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          Information Encoding for WSON with Impairments Validation
                draft-martinelli-ccamp-wson-iv-encode-05

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

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

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   This Internet-Draft will expire on September 10, 2015.

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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:
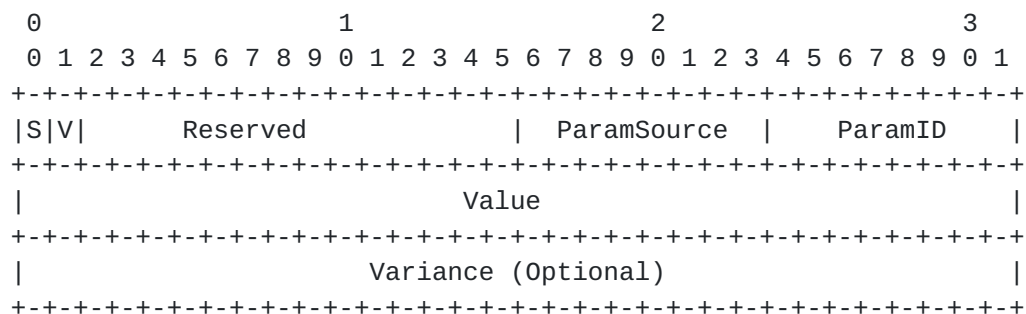
    Optical Parameter (OPTICAL_PARAM)

    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
   [I-D.ietf-ccamp-general-constraint-encode] 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
   [I-D.ietf-ccamp-general-constraint-encode]).

   MatrixID: matrix identifier,following same rules as
   [I-D.ietf-ccamp-general-constraint-encode].

   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 [I-D.ietf-ccamp-rwa-wson-encode], 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 [I-D.ietf-ccamp-rwa-wson-encode].

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   converged here.

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   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, March 1997.

6.2. Informative References

   [I-D.ietf-ccamp-general-constraint-encode]
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              Network Element Constraint Encoding for GMPLS Controlled
              Networks", draft-ietf-ccamp-general-constraint-encode-20
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   [I-D.ietf-ccamp-rwa-wson-encode]
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          ccamp-wson-iv-info-00 (work in progress), October 2014.

[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., Bernstein, G., Li, D., and G. Martinelli, "A
          Framework for the Control of Wavelength Switched Optical
          Networks (WSONs) with Impairments", RFC 6566, March 2012.

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