Problem Statement

Signaling extensions for Media Channel sub-carriers configuration in Spectrum Switched Optical Networks (SSON) in Lambda Switch Capable (LSC) Optical Line Systems.

draft-ggalimbe-ccamp-flexigrid-carrier-label-04

Gabriele Galimberti   Cisco Systems
Domenico La Fauci   Cisco Systems
Andrea Zanardi   Create-Net   FBK
Lorenzo Galvagni   Create-Net   FBK

I E T F ®

Motivation

- Generalised Multiprotocol Label Switched (GMPLS) is widely used in Wavelength Switched Optical Network (WSON) to support the optical circuits set-up through the signalling between Core Nodes and Edge Nodes.

- Spectrum Switched Optical Networks (sson) are in advanced development phase or even ready to be deployed.

- No information is available in signalling to support the sub-carriers definition / reservation in sson

- RFC7698 Ch.3.3 defines the concept of Media Channel and the associated carriers set needed for Spectrum Switched Optical Network (SSON).

- The new labels are related to the Media Channel and the carriers routed with it and keep the backward compatibility with the WSON signalling. In particular this informational memo wants do address the use cases where the SSON LSP (the Media Channel in RFC7698) carries multiple carrier (OTSi) containing same Payload. The set of the carriers can be seen as single Logical circuit.

I E T F

Document Scope

- This document proposes the experimental results from the GMPLS implementation supporting the Spectrum Switched Optical Network

- This   memo can be considered as the "companion" of [RFC7699] The contents and the parameters reflect the experimental activity on IP over SSON recently done.

- Or can be and extension of [RFC7792] (TSPEC/FLOW_SPEC)

- Goal to address the new model definition coming from ITU-T (G.media) and ONF.

I E T F

Changes from the previous version

- Addressed the comments from ccamp IETF 101

- Fixed typos

- Fixed some description text
  - Reshaped chapters/paragraphs (4.2.1 and 4.2.2)
  - TLV – figures description

- TLVs changes
  - Splitted Port Identifier into Source Port Identifier and Destination Port Identifier

The application

Multiple carrier are mapped into a Media Channel. A set of parameters must be shared on the UNI to allow the GMPLS to do the proper routing and Spectrum Assignment and decide the carrier position.

```
    +------+      +------+  _____  +------+      +------+
    | E.N. |      | C.N. | /        /\  | C.N. |      | E.N. |
    | OTS1 | ----- |     ||        |  ||      | ----- |OTS1  |
 ==|  OTS2| ----- |     || Media  |  ||      | ----- |OTS2  |==
 ==|  OTS3| ----- |     || Channel|  ||      | ----- |OTS3  |==
    | OTS4 | ----- |     ||        |  ||      | ----- |OTS4  |
    |      |      | ROADM| _____\/ | ROADM|      |      |
    +------+      +------+             +------+      +------+
        ^             ^                    ^             ^
        |             |                    |             |
        +---UNI---+                        +---UNI---+
```
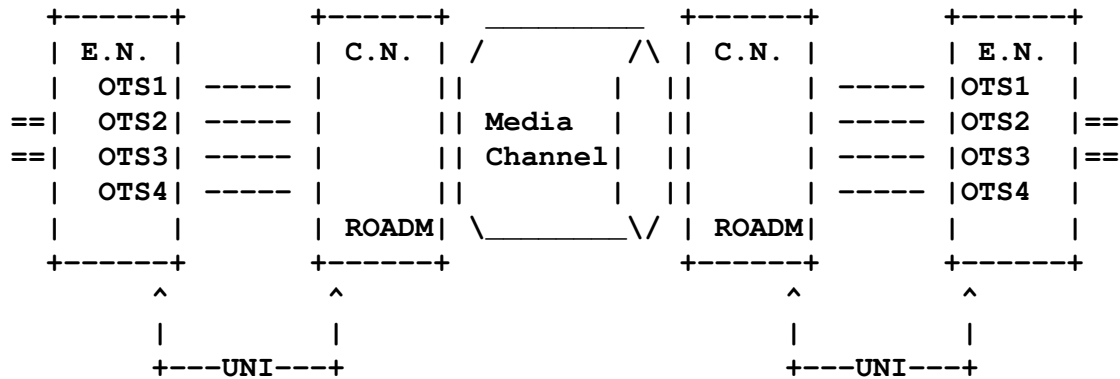
E.N. = Edge Node – UNI Client
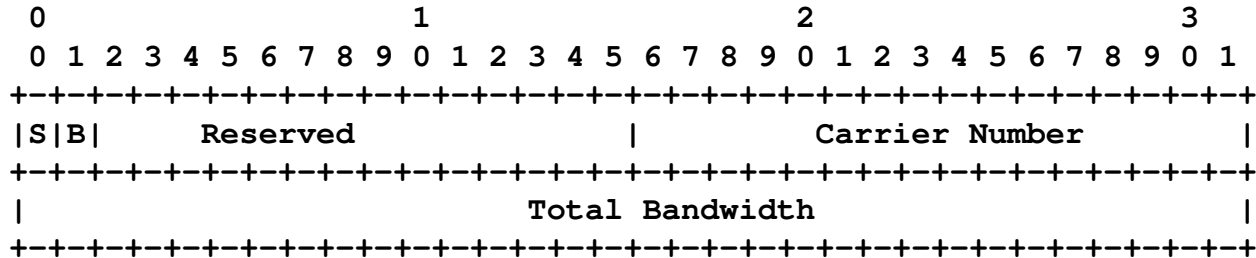**C.N. = Core Node – UNI Network**
ROADM = Lambda/Spectrum switch
Media Channel = the optical circuit
OTSi = Carriers belonging to the same Network Media Channel (or Super Channel)
UNI = Signalig interface

Model proposal

New LSP set-up parameters: SSON LSP set-up request

```
 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|B|      Reserved             |         Carrier Number        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                          Total Bandwidth                      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Carrier Number: number of carrier to be allocated for the requested
        channel (16-bit unsigned integer)
        If Carrier Number == 0 no constraint set on the number of
        carriers to be used
S strict number of subcarrier
    – S = 0 the number of requested carriers is the maximum number
              that can be allocated (a lower value can be allocated if
              the requested bandwidth is satisfied)
    – S = 1 the number of requested carriers is strict (must be > 0)
Total Bandwidth: the requested total bandwidth to be supported by
        the Media Channel (32-bit IEEE float, bytes/s)
        If Total Bandwidth == 0: no bandwidth constraint is defined
        (B must be 0)   B Bandwidth constraints
    – B = 0: the value is the maximum requested bandwidth (a lower
              value can be allocated if resources are not available)
    – B = 1: the requested bandwidth is the minimum value to be
              allocated (a higher value can be allocated if requested
              by the physical constraints of the ports)
Reserved: unused bit (for future use, should be 0)

Model proposal

```
Extension to LSP set-up reservation:


    COMMON to all carriers
 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
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |        Modulation Format         |            FEC             |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |                    baud rate   (Symbol Rate)                  |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

I E T F ®
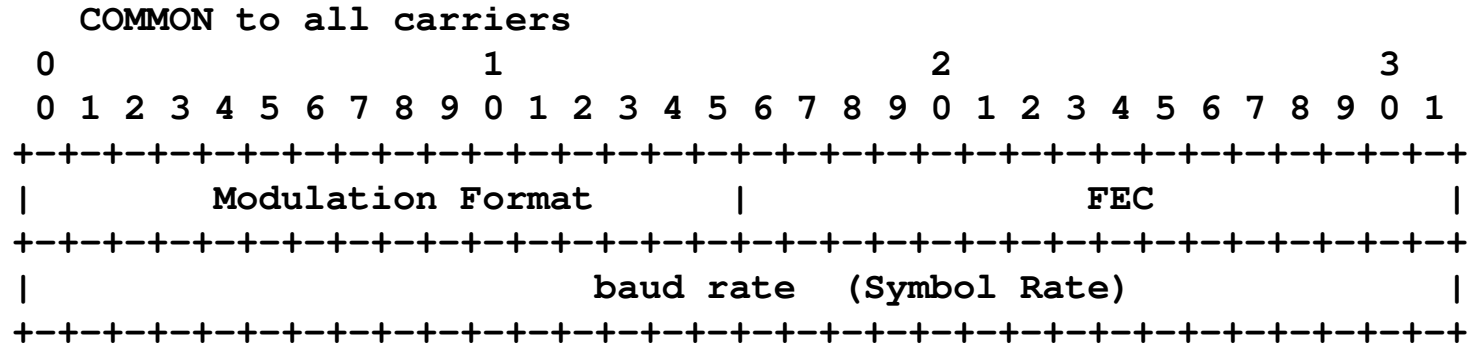
Model Proposal cont'

- m Media Channel width

- n Media channel central frequency

- Sub carrier identifier field: sub-carrier   identifier inside the Media Channel

- J field: granularity of the channel spacing, can be a multiple of 0.01GHz. default value is 0.1GHz.

- K field: positive or negative integer (including 0) to multiply by J and identify the S.C. Position inside the Media Channel, J can be set at default value = 0.1GHz.

```
                                     m=8
    +---------------------------------X---------------------------------+
    |                                 |                                 |
    |           sub-carrier           |            sub-carrier          |
    |      +-------------X---------+   |    +----------X----------+      |
    |      |          OTSi         |   |    |        OTSi          |     |
    |      |            o          |   |    |          o           |     |
    |      |            |          |   |    |          |           |     |
   -4  -3  -2  -1   0   1   2   3   4   5   6   7   8   9  10  11  12
  --+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+-
                    |              n=4    |
                   K1      -236    |    +236      K2
    <---------------------------- Media Channel --------------------->
```
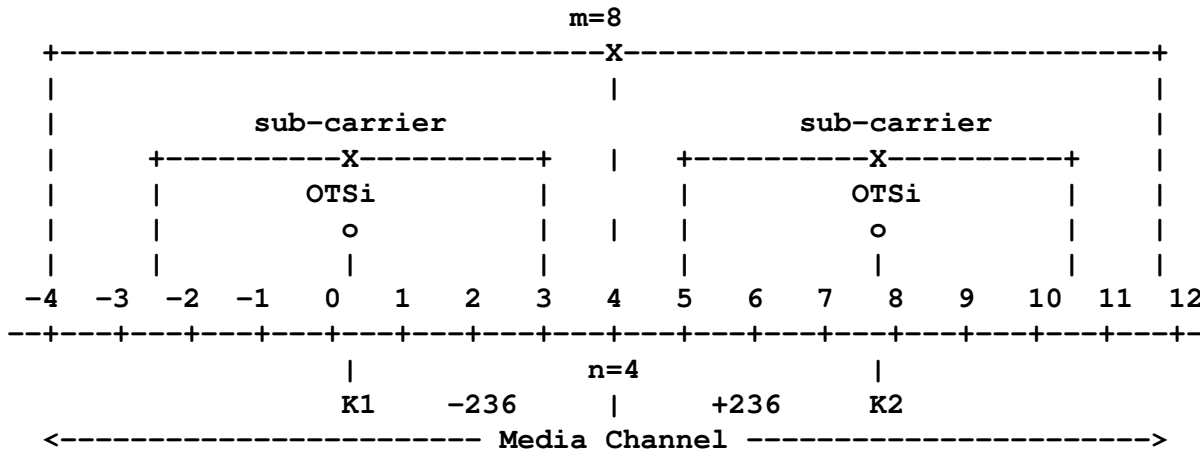
Media Channel CF = 193.1 + n * 0.00625 (THz)
Media Channel Width = m * 0.0125 (THz)
SC-1 = MC-CF + k1 * 0.1 GHz. (j)   (GHz)
SC-2 = MC-CF + k2 * 0.1 GHz. (j)   (GHz)

Model proposal

The defined sub-TLVs are:

Source Port Identifier

```
 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 (TBA)         |            Length (TBD)       |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                    Source Port Identifier                    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
Source Port Identifier: the HEAD UNI-C optical logical source end   point
identifier (32-bits integer, ifindex)

Destination Port Identifier

```
 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 (TBA)         |           Length (TBD)        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                  Destination Port Identifier                 |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
Destination Port Identifier: the local upstream optical logical
destination end point identifier (32-bits integer, ifindex)

I E T F
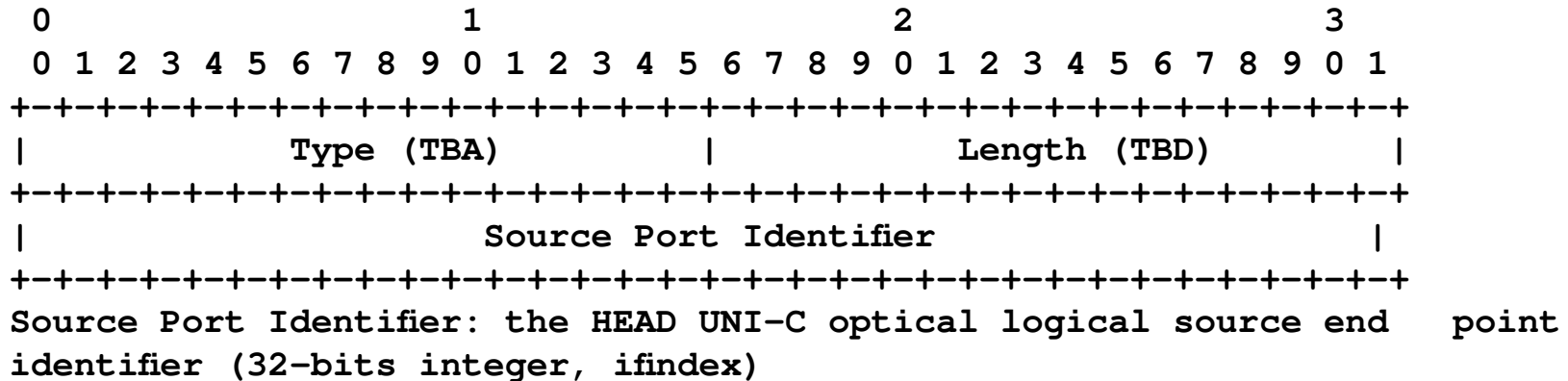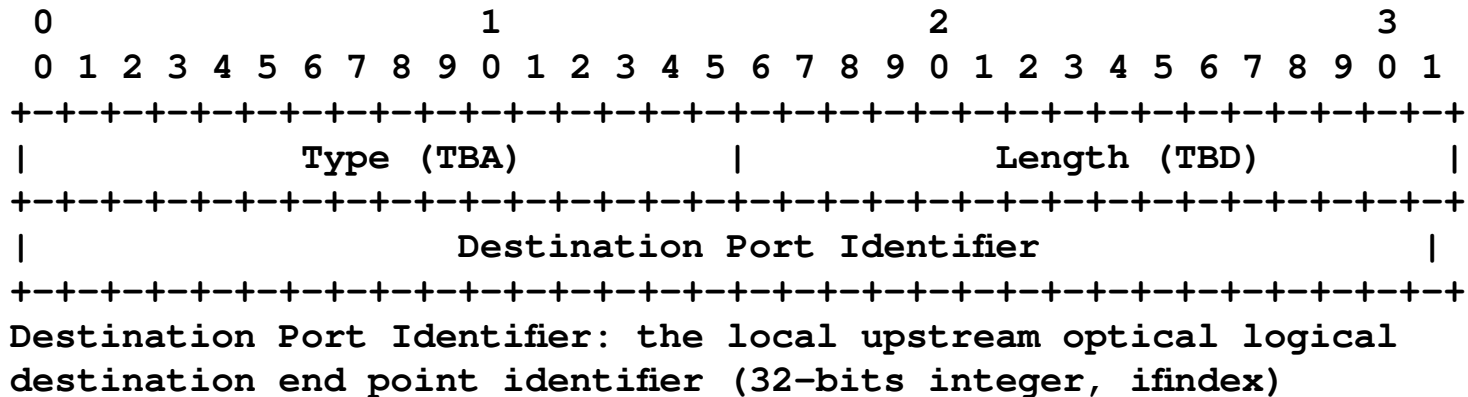
Model proposal

The defined sub-TLVs are:

Carrier Power:

```
 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 (TBA)           |         Length (TBD)        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                         carrier power                         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
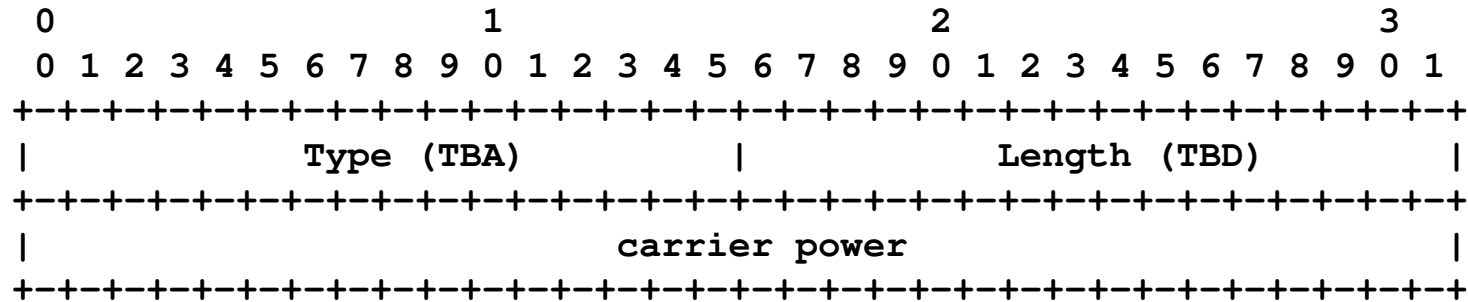
Next steps

- Check the proposal against the new ITU-T and ONF models

- Address feedbacks and comments

- Start discussion how to progress to a WG adoption