to LMP(rfc4209) for
   managing Optical parameters associated with Wavelength Division
   Multiplexing (WDM) adding a set of parameters related to multicarrier
   DWDM interfaces to be used in Spectrum Switched Optical Networks
   (sson).

Copyright Notice

Status of This Memo

Copyright Notice

Table of Contents

1. Introduction

   This experimental extension addresses the use cases described by
   "draft-kdkgall-ccamp-dwdm-if-mng-ctrl-fwk-00" to the Spectrum
   Switched Optical Network applications. LMP [RFC4902] provides link
   property correlation capabilities that can be used between a
   transceiver device and an Optical Line System (OLS) device. Link
   property correlation is a procedure by which, intrinsic parameters
   and capabilities are exchanged between two ends of a link. Link
   property correlation as defined in RFC3591 allows either end of the
   link to supervise the received signal and operate within a commonly
   understood parameter window. Here the term 'link' refers in
   particular to the attachment link between OXC and OLS (see Figure 1).
   The relevant novelty is the interface configuration having a multiple
   carrier where the client signal is spread on. The parameters
   parameters are not yet fully defined by ITU-T do this document can
   jast be seen as an experimental proposal not binding operators and
   vendors to require and implement them

2. DWDM line system

Figure 1 shows a set of reference points (Rs and Ss), for a single-
channel connection between transmitter (Tx) and receiver (Rx)
devices. Here the DWDM network elements in between those devices
include an Optical Multiplexer (OM) and an Optical Demultiplexer
(OD). In addition it may include one or more Optical Amplifiers (OA)
and one or more Optical Add-Drop Multiplexers (OADM).

```
          +----------------------------------------------------+
     Ss   |             DWDM Network Elements          |  Rs
    +--+ |  |  | \                               / |  |  | +--+
    Tx L1--|->|   \     +------+          +------+   /   |--|-->Rx L1
    +---+  |  |   |   |      | +------+ |      |  |   |  |   +--+
    +---+  |  | FX |   |      | | FLEX | |      |  | FX |  |   +--+
    Tx L2--|->| OM |-->|------|->|ROADM |--|------|->| OD |--|-->Rx L2
    +---+  |  |   |   |      | |      | |      |  |   |  |   +--+
    +---+  |  |   |   |      | +------+ |      |  |   |  |   +--+
    Tx L3--|->|   /   | DWDM |   | ^   | DWDM |   \  |--|-->Rx L3
    +---+  |  | /     | Link +----|--|----+ Link |    \ |  |   +--+
        +-----------+          |  |              +----------+
                          +--+  +--+
                           |     |
                          Rs v      | Ss
                          +-----+  +-----+
                          |RxLx |  |TxLx |
                          +-----+  +-----+
```
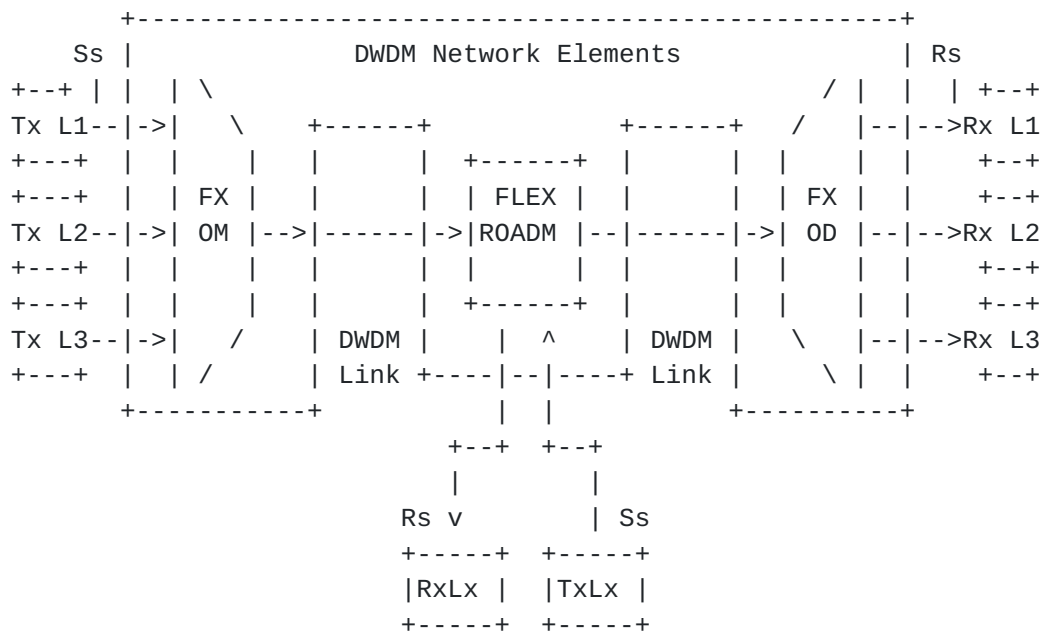
Ss = Sender reference point at the DWDM network element
     tributary output, this can be a set of multiple transceivers
     carrying the same client payload.
Rs = Receiver reference point at the DWDM network element
     tributary input this can be a set of multiple transceivers
     carrying the same client payload.
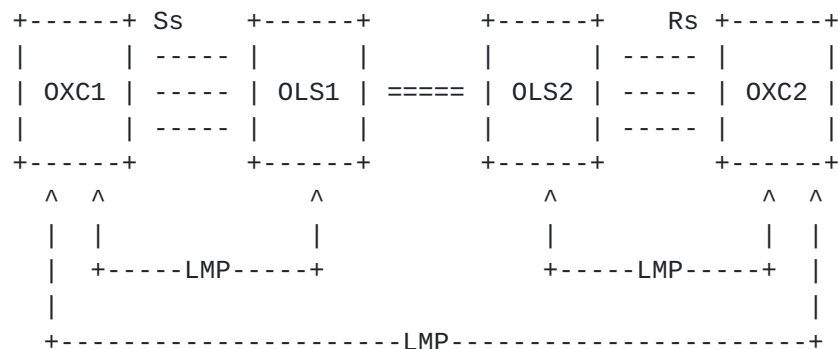
FX OM = Flex-Spectrum Optical Mux
FX OD = Flex-Spectrum Optical Demux
Flex OADM = Flex-Spectrum Optical Add Drop Mux

extending Fig. 5.1/G.698.2

                    Figure 1: Linear Single Channel approach

Figure 2 Extended LMP Model (from [RFC4209])

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

    OXC   : is an entity that contains Multiple carriers transponders
    OLS   : generic Flex-Spectrum optical system, it can be -
              Optical Mux, Optical Demux, Optical Add
              Drop Mux, Amplifier etc.
    OLS to OLS: represents the Optical Multiplex section
              <xref target="ITU.G709"/>
    Rs/Ss   : reference points in between the OXC and the OLS

                    Figure 2: Extended LMP Model

3. Use Cases

The set of paramentes exchanged between is to support the Spectrum
Switched Optical Network in therms of Number of Sub-carriers
available at the transceiver , their characteristics to provide the
SSON control plane all the information suitable to calculate the

4. Extensions to LMP-WDM Protocol

This document defines extensions to [RFC4209] to allow a set of
characteristic parameters, 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. These messages and their usage are defined in
subsequent sections of this document.

   The following new messages are defined for the SSON extension
     - Multi carrier Transceiver   (sub-object Type = TBA)

5. **Multi carrier Transceiver**

   These are a set of general parameters extending the description in
   [G698.2] and [G.694.1]. IYU-T working group are working to detail
   most of parameters and an update of the TLV may be required.

 The general parameters are
  1. Modulation identifier: indicates the Transceiver capabilities
     to support a single or multiple modulation format like:
     BPSK (1), DC-DP-BSPSK, QPSK, DP-QPSK, QAM16, DP-QAM16,
     DC-DP-QAM16
  2. FEC: indicates the FEC types the transceiver can support
  3. baud rate: number of symbols rate, besically this identify the
     channel frequency
  4. Num Carriers: number of subcarriers the trasceiver can support
     and can be "mapped" in a Mediachannel
  5. Bits/symbol: number of bit per simbol (aka spectral efficiency)
  6. Subcarrier band (minimum distance between subcarriers) in GHz
  7. Guard band (required guard band at the side of media channel)
  8. Sub-carrier TX Power: output optical power the transceiver can
     provide
  9. Sub-carrier RX Power: Input optical power Range the transceiver can
     support, this is known also as Sensitivity
  10. Sub-carrier OSNR robustness

Figure 3: 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)           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|S|I|       Modulation ID       |             FEC               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                    baud rate  (Symbol Rate)                   |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|      Number of subcarriers    |          Bit/Symbol           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|          subcarrier band      |         guard band            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                  sub-carrier TX power                         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                 sub-carrier RX power HIGH                     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                 sub-carrier RX power LOW                      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                    sub-carrier OSNR                           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

   - S: standardized format;
   - I: input / output (1 / 0)
   - Modulation IDs: BPSK (1), DC DP BSPSK, QPSK, DP QPSK, 8QAM
     16QAM, 64QAM
   - FEC
   - baud rate: Symbol Rate IEEE float in bauds/s
   - Num Carriers
   - Bits/symbol
   - Subcarrier band (minimum distance between subcarriers)
   - Guard band (required guard band at the side of media channel)
   - Sub-carrier Transmit Power
   - Sub-carrier Receive HIGH Power range (Sensitivity)
   - Sub-carrier Receive LOW Power range (Sensitivity)
   - Sub-carrier OSNR robustness

Figure 3: Multi carrier Transceiver

6. 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.

7. 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"/>)
   - Multi carrier Transceiver   (sub-object Type = TBA)

8. Contributors

    Zafar Ali
       Cisco
       3000 Innovation Drive
       KANATA
       ONTARIO K2K 3E8
       zali@cisco.com</email>

9. References

9.1. Normative References

[I-D.kdkgall-ccamp-dwdm-if-mng-ctrl-fwk]
          Kunze, R., Grammel, G., Beller, D., and G. Galimberti, "A
          framework for Management and Control of G.698.2 optical
          interface parameters", draft-kdkgall-ccamp-dwdm-if-mng-
          ctrl-fwk-00 (work in progress), October 2015.

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

[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, 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.

[RFC4054] Strand, J., Ed. and A. Chiu, Ed., "Impairments and Other
          Constraints on Optical Layer Routing", RFC 4054,
          DOI 10.17487/RFC4054, May 2005,
          <http://www.rfc-editor.org/info/rfc4054>.

[RFC4204] Lang, J., Ed., "Link Management Protocol (LMP)", RFC 4204,
          DOI 10.17487/RFC4204, October 2005,
          <http://www.rfc-editor.org/info/rfc4204>.

[RFC4209] Fredette, A., Ed. and J. Lang, Ed., "Link Management
          Protocol (LMP) for Dense Wavelength Division Multiplexing
          (DWDM) Optical Line Systems", RFC 4209,
          DOI 10.17487/RFC4209, October 2005,
          <http://www.rfc-editor.org/info/rfc4209>.

[RFC6205] Otani, T., Ed. and D. Li, Ed., "Generalized Labels for
          Lambda-Switch-Capable (LSC) Label Switching Routers",
          RFC 6205, DOI 10.17487/RFC6205, March 2011,
          <http://www.rfc-editor.org/info/rfc6205>.

9.2. Informative References

[RFC2629] Rose, M., "Writing I-Ds and RFCs using XML", RFC 2629,
          DOI 10.17487/RFC2629, June 1999,
          <http://www.rfc-editor.org/info/rfc2629>.

   [RFC3410]   Case, J., Mundy, R., Partain, D., and B. Stewart,
               "Introduction and Applicability Statements for Internet-
               Standard Management Framework", RFC 3410,
               DOI 10.17487/RFC3410, December 2002,
               <http://www.rfc-editor.org/info/rfc3410>.

   [RFC4181]   Heard, C., Ed., "Guidelines for Authors and Reviewers of
               MIB Documents", BCP 111, RFC 4181, DOI 10.17487/RFC4181,
               September 2005, <http://www.rfc-editor.org/info/rfc4181>.

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

Ruediger Kunze
Deutsche Telekom
Dddd, xx
Berlin
Germany

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