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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-01

Abstract

This memo defines the signaling extensions for managing Spectrum Switched Optical Network (SSON) parameters shared between the Client and the Network and inside the Network in accordance to the model described in RFC 7698. The extensions are in accordance and extending the parameters defined in ITU-T Recommendation G.694.1.[ITU.G694.1] and its extensions and G.872.[ITU.G872].

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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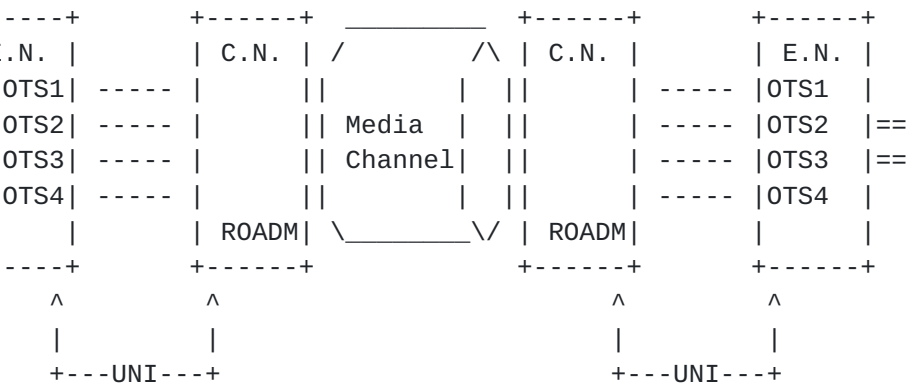
1. Introduction

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. This extension addresses the use cases described by [RFC7698] Ch.3.3 and supports the information, needed in Spectrum Switched Optical Network (SSON), to signal a Media Channel and the associated carriers set request. The new set of parameters is related to the Media Channel and the carrier(s) routed with it and keep the backward compatibility with the WSON signalling. In particular this 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. This memo can be considered as the extension of [RFC7792]. The contents

and the parameters reflect the experimental activity on IP over SSON recently done by some vendors and research consortia.

Figure 1 shows how the 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. = 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 = Signallig interface

from Fig. 5.1/G.698.2

Figure 1: Multi carrier LSP

2. Client interface parameters

The Edge Node interface can have one or multiple carriers (OTSi). All the carrier have the same characteristics and are provisionable in terms of:

Number of subcarriers:
This parameter indicates the number of subcarriers available for the super-channel in case the Transceiver can support multiple carrier circuits.

Central frequency (see G.694.1 Table 1):

This parameter indicates the Central frequency value that Ss and Rs will be set to work (in THz). See the details in Section 6/ G.694.1 or based on "n" value explanation and the following "k" values definition in case of multicarrier transceivers.

Central frequency granularity:
This parameter indicates the Central frequency granularity supported by the transceiver, this value is combined with k and n value to calculate the central frequency of the carrier or sub-carriers.

Minimum channel spacing:
This is the minimum nominal difference in frequency (in GHz) between two adjacent channels (or carriers) depending on the Transceiver characteristics.

Bit rate / Baud rate of optical tributary signals:
Optical Tributary Signal bit (for NRZ signals) rate or Symbol (for Multiple bit per symbol) rate .

FEC Coding:
This parameter indicate what Forward Error Correction (FEC) code is used at Ss and Rs (R/W) (not mentioned in G.698.2). .

Wavelength Range (see G.694.1): [ITU.G694.1]
This parameter indicate minimum and maximum wavelength spectrum in a definite wavelength Band (L, C and S).

Modulation format:
This parameter indicates the list of supported Modulation Formats and the provisioned Modulation Format..

Inter carrier skew:
This parameter indicates, in case of multi-carrier transceivers the maximum skew between the sub-carriers supported by the transceiver.

Laser Output power:
This parameter provisions the Transceiver Output power, it can be either a setting and measured value.

receiver input power:
This parameter provisions the Min and MAX input pover suppotred by the Transceiver, i.e. Receiver Sensitivity.

The above parameters are related to the Edge Node Transceiver and are used by the Core Network GMPLS in order to calculate the optical feasibility and the spectrum allocation. The parameters can be

shared between the Client and the Network via LMP or provisioned in the Network by an EMS or an operator OSS.

3. Use Cases

The use cases are described in draft-ietf-ccamp-dwdm-if-mng-ctrl-fwk and [RFC7698]

4. Signalling Extensions

Some of the above parameters can be applied to RFC7699 (SENDER_TSPEC/ FLOWSPEC). The above parameters could be applied to [RFC4208] scenarios but they are valid also in case of non UNI scenarios. The [RFC6205] parameters remain valid.

4.1. New LSP set-up parameters

When the E.N. wants to request to the C.N. a new circuit set-up request or the GMPLS want to signal in the SSON network the Optical Interface characteristics the following parameters will be provided to the C.N.:

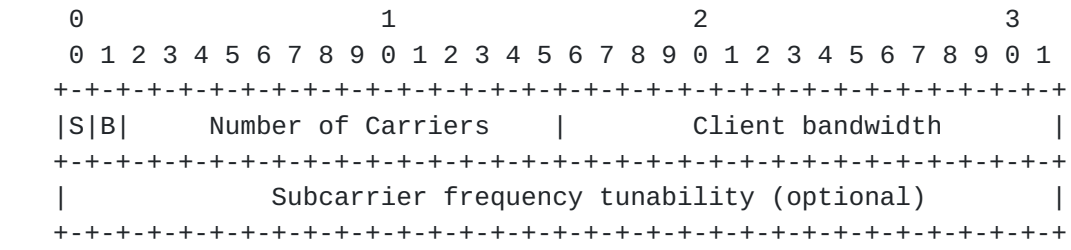
Number of available subcarriers (c):
   This parameter is an integer.

Total bandwidth request:
   e.g. 200Gb, 400Gb, 1Tb

Policy (strict/loose):
   Strict/loose referred to B/W and subcarrier number.

Subcarrier bandwidth tunability:
   (optional) e.g. 34Ghz, 48GHz.

Figure 2: The format of the this sub-object (Type = TBA, Length = TBA) is as follows:



Sub-Transponder Mod Format: In the Value Field (96 bits) it is specified
S strict number of subcarrier (No = 0, Yes = 1)
B strict client bandwidth (No = 0, Yes = 1)
- Num Carriers
- Client bandwidth (100Gb, 150Gb, 200Gb, 400Gb, 1Tb, etc)
- Subcarrier frequency tunability (optional)

Figure 2: SSON LSP set-up request

4.2. Extension to LSP set-up reservation

Once the GMPLS has calculated the Media Channel path, the Spectrum Allocation, the Sub-carrier number and frequency, the modulation format, the FEC and the Transmit power, sends back to the E.N. the path set-up confirmation providing the values of the calculated paramenters:

Media Channel:
(Grid, C.S., Identifier m and n).

List of subcarriers:
This parameter indicates the subcarriers to be used for the super-channel in case the Transceiver can support multiple carrier Circuits.

Central frequency (see G.694.1 Table 1):
Grid, Identifiers, central frequency and granularity.

Central frequency granularity:
This parameter indicates the Central frequency granularity supported by the transceiver, this value is combined with K and n value to calculate the central frequency on the carrier or sub-carriers.

Bit rate / Baud rate of optical tributary signals:

Optical tributary signal bit (for NRZ signals) rate or Symbol (for Multiple bit per symbol) rate.

FEC Coding:
This parameter indicate what Forward Error Correction (FEC) code must be used by the Transceivers (not mentioned in G.698). .

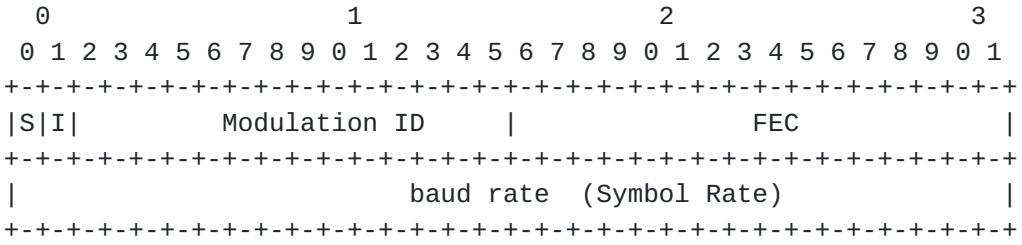
Modulation format:
This parameter indicates the Modulation Formats to be set in the Transceivers.

Laser Output power:
This parameter provisions the Transceiver Output power, it can be either a setting and measured value.

Circuit Path, RRO, etc:
All these info are defined in [RFC4208].

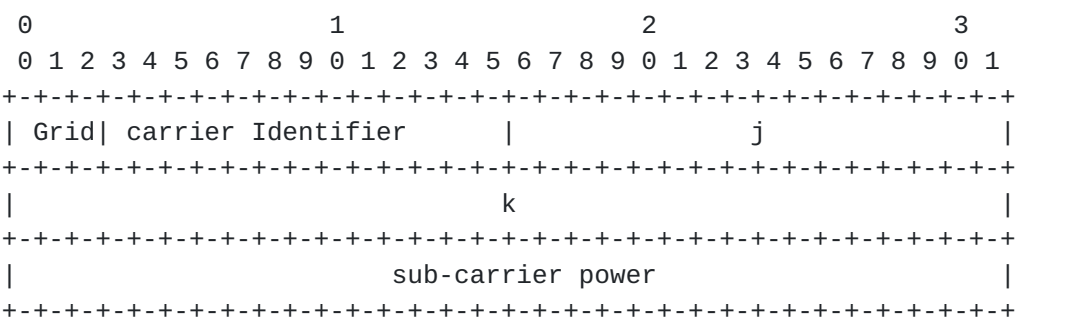
Path Error:
e.g. no path exist, all the path error defined in [RFC4208].

Figure 3: The format of this sub-object (Type = TBA, Length = TBA) is as follows:



Traffic Type
- R: standardized format
- I: input / output (1 / 0)
- Modulation IDs: BPSK, DC DP BSPSK, QPSK, DP QPSK, 8QAM, 16QAM, 16QAM, 64QAM, Hybrid, etc.
- FEC
- Baud Rate: IEEE float in bauds/s

For Each carrier inside the Media Channel the TLV is used:



Carrie set-up:

- Media channel Grid

Grid	Value
ITU-T Flex	3

- Sub carrier identifier field: sub-carrier identifier inside the mediachannel
- 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.
- sub-carrier power: subcarrier output power to be set (optional ?)

In summary S.C. Frequency = MC-C.F. (in THz) + K * J GHz

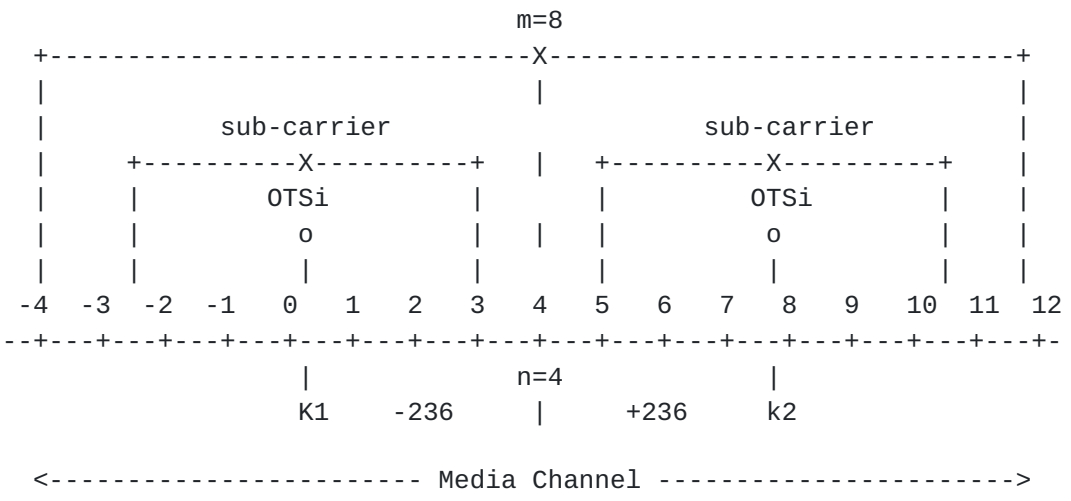


Figure 3: OCh_General

4.3. RSVP Protocol Extensions considerations

The additional information described in the draft, is related to the Media Channel supported traffic. It could be encoded as specific extensions of the SENDER_TSPEC/FLOW_SPEC object for Flexi-Grid networks (see [RFC7792])

5. Security Considerations

GMPLS message security uses IPsec, as described in xxxx. This document only defines new UNI objects that are carried in existing UNI messages, similar to the UNI objects in xxx. This document does not introduce new security considerations.

6. IANA Considerations

T.B.D.

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