Extension to the Link Management Protocol (LMP/DWDM - rfc4209) for Dense Wavelength Division Multiplexing (DWDM) Optical Line Systems

draft-dharinigert-ccamp-g-698-2-lmp-02.txt

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Motivation & Problem statement

Motivation

1. RFC4209 extension to cover the parameters as defined in G. 698.2
2. draft-dharinigert-ccamp-g-698-2-lmp extensions are in alignment with draft-galikunze-ccamp-g-698-2-snmp-mib

The need of this work has been highlighted during the discussion at IETF-83, IETF-84 and IETF-85

Problem Statement

1. Correlate and check Link properties of both ends of a link and notify inconsistency.
2. Extending Link Property correlation for G.698.2 based links
3. Extend RFC4209 covering Application Codes

About LMP

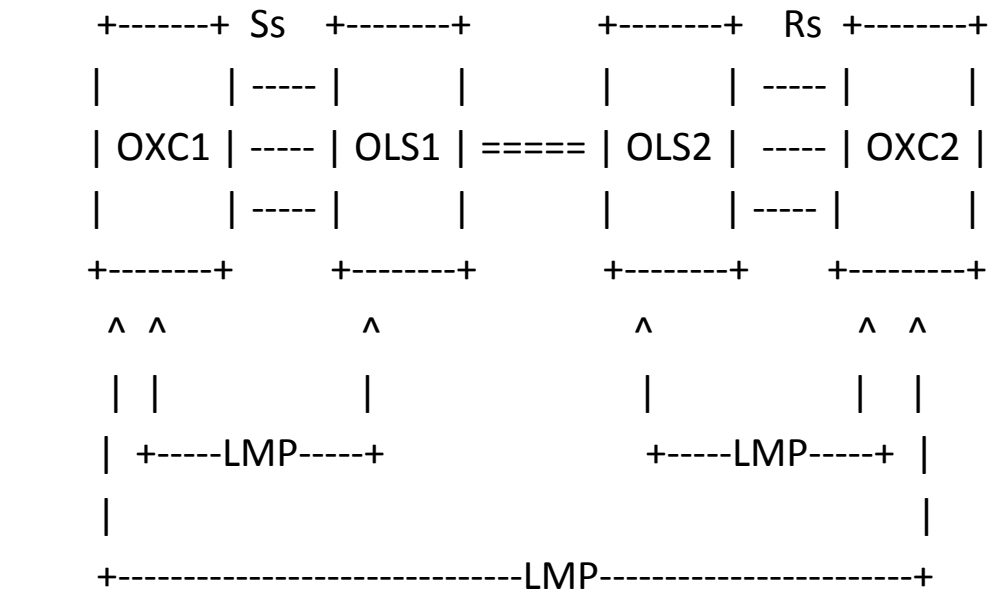
- RFC4204 (LMP) and RFC4209 (LMP-WDM)

  "For scalability purposes, multiple data links can be combined to form a single traffic engineering (TE) link. Furthermore, the management of TE links is not restricted to in-band messaging, but instead can be done using out-of-band techniques. This document specifies a link management protocol (LMP) that runs between a pair of nodes and is used to manage TE links."

- Currently addressing Transponder based links only
- Needs extension for wavelength, optical impairments and transceiver characteristics according to G.698.2 and G.694.1

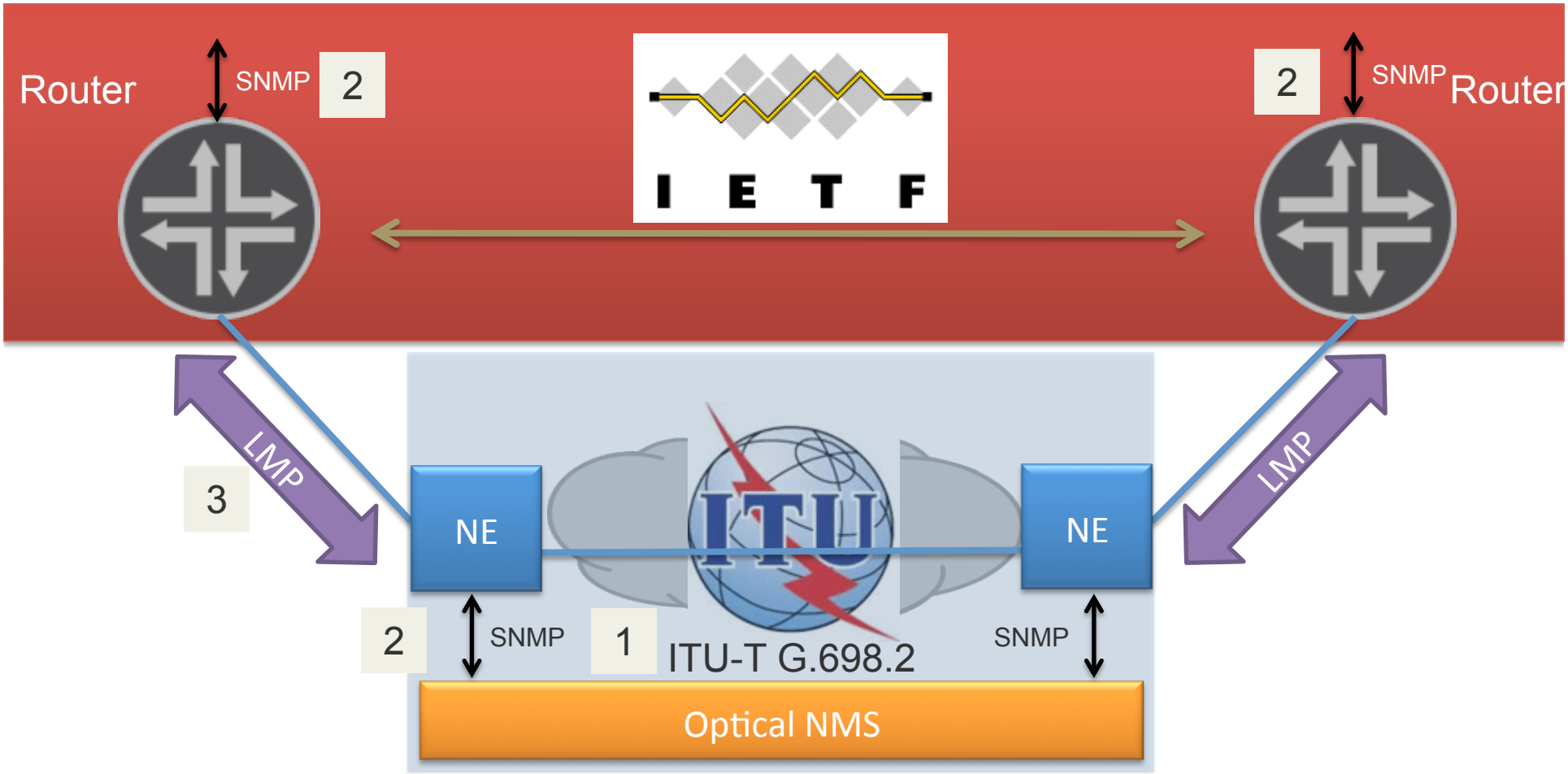
NON-GOAL: LMP is neither a signaling nor a routing protocol

RFC 4209 Extended LMP Model



- OXC : is an entity that contains transponders
- OLS : generic optical system, it can be - Optical mux, Optical demux, Optical Add Drop Mux, etc
- OLS1 to OLS2 : represents the black-Link itself
- Rs/Ss : between the OXC1 and the OXC2

Packet/Optical Networking – An example for an architecture



G.698.2-LMP

1. Goal: LMP correlates the link properties east and west of G.698.2 reference points (Rs / Ss):
   - Ensure that both ends match **before** wavelength is lit-up
2. How it works for standard application codes:
   - When connected, Router and Optical Line System perform discovery procedures and exchange Application codes and BL messages.

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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]
     - BL_General           (sub-object Type = TBA)
     - BL_ApplicationCode   (sub-object Type = TBA)
     - BL_Ss                (sub-object Type = TBA)
     - BL_SsRs              (sub-object Type = TBA)
     - BL_Rs                (sub-object Type = TBA)
     - BL_OLS_Status        (sub-object Type = TBA)
```

Extended RFC4209 LMP Messages for G.698.2 (1)

- **The general parameters - BL_General**

  These are the general parameters as described in [G698.2]

  1. Bit-Rate/line coding of optical tributary signals
  2. Wavelength - (Tera Hertz) 4 bytes (see RFC6205 sec.3.2 and 3.3 TLV):
     Grid / Cannel Spacing / Identifier / n
  3. Min Wavelength Range - (Tera Hertz) 4 bytes (see RFC6205 sec.3.2 and 3.3 TLV):
     Grid/Cannel Spacing/Identifier/n
  4. Max Wavelength Range - (Tera Hertz) 4 bytes (see RFC6205 sec.3.2 and 3.3 TLV):
     Grid/Cannel Spacing/Identifier/n
  5. BER mantissa - 4 bytes
  6. BER exponent - 4 bytes
  7. FEC Coding - 1 byte
  8. Administrative state - 1 byte
  9. Operation state - 1 byte

- **Black Link ApplicationCode - BL_ApplicationCode**

  1. Single-channel application codes -- 32 bytes (from [G698.1]/[G698.2]/[G959.1]
  2. Vendor Transceiver Class -- 32 bytes

Extended RFC4209 LMP Messages for G.698.2 (2)

- **Black Link - BL_Ss**

  These are the G.698.2 parameters at the Source(Ss reference points

  1. Minimum Mean Channel Output Power -(0.1 dbm) 4 bytes
  2. Maximum Mean Channel Output Power -(0.1 dbm) 4 bytes
  3. Minimum Central Frequency - (THz) 4 bytes (see RFC6205 sec.3.2 and 3.3 TLV): Grid / Cannel Spacing / Identifier / n
  4. Maximum Central Frequency - (THz) 4 bytes (see RFC6205 sec.3.2 and 3.3 TLV): Grid / Cannel Spacing / Identifier / n
  5. Maximum Spectral Excursion - (0.1 GHz) 4 bytes
  6. Maximum Tx Dispersion OSNR Penalty - (0.1 dbm) 4 bytes
  7. Current Output Power - (0.1dbm) 4 bytes
  8. Status of TX - Status of the Transmit link at OXC - 4 bytes

- **Black Link - BL_SsRs**

  These are the G.698.2 parameters for the path (Ss-Rs)

  1 Minimum Chromatic Dispersion - (ps/nm) 4 bytes
  2. Maximum Chromatic Dispersion -(ps/nm) 4 bytes
  3. Minimum Src Optical ReturnLoss -(0.1 db) 4 bytes
  4. Maximum Discrete Reflectance Src To Sink - (0.1 db) 4 bytes
  5. Maximum Differential Group Delay - (ps) 4 bytes
  6. Maximum Polarisation Dependent Loss - (0.1 db) 4 bytes
  7. Maximum Inter Channel Crosstalk - (0.1 db) 4 bytes
  8. Interferometric Crosstalk - (0.1 db) 4 bytes
  9. Optical Path OSNR Penalty - (0.1 db) 4 bytes
  10. Fiber type - 1 byte

Extended RFC4209 LMP Messages for G.698.2 (3)

- **Black Link - BL_Rs**

  These are the G.698.2 parameters at the Sink (Rs reference points).

  1. Minimum Mean Input Power - (0.1dbm) 4bytes
  2. Maximum Mean Input Power - (0.1dbm) 4bytes
  3. Minimum OSNR - (0.1dB) 4bytes
  4. OSNR Tolerance - (0.1dB) 4bytes
  5. Current Input Power at the OXC - (0.1dbm) 4bytes
  6. Threshold of the input power at OLS - The power level above which the OLS will not function (0.1dbm) 4bytes
  7. Current Optical OSNR (0.1dB)
  8 Q factor
  9. Post FEC BER Mantissa
  10. Post FEC BER Exponent
  11. Status of RX - Status of the Receive link at OXC - 2bytes

- **Black Link - OLS_Status**

  This message is sent by the OLS to the OXC. It includes the wavelength information and the status of the

  1. Wavelength - The wavelength which has been accepted by the OLS (Tera Hertz) 4 bytes. (see RFC6205 sec.3.2 and 3.3 TLV): Grid / Cannel Spacing / Identifier / n
  2. Length of the Wavelength Availability Map 1 byte
  3. Wavelength Availability bits - variable bits depending on the number of wavelengths available (For eg 96 bits for C-band 50GHz) (Allocation is in multiples of 1byte - 96 bits - 12 bytes) 0 - wavelength is available, 1 - used - variable length
  4. Current Input Power (0.1dbm) 4 bytes - This is the current input power at OLS
  5. Delta between output power at the Src(OXC)and Input Power at OLS (0.1dbm) 4 bytes - This is the delta between the input power and the transmitted output power at the OXC (from message 2.2 BL_Src)
  6. Threshold of the input power at OLS 4 bytes - This is the power level above which the OLS will not function.
  7. Current Output Power (0.1dbm) 4 bytes - This is the transmitted output power at the OLS.
  8. Status of Rx link at OLS 2 bytes - Status of the Receive link at the OLS
  9. Status of Tx link at OLS 2 bytes - Status of the Transmit link at the OLS

Draft Changes and Next Steps

Changes

1. Updated revision

   draft-dharinigert-ccamp-g-698-2-lmp-02.txt

2. Modified:
   - Kept alignment with draft-galikunze-ccamp-g-698-2-snmp-mib-02.txt
   - Modified Frequency and Wavelength as per RFC6205 sec.3.2 and 3.3 TLV): Grid / Cannel Spacing / Identifier / n
   - Cosmetic changes

Next Steps

1. Get ccamp consensus to go for WG status
2. Keep alignment with draft-galikunze-ccamp-g-698-2-snmp-mib-02.txt
3. Cover the parameter set of G.698.2

Questions

- Does the draft cover all the G.698.2 parameters?
- Can Q6 provide guidance on which parameters is work ongoing: 10G, 40G, 100G, 400G, 1T?
- What are the provisions in the information model to deal with Transceivers that meet a set of application codes in future? E.g. A standard receiver and a high-sensitivity-receiver that can operate under the same conditions but also in an extended range?