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OSPF-TE extensions for MLNMRN based on OTN
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Abstract

This document specifies OSPF extensions for multi-layer/multi-region where one of the regions is multi-layer e.g. OTN, SONET/SDH.

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1 Introduction

In order to do end-to-end path computation, where a path may involve more than one region and part of single routing domain, TE Links connecting the two regions need to have bandwidth capacity advertised for the switch that connects the two regions. This document specifies the OSPF extensions that are required if any of the region is a multi-layer network. The specification is based on the requirement as specified in RFC 5212. As per the said RFC, ISCD characterizes the information associated to one or more network layers. Same RFC also says that the information about the adjustment capabilities of the nodes in the network allow the path computation process to select an end-to-end multi-layer or multi- region path that includes links with different switching capabilities joined by LSRs that can adapt (i.e., adjust) the signal between the links. By inference, information about the adjustment capabilities should be able to identify a layer in ISCD, if ISCD specifies more than one layer.

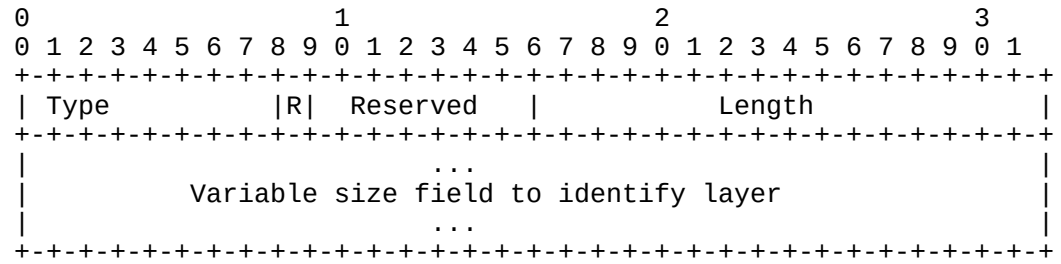
RFC6001 specifies how to advertise adjustment capabilities between two switching regions. IACD definition has provision to extend it for a specific technology through Adjustment Capability Specific information (ACSI) field, if required. ACSI field can be used to identify a layer in the multi-layer ISCD.

While OTN multi-layer technology is a primary driver for this extension, the extensions in this document does cover specifications for multi-layer technologies in general. To make sure the extensions are extensible to other multi-layer technologies as well, this document covers SDH/SONET as well.

2 Layer Identification

Multi-region path computation requires to identify a layer in the multi-layer region. This mandates layer identification along with identification of technology in the region. The technology identification is done via Switching capability and Encoding type.

IACD needs to be extended to be able to carry layer identification. the layer Identification is OPTIONAL and used only when interface supports layer multiplexing and hence creating a need to identify a layer. A new Layer ID Sub-TLV has been defined to carry layer identification.



Type : Type field is used to identify a particular structure of variable size field, which is specific to the particular Switching Capability and Encoding type combination

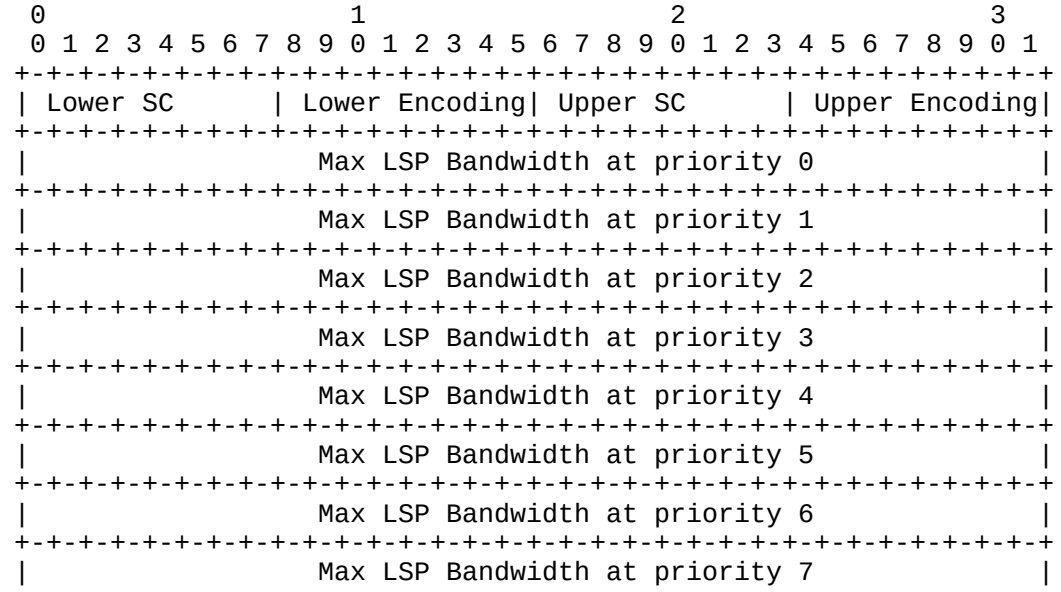
R : This bit is used to make sense whether the Layer ID is for Lower region or upper region. 1 means upper region and 0 means lower.

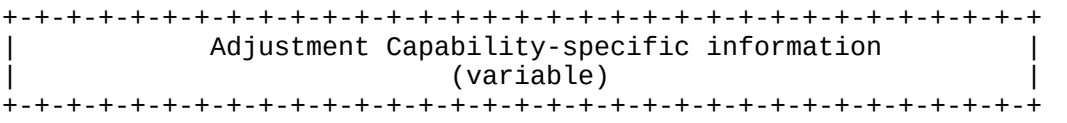
IACD can have at-most 2 Layer ID TLVs, if both the regions are multi-layer.

Next two sections specifies Layer ID for two multi-layer technologies namely, OTN and SONET/SDH

3 OTN Layer ID

RFC6001 defines IACD sub-TLV as follows. Please refer to the RFC for definition of individual fields of the sub-TLV.

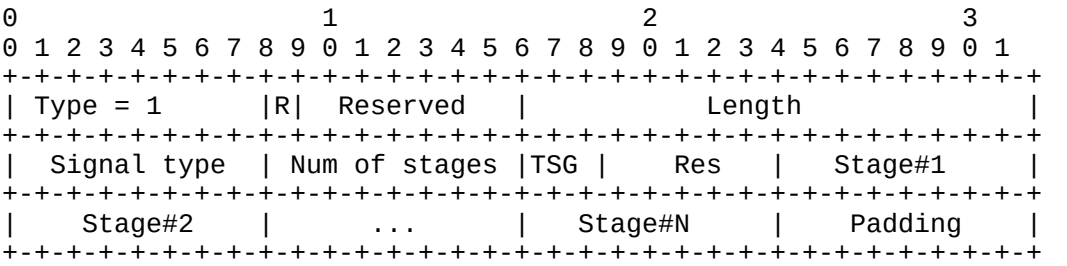




[GMPLS-OTN-OSPF] defines attributes that identifies a layer in multi-layer OTN ISCD. These attributes are part of Bandwidth sub-TLV in Switch capability specific information of ISCD. These attributes are reproduced here for completeness sake.

* Signal Type: Layer for which bandwidth is being advertised.
* Hierarchy : also called as multiplexing branch that specifies all the layers between server layer and signal type.
* TSG : Time Slot Granularity

Adjustment Capability-specific information abbreviated as ACSI henceforth for OTN G.709v3 carries LayerID Sub-TLV which is defined as follows



This LayerID sub-TLV is applicable only when one of the regions is OTN, which means either lower or upper SC and Encoding type MUST have Switch Cap as OTN-TDM and encoding type as G.709 ODUk.

R bit is used to make sense whether the Layer ID is for Lower region or upper region. 1 means upper region and 0 means lower.

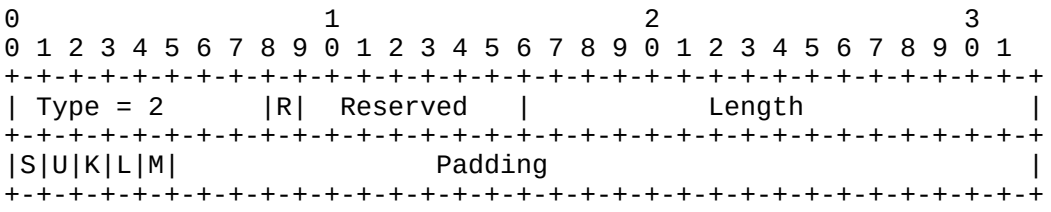
The 8 priorities of the BW as defined in main IACD structure, is adjustment capability between the two regions where one of the region is identifies by LayerID sub-TLV.

Absence of this sub-TLV for OTN means that the OTN ISCD doesn’t support multiplexing.

4 SONET/SDH Layer Identification

G.707 defines the structure of SDH multiplexing hierarchy and RFC 4606 defines generalized label structure needed to fully specify SONET/SDH multiplexing hierarchy. This Label structure also referred as SUKLM structure identifies all the layers of the multiplexing hierarchy along with time slots. For the purpose of this draft, only layer identification is needed, hence each layer can be identified by a bit. Bit value 1 signifies presence of the layer and 0, its absence. 5 Bits, each representing one layer is sufficient to fully identify the SONET/SDH multiplexing hierarchy.

Layer ID sub TLV for SONET/SDH is defined as follows



SUKLM bits signifies the presence of SONET/SDH layers and these bits together fully specifies the multiplexing hierarchy. Refer to Section 3 of RFC 4606 for full specification of SUKLM bits.

Absence of sub-TLV means that the SONET/SDH ISCD doesn’t support multiplexing and needs only transparent mapping to other Interface.

5 Procedure

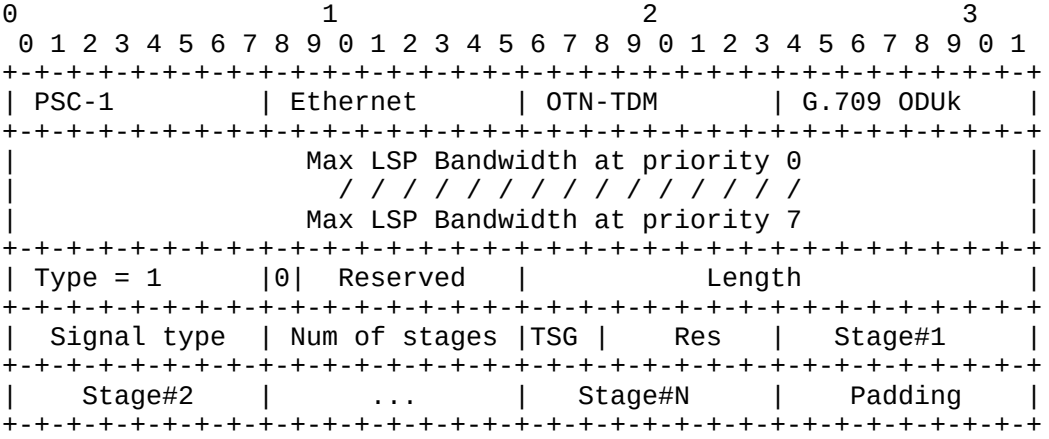
A node advertising IACD for the bandwidth between regions where one or both of them are hierarchical i.e. OTN or SONET/SDH, MUST include the Layer ID sub-TLV as part of ACSI as defined above.

For multi-region path computation, the path computing node MUST look at the LayerID sub-TLV (in ACSI part of IACD) if lower/upper {SC,Enc] is {OTN-TDM,G.709ODUk} or {TDM,SONET/SDH} to identify the layer for correct layer for BW check.

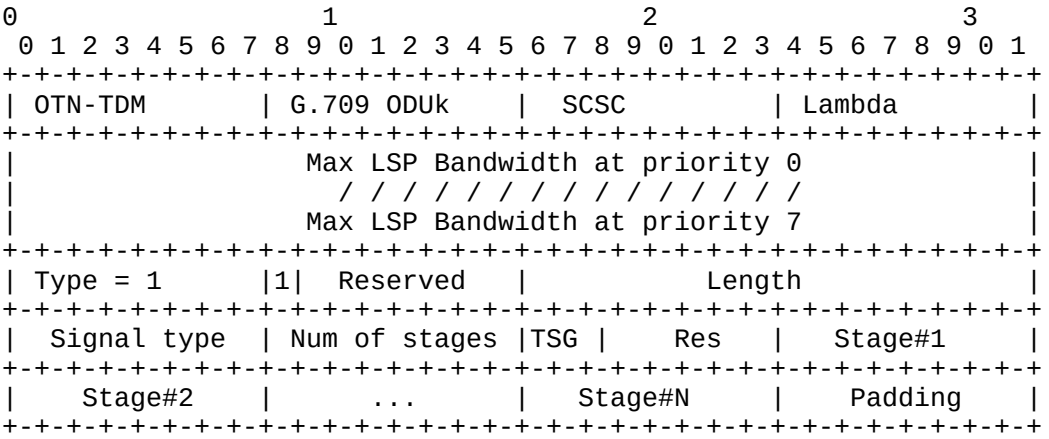
6 Examples

This section exemplifies TLV values for various technology region combinations, where one of the region is OTN

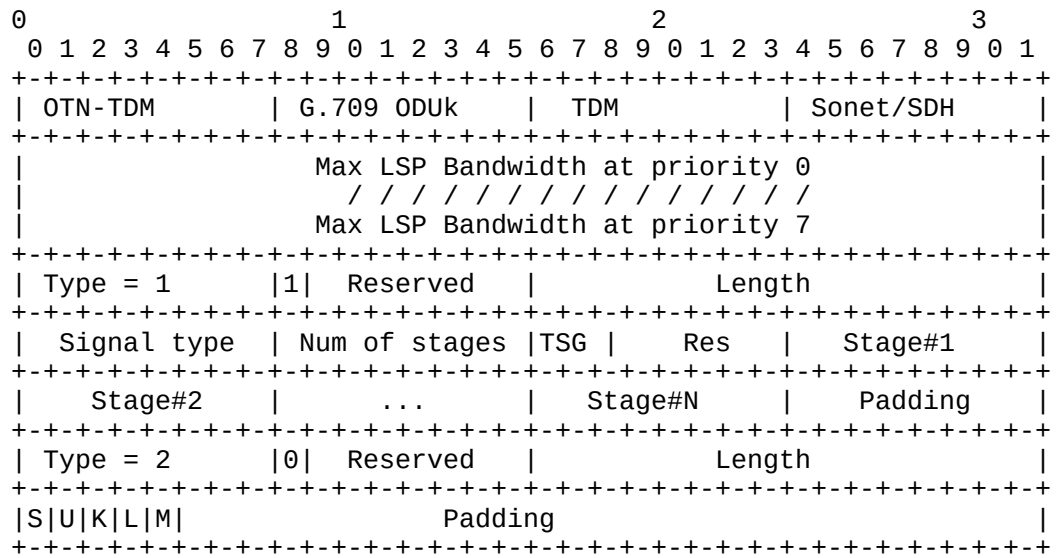
6.1. Ethernet and OTN When upper region is Ethernet and lower region is OTN



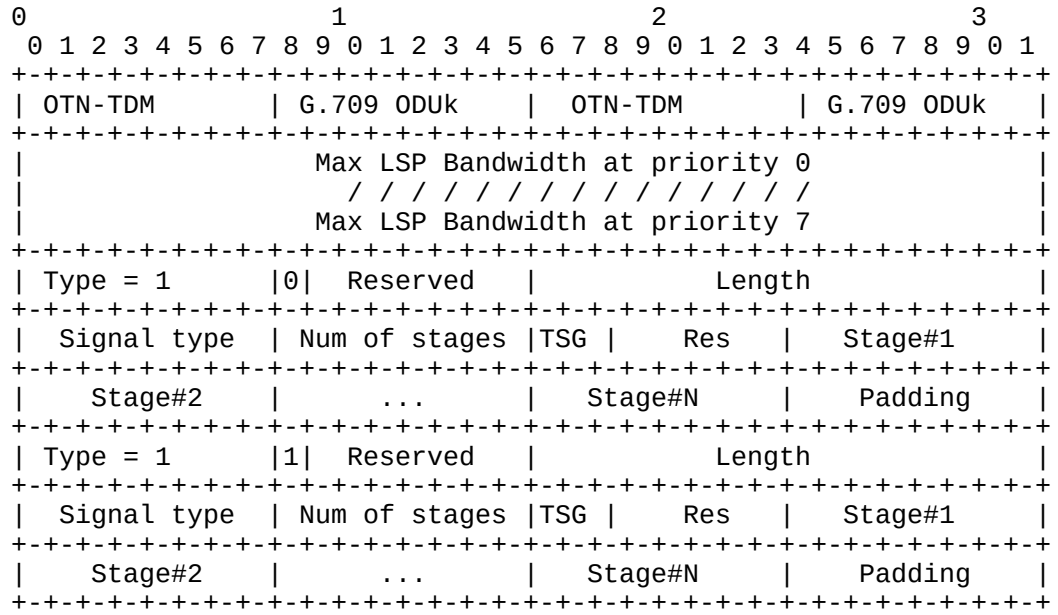
6.2. OTN and FlexGrid



6.3. OTN and SONET/SDH



6.4. OTN and OTN



7 IANA Considerations

TBD

8 Security Considerations

TBD

9 References

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[RFC6001] Papadimitriou, D., Vigoureux, M., Shiomoto, K., Brungard, D., and JL. Le Roux, "Generalized MPLS (GMPLS) Protocol Extensions for Multi-Layer and Multi-Region Networks (MLN/MRN)", RFC 6001, October 2010.

[RFC4606] E. Mannie, Perceval, D. Papadimitriou, "Generalized Multi-Protocol Label Switching (GMPLS) Extensions for Synchronous Optical Network (SONET) and Synchronous Digital Hierarchy (SDH) Control", RFC 4606, Aug 2006

[GMPLS-OTN-OSPF] Traffic Engineering Extensions to OSPF for Generalized MPLS (GMPLS)Control of Evolving G.709 OTN Networks

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