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Super-Channel Optical Parameters GMPLS Signaling Extensions
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Abstract

This document builds on [6][7] and defines GMPLS signaling extensions to carry super-channel optical parameters for efficient spectrum assignment on flexible grid networks.

Status of this Memo

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1. Introduction

Future transport systems are expected to support service upgrades to data rates of 1 Tbps and beyond. To scale networks beyond 100Gbps, multi-carrier super-channels coupled with advanced multi-level modulation formats and flexible channel spectrum bandwidth allocation schemes have become pivotal for future spectral efficient transport network architectures [1,2].

The coexistence of super-channels using different modulation formats on the same optical fiber network infrastructure may have a detrimental effect on the Optical Signal to Noise Ratio (OSNR) of adjacent super-channels due to interference such as cross-phase modulation. Therefore, it may be highly desirable to be able to evaluate the mutual impact of the existing and new super-channels on each other's quality of transmission (e.g., bit error rate) before establishing new super-channels.

This document defines GMPLS signaling extensions to convey super-channel optical parameters such as number of carriers, each carrier's center frequency, modulation, and FEC type in the RSVP message. This allows nodes along the super-channel path to learn the aforementioned super-channel optical characteristics and in turn advertise this information to other nodes in the network using GMPLS routing extensions defined in [9].

2. Terminology

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].

3. GMPLS Signaling Extensions for Super-Channel Optical Parameters

This document defines extensions for signaling super-channel optical parameters including:

- Number of Carriers
- Carrier Center Frequency (THz)
- Carrier Modulation
- Carrier Baudrate (Gbit/s)
- Carrier FEC Type

This document defines two options for encoding this information.

[Editor's note: to allow full flexibility we have included two encoding options]

3.1. Option 1: Encode Super-Channel Optical Parameters in the RSVP FLOWSPEC or TSPEC Object

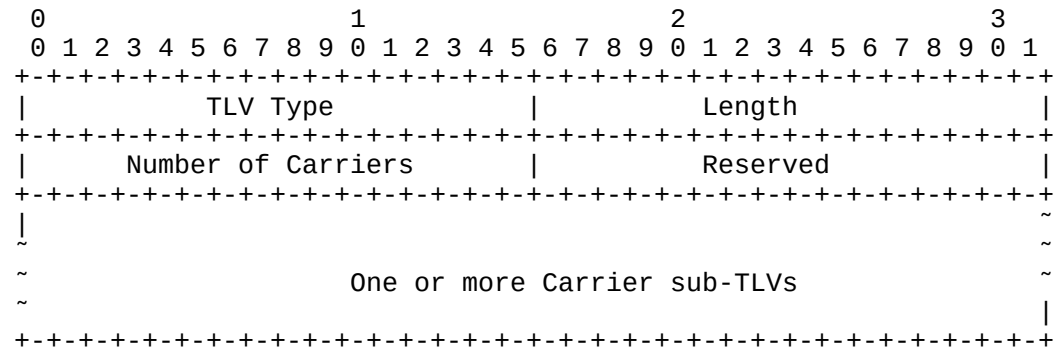

Figure 1: Super-Channel Carriers TLV Format

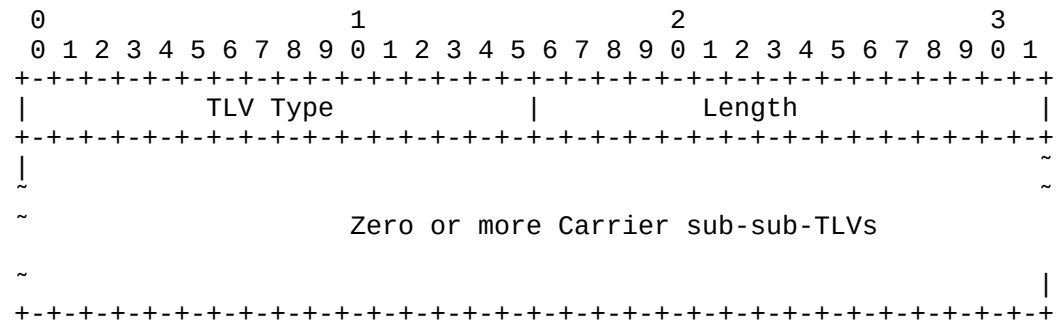

Figure 2: Carrier sub-TLV Format.

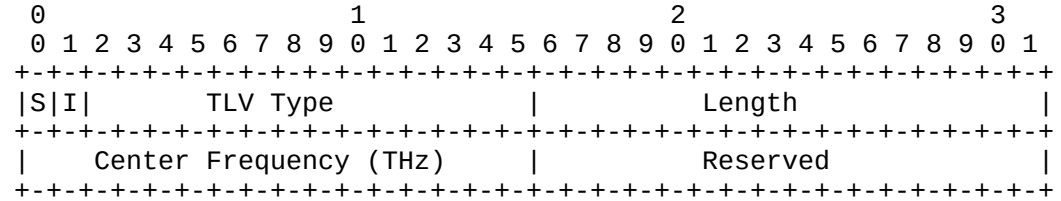

Figure 3: Carrier Center Frequency sub-sub-TLV.

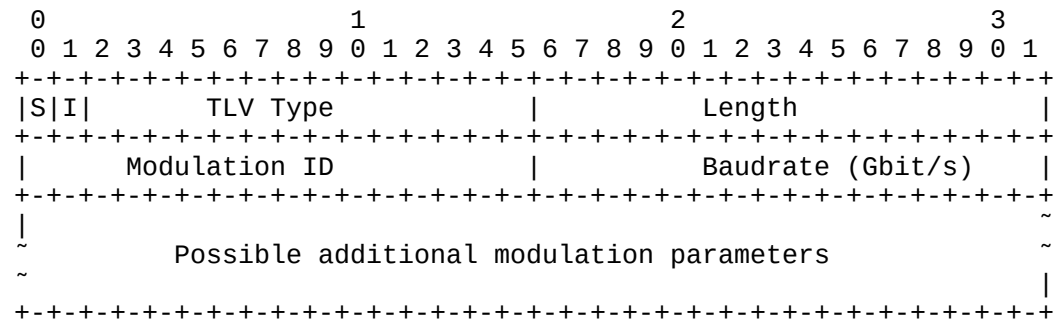

Figure 4: Carrier Modulation sub-sub-TLV.

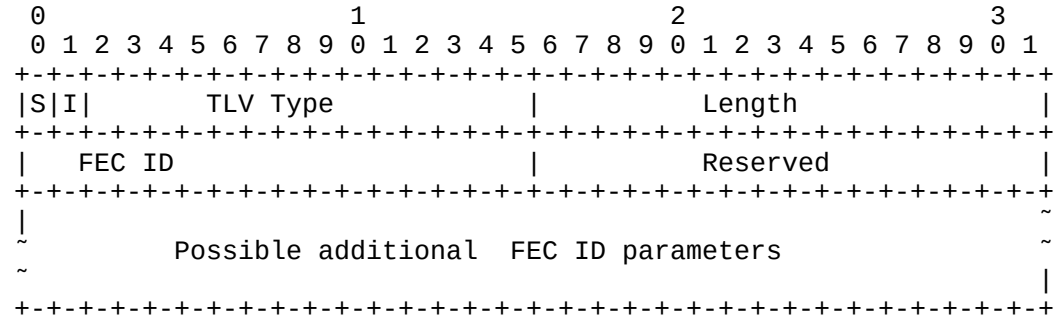

Figure 5: Carrier FEC sub-sub-TLV.

Where:

- When the S bit in a TLV is set to 1 it indicates that the TLV contains standardized fields (e.g., Modulation, FEC Type) and when the S bit is set to 0 in a TLV it indicates a vendor specific TLV (see [8])
- Modulation ID, FEC ID, and I fields are similar to as defined in [8]
- The Length field in the super-channel Carriers TLV specifies the length in octets of the complete set of TLVs including the set of sub-TLVs that follow.

3.2. Option 2: Encode the Aforementioned Information along with the Super-Channel Label

For example use Super-Channel Label defined in [7] to also encode Super-Channel Carriers TLV, the Carrier sub-TLVs, and the associated set of sub-sub-TLVs defined in the previous section.

4. Procedure for Signaling Super-Channel Optical Parameters

- The optical parameters of the super-channel are signaled in the RSVP message using encoding option 1 (or option 2).
- During a new super-channel establishment, each node along the new super-channel setup path allocates the required number of slices and also learns the associated set of signaled super-channel optical parameters.

5. TLV Encoding Examples

To be added later.

6. Security Considerations

<Add any security considerations>

7. IANA Considerations

IANA needs to assign a new Grid field value to represent ITU-T Flex-Grid.

8. References

8.1. Normative References

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[RFC3471] Berger, L., Ed., "Generalized Multi-Protocol Label Switching (GMPLS) Signaling Functional Description", RFC 3471, January 2003.

[RFC6205] Otani, T., Ed., "Generalized Labels for Lambda-Switch-Capable (LSC) Label Switching Routers", RFC 6205, March 2011.

[RFC6163] Lee, Y., Ed., "Framework for GMPLS and Path Computation Element (PCE) Control of Wavelength Switched Optical Networks (WSONs)", RFC 6163, April 2011

8.2. Informative References

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[2] M. Jinno et. al., "Spectrum-Efficient and Scalable Elastic Optical Path Network: Architecture, Benefits and Enabling Technologies", IEEE Comm. Mag., Nov. 2009, pp. 66-73.

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[4] ITU-T Recommendation G.694.1, "Spectral grids for WDM applications: DWDM frequency grid", June 2002

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[8] G. Bernstein, et.al., "Routing and Wavelength Assignment Information Encoding for Wavelength Switched Optical Networks", draft-ietf-ccamp-rwa-wson-encode, work in progress, October 2011.

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9. Acknowledgments

<Add any acknowledgements>

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