CCAMP   G. Martinelli, Ed.
Internet-Draft   Cisco
Intended status: Standards Track   X. Zhang, Ed.
Expires: May 4, 2017   Huawei Technologies
                                                   G. Galimberti
                                                           Cisco
                                                     D. Siracusa
                                                      A. Zanardi
                                                    F. Pederzolli
                                                      CREATE-NET
                                                          Y. Lee
                                                        F. Zhang
                                             Huawei Technologies
                                                October 31, 2016

     Information Encoding for WSON with Impairments Validation
              draft-martinelli-ccamp-wson-iv-encode-07

Abstract

   Impairment-Aware (IA) Routing and Wavelength Assignment (RWA)
   function might be required in Wavelength Switched Optical Networks
   (WSON) that already support RWA. This document defines proper
   encoding to support this operation. It goes in addition to the
   available impairment-free WSON encoding and it is fully compatible
   with it.

   As the information model, the encoding is independent from control
   plane architectures and protocol implementations. Its definitions
   can be used in related protocol extensions.

Status of This Memo

Table of Contents

1. Introduction

   In case of WSON where optical impairments play a significant role,
   the framework document [RFC6566] defines related control plane
   architectural options for Impairment Aware Routing and Wavelength
   Assignment (IA-RWA). This document provides a suitable encoding for
   the related WSON impairment information model as defined
   [I-D.ietf-ccamp-wson-iv-info].

   This document directly refers to ITU recommendations [ITU.G680] and
   [ITU.G697] as already detailed in the information model.

1.1. Requirements Language

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].

2. Encoding

This section details encoding for all elements defined within [I-D.ietf-ccamp-wson-iv-info]. Elements to encode are:

Optical Parameter (OPTICAL_PARAM)

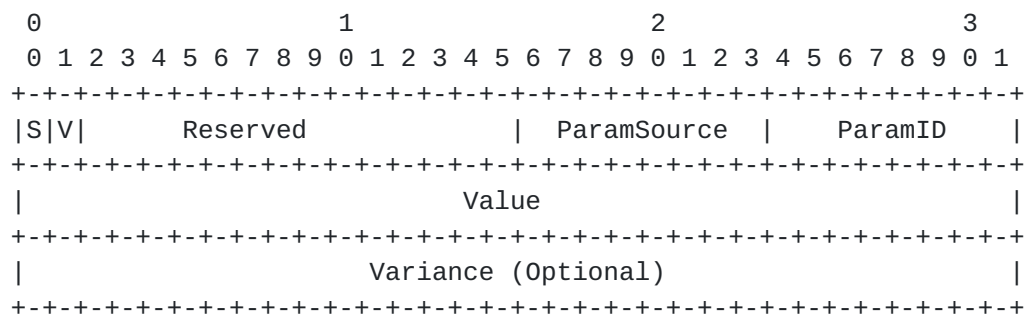Optical Impairment Vector (OIV)

Impairment Matrix

Impairment Resource Block Information

2.1. Optical Parameter

The OPTICAL_PARAM is defined as a sub-TLV object.

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|S|V|     Reserved            |   ParamSource  |    ParamID    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                           Value                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                     Variance (Optional)                       |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

The following flag is defined:

S: Standard bit.
     S=1 indentifies a set of parameters standardized by ITU; while
     S=0 identifies a non-standardized set of parameters.

V: Variance bit.
     V=0 only parameter value, V=1 parameter value and variance.

With the flag S=1 the following parameters are defined:

ParamSource = 1.
     Identify the ITU document that defines the following parameter
     list. Currently [ITU.G697] defines this value 1 for this
     parameter.

ParamID.
      Parameter identifier according to the source. [ITU.G697] table
      V.3 defines the following identifiers:

      1. Total Power (dBm)
          Not reported within [I-D.ietf-ccamp-wson-iv-info] parameter
          list but relates to Channel Power through the number of
          channels.

      2. Channel Power (dBm).
          Referred as parameter L-3 in [I-D.ietf-ccamp-wson-iv-info]

      3. Reserved ("Frequency Deviation from Nominal, GHz", defined
          in [ITU.G697] but not used)

      4. Reserved ("Wavelength Deviation from Nominal, nm", defined
          in [ITU.G697] but not used)

      5. OSNR (db).
          Referred as parameter G-1 in [I-D.ietf-ccamp-wson-iv-info]

      6. Reserved. (Q Factor, a pure number).
          Not reported within [I-D.ietf-ccamp-wson-iv-info] parameter
          list but is a known index for assessing channel quality.

      7. PMD (ps).
          Referred as parameter G-3 in [I-D.ietf-ccamp-wson-iv-info]

      8. Residual Chromatic Dispersion (ps/nm).
          Referred as parameter G-2 in [I-D.ietf-ccamp-wson-iv-info]

   Value.
      Value for the parameter. As defined by [ITU.G697], it is a 32
      bit IEEE floating point number.

   Variance.
      Variance for the parameter, a 32 bit IEEE floating point
      number.

   According to [I-D.ietf-ccamp-wson-iv-info], there are some parameters
   required for the IV function not listed within [ITU.G697]. Current
   information source for such parameters is [LS78] hence, this document
   proposes to use a different value for the field parameter source.

   ParamSource = 0 (proposal).
      List of parameters within [I-D.ietf-ccamp-wson-iv-info].
      [Editor Note: Value to be confirmed through ITU Liaison].

ParamID.
    A number that take the following list of values.

    1. Ripple (dBm). L-4 in [I-D.ietf-ccamp-wson-iv-info].

    2. Channel signal-spontaneous noise figure. L-5 in
        [I-D.ietf-ccamp-wson-iv-info].

    3. DGD, Differential Group Delay. L-8 in
        [I-D.ietf-ccamp-wson-iv-info].

    4. Reflectance. L-11 in [I-D.ietf-ccamp-wson-iv-info].

    5. Isolation. L-12 in [I-D.ietf-ccamp-wson-iv-info].

    6. Channel extintion. L-13 in [I-D.ietf-ccamp-wson-iv-info].

    7. Attenuation Coefficient. L-14 in
        [I-D.ietf-ccamp-wson-iv-info].

2.2. Impairment Vector

This sub-TLV is a list of optical parameters and they MAY have a
wavelength dependency information.

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|0|      Reserved            |      Number of Parameters       |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                    Optical Param sub-TLV(s)                   |
:                                                              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Where:

    W = 0. Wavelength Dependency flag. There is no wavelength
    dependency.

    Number of Parameters contained in this vector.

    Optical Param sub-TLV(s) present a list of Object as defined in
    Section 2.1.

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|1|      Reserved               |    Number of Parameters      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                       Label Set                              |
:                                                              :
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                  Optical Param sub-TLV(s)                    |
:                                                              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

   Where:

      W = 1. Wavelength Dependency flag. There is wavelength
      dependency.

      The Label Set object is defined in [RFC7579] Section 2.1. Likely
      an inclusive range will be the only option required by the Action
      defined in the Label Set.

2.3. Impairment Matrix

   As defined by the [I-D.ietf-ccamp-wson-iv-info], the impairment
   matrix follows the same structure as the connectivity matrix.

```
  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
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 | Conn  |  MatrixID   |              Reserved              |0|
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |                       Link Set A #1                          |
 :                           :                           :
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |                       Link Set B #1                          |
 :                           :                           :
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |                 Impairment Vector sub-TLV(s)                 |
 :                           :                           :
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |      Additional Link Set pairs and Impairment Vector(s)      |
 :                           :                           :
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

  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
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 | Conne |  MatrixID   |              Reserved              |1|
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |                 Impairment Vector sub-TLV(s)                 |
 :                           :                           :
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Where:

   Connectivity (Conn) (4 bits) has value 2 for the impairment matrix
   (Values 0 and 1 defined by [RFC7579]).

   MatrixID: matrix identifier,following same rules as [RFC7579].

   N: Node scope flag. With this flag set there's no Link Set
   information but only a list of optical parameters TLVs that apply
   to the whole optical node.

The usage of multiple matrixes with connectivity type equal to 2
(Impairment Matrix) MIGHT be used to grup optical parameters by
connectivity. For example, if a subset of parameters apply to the
whole node, a unique matrix with flag N=1 is used. At the same some
another subset of parameters applies only to some LinkSet pairs, a
specific Impairment Matrix will be added.

2.4. Resource Block Information

   As defined by [I-D.ietf-ccamp-wson-iv-info], the concept of resource
   block is extended to support the description of the impairments
   related to that block. The encoding follows the same structure as
   the one defined in [RFC7581], with the addition of an optional
   Impairment Vector sub-object:

```
    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
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                        RB Set Field                          |
   :                                                              :
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |I|O|                      Reserved                            |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |              Optical Interface Class List(s) (opt)           |
   :                                                              :
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |              Acceptable Client Signal Type (opt)             |
   :                                                              :
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                  Input Bit Rate List (opt)                   |
   :                                                              :
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |              Processing Capabilities List (opt)              |
   :                                                              :
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                  OIV-Impairment Vector (opt)                 |
   :                                                              :
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

   The Impairment Vector is defined within Section 2.2. All the other
   fields are defined within [RFC7581].

3. Acknowledgements

   Authors would like to acknoledge Greg Bernstein and Moustafa Kattan
   as authors of a previous similar draft whose content partially
   converged here.

   Authors would like to thank ITU SG15/Q6 and in particular Peter
   Stassar and Pete Anslow for providing useful information and text to
   CCAMP through join meetings and liaisons.

4. IANA Considerations

   This document does not contain any IANA request.

5. Security Considerations

   This document defines an protocol-neutral encoding for an information
   model describing impairments in optical networks and it does not
   introduce any security issues. If such a encoding is put into use
   within a network it will by its nature contain details of the
   physical characteristics of an optical network. Such information
   would need to be protected from intentional or unintentional
   disclosure.

6. References

6.1. Normative References

   [ITU.G680]
              International Telecommunications Union, "Physical transfer
              functions of optical network elements",
              ITU-T Recommendation G.680, July 2007.

   [ITU.G697]
              International Telecommunications Union, "Optical
              monitoring for dense wavelength division multiplexing
              systems", ITU-T Recommendation G.697, February 2012.

   [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate
              Requirement Levels", BCP 14, RFC 2119,
              DOI 10.17487/RFC2119, March 1997,
              <http://www.rfc-editor.org/info/rfc2119>.

6.2. Informative References

   [I-D.ietf-ccamp-wson-iv-info]
              Martinelli, G., Zhang, X., Galimberti, G., Zanardi, A.,
              Siracusa, D., Pederzolli, F., Lee, Y., and F. Zhang,
              "Information Model for Wavelength Switched Optical
              Networks (WSONs) with Impairments Validation", draft-ietf-
              ccamp-wson-iv-info-03 (work in progress), October 2016.

   [LS78]   International Telecommunications Union SG15/Q6, "LS/s on
              CCAMP Liaison to ITU-T SG15 Q6 and Q12 on WSON",
              LS https://datatracker.ietf.org/liaison/1288/, October
              2013.

   [RFC6566] Lee, Y., Ed., Bernstein, G., Ed., Li, D., and G.
              Martinelli, "A Framework for the Control of Wavelength
              Switched Optical Networks (WSONs) with Impairments",
              RFC 6566, DOI 10.17487/RFC6566, March 2012,
              <http://www.rfc-editor.org/info/rfc6566>.

   [RFC7579] Bernstein, G., Ed., Lee, Y., Ed., Li, D., Imajuku, W., and
              J. Han, "General Network Element Constraint Encoding for
              GMPLS-Controlled Networks", RFC 7579,
              DOI 10.17487/RFC7579, June 2015,
              <http://www.rfc-editor.org/info/rfc7579>.

   [RFC7581] Bernstein, G., Ed., Lee, Y., Ed., Li, D., Imajuku, W., and
              J. Han, "Routing and Wavelength Assignment Information
              Encoding for Wavelength Switched Optical Networks",
              RFC 7581, DOI 10.17487/RFC7581, June 2015,
              <http://www.rfc-editor.org/info/rfc7581>.

Authors' Addresses

   Giovanni Martinelli (editor)
   Cisco
   via Philips 12
   Monza 20900
   Italy

   Phone: +39 039 2092044
   Email: giomarti@cisco.com

   Xian Zhang (editor)
   Huawei Technologies
   F3-5-B R&D Center, Huawei Base
   Bantian, Longgang District
   Shenzen 518129
   P.R. China

   Phone: +86 755 28972913
   Email: zhang.xian@huawei.com

Gabriele M. Galimberti
Cisco
Via Philips,12
Monza 20900
Italy

Phone: +39 039 2091462
Email: ggalimbe@cisco.com

Domenico Siracusa
CREATE-NET
via alla Cascata 56/D, Povo
Trento 38123
Italy

Email: domenico.siracusa@create-net.org

Andrea Zanardi
CREATE-NET
via alla Cascata 56/D, Povo
Trento 38123
Italy

Email: andrea.zanardi@create-net.org

Federico Pederzolli
CREATE-NET
via alla Cascata 56/D, Povo
Trento 38123
Italy

Email: federico.perderzolli@create-net.org

Young Lee
Huawei Technologies
1700 Alma Drive, Suite 100
Plano, TX 75075
U.S.A

Email: ylee@huawei.com

Fatai Zhang
Huawei Technologies
F3-5-B R&D Center, Huawei Base
Bantian, Longgang District
Shenzen 518129
P.R. China

Email: zhang.fatai@huawei.com