

OSPF Extensions for Routing Constraint Encoding and Wavelength range Allocation in Flexible Grid Network

[draft-wangl-ccamp-ospf-ext-constraint-flexi-grid-01](#)
[draft-wang-ccamp-flexigrid-wavelength-range-ospf-00](#)

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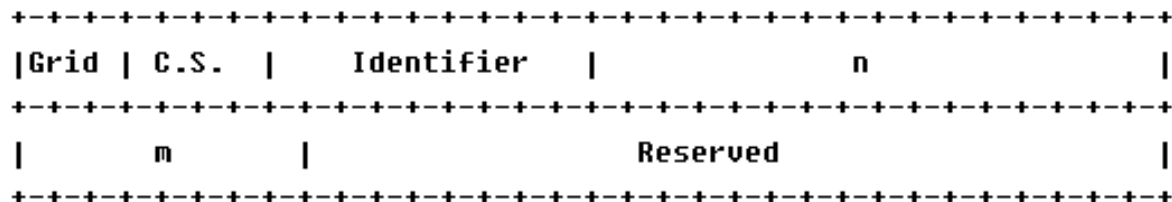
- Requirements
 - Spectrum available constraint
 - Flexible grid ability constraint
 - Optical signal compatibility constraint
 - Wavelength range allocation constraint
- Protocol Extensions

Requirements

- Spectrum available constraint
 - Spectrum assignment should conform to spectrum continuity constraints.
- Flexible-Grid ability constraint
 - Grid type, slot width granularity and Max/Min slot width.
 - Advertisement of these parameters can avoid invalid RSA and improve routing efficiency.
- Optical signal compatibility constraint
 - Provide sufficient information to characterize OE/EO elements in RSA process to determine the signal compatibility along the path.
 - Mapping relations between data rate/modulation format and slot width.
- Wavelength range allocation constraint
 - One wavelength range for a particular bit rate and/or modulation format to avoid fragmentation and XPM effect.

Protocol Extensions

- Spectrum availability constraint → **Label set object**
 - The general format for a label set should be in accordance with wavelength set defined in WSON.
 - Five types of label set defined in WSON
 - 0/1 Inclusive/Exclusive list
 - 2/3 Inclusive/Exclusive range
 - 4 bitmap
 - Label object format
 - in accordance with label in [I-D.farrkingel-ccamp-flexigrid-lambda-label].



Protocol Extensions

- Label set object format continued:

1). Inclusive/Exclusive list

1	0or1	Num Labels (not used)	Length
:	:	Label 1 (n, m)	:
:	:	:
:	:	Label n (n, m)	:

For flexi-grid label set

2). Inclusive/Exclusive range

1	2or3	Num Labels (not used)	Length
:	:	Start Label 1 (n, m=1)	:
:	:	End Label 1 (n, m=1)	:
:	:	:
:	:	Start Label 1 (n, m=1)	:
:	:	End Label 1 (n, m=1)	:

For case 2 and 3, we could delete the “m” field to improve the encoding.

3). Bitmap encoding

1	4	Num Labels	Length
:	:	Start Label 1 (n, m=1)	:
:	:	Bit Map Word (one bit for 6.25 GHz)	:

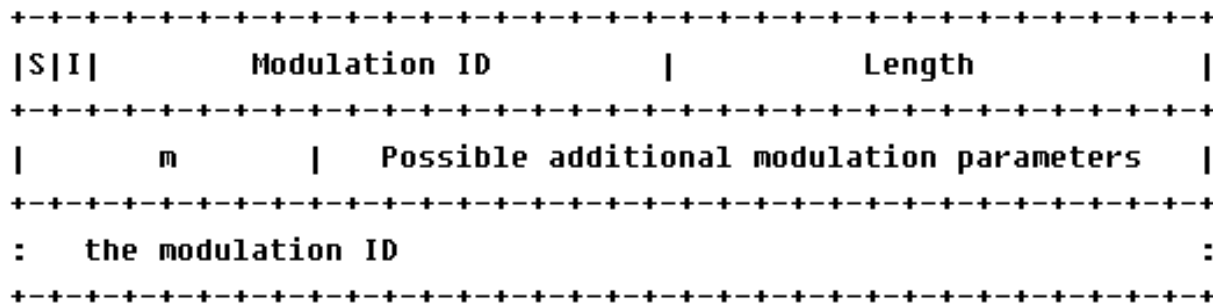
Protocol Extensions

- Flexible-Grid ability → **Port label restriction sub-TLV**
 - Relative static; inherent attribution of optical components
- Encoding
 - A new RstType
 - Grid/C.S. information.
 - Min-width/Max-width: minimum/maximum slot width that node' port or link supports.
 - $\text{Min/Max Slot Width (GHz)} = 12.5\text{GHz} * \text{Min-Width/Max-width};$

```
+++++
| MatrixID      | RstType = 5  |          Reserved          |
+++++
| Grid | C.S.  |   Reserved   |  Min-Width  |  Max-Width  |
+++++
```

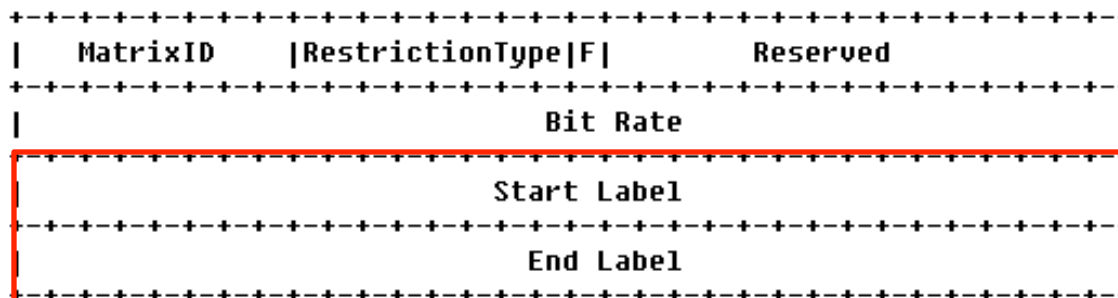
Protocol Extensions

- Optical signal compatibility → modulation type sub-TLV
 - Relative static; inherent attribution of optical components
- Encoding
 - General format in accordance with that in WSON.
 - a new field “m” (8bit) is added to represent the minimum slot width required by the OE/EO subsystem (transponder, regenerator...) with corresponding Modulation ID.
 - Minimum Slot Width = 12.5GHz * m.



Protocol Extensions

- Wavelength range allocation → **Port label restriction sub-TLV**
 - Configured by operators, but relative static.
 - Signals of the same bitrates usually use the same modulation format on a link, grouping of wavelength with the same bitrates is preferable.
 - A wavelength range can be allocated to be used for constructing path with specific bitrates. . Signals in the same wavelength group with the same bitrates looks like traditional fixed grid. Mapping between wavelength range and corresponding bitrates should be advertised.



Next steps

- Conform to ITU-T work.
- Refine the document according to the feedback of meeting and mailing list.