PCEP Protocol Extension for Spectrum Utilization Optimization in Flexi-Grid Networks

draft-zhaoyl-pce-flexi-grid-pcep-ex-00.txt

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Motivation

Flexi-grid networks

Advantage

✓ **Flexible**

accommodate the bandwidth requirement of various client services.

Disadvantage

✓**Contiguous spectrum**

Before assigning the client LSP, we have to find suitable route and fit contiguous spectrum for it, and it is a complex process.

✓**Fragmentation**

In a dynamic traffic scenario, the procedure of channel setup and tear down leads to fragmentation of spectral resources.

General Assumptions

To overcomes above two problems that would affect Spectrum utilization, we introduce some optimization in Routing and Spectrum assignment (RSA) and propose defragmentation.

1. RSA

- Different from RWA, RSA has to find contiguous spectrum for every client LSP.
- Similar to RWA , there are also several spectrum assignment algorithms. To increase utilization rate of spectrum resources, we have to select different RSA algorithms for different networks.

2. Defragmentation

- The procedure of channel setup and tear down leads to fragmentation of spectral resources, defragmentation is proposed to improve the continuity of spectrum resources.

- Advantage of defragmentation
  - ✓consolidate discontinuous spectrum resources
  - ✓increase utilization rate of spectrum resources
  - ✓reduce the blocking probability

- Defragmentation doesn't exist in traditional networks. Flexi-grid networks require to extend PCEP protocol to support it.

RSA

PCEP Extension Requirements

PCReq

- Add RAEO-list information to support RSA algorithms selection.
- Extend <RP> [<NO-PATH>] information to find whether contiguous spectrum is satisfied.

<request>::= **<RP>**

<END-POINTS>

[<RAEO-list>]

[<LSPA>]

[<BANDWIDTH>]

[<metric-list>]

[<RRO>

[<BANDWIDTH>]]

[<IRO>]

[<LOAD-

BALANCING>]

<response>::=<RP>

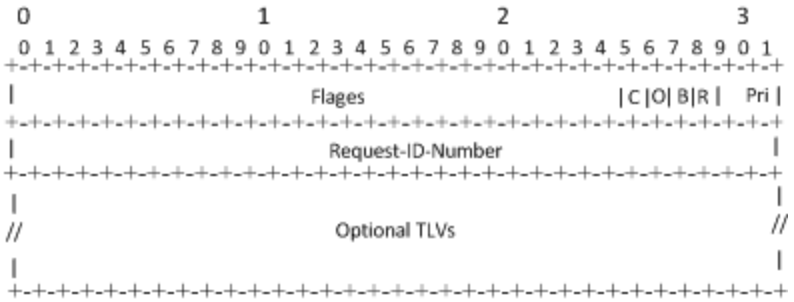
[<NO-PAT

[<attribut

[<path-lis

RP Object :

C bit is the Cascade bit, if C=1,assign continuous spectrum for traffic else assign uncontinuous spectrum.



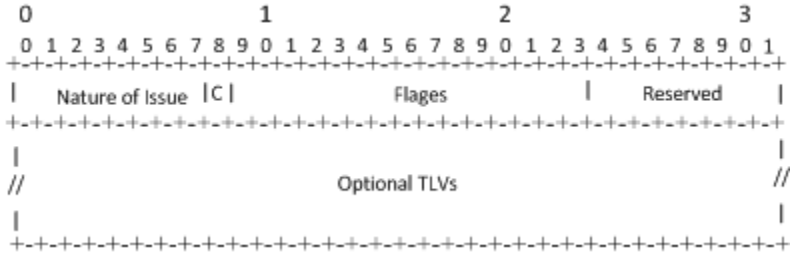
NO-PATH:

NI -Nature of Issue (8 bits): The NI field is used to report the nature of the issue that leads to a negative reply. Two values are currently defined:

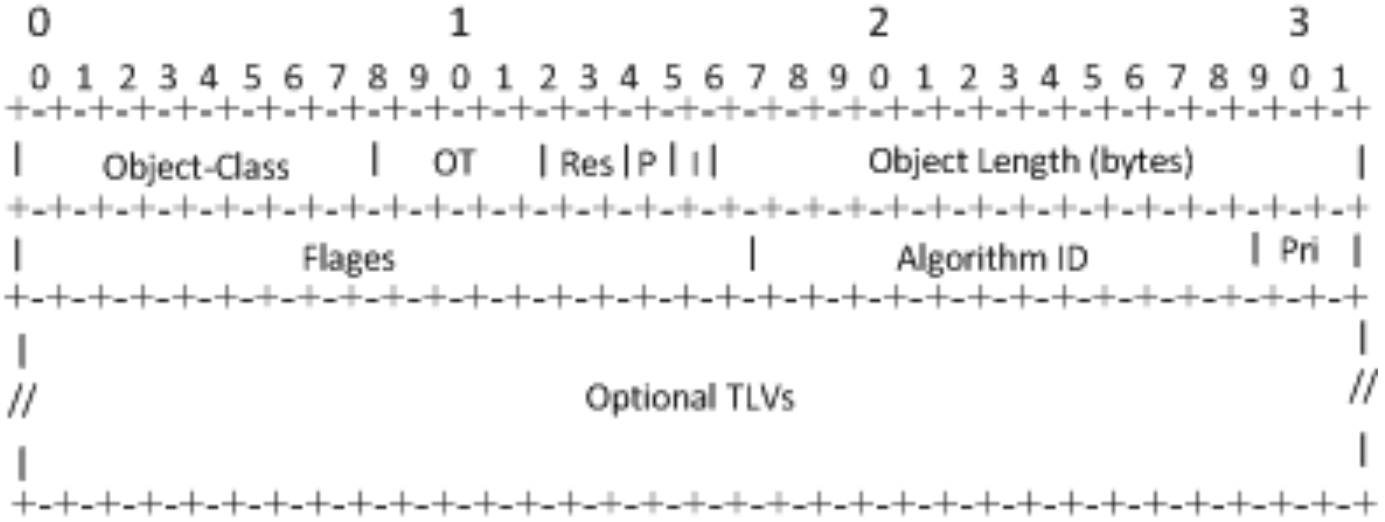
0: No path satisfying the set of constraints could be found

1: PCE chain broken

2: No path satisfying the Continuous spectrum



[<RAEO-list>] defined as follows:
“Algorithm Id”, which stands for the number of different algorithms
"Pri" that means priority of these algorithms.



Defragmentation
PCEP Extension Requirements

Add two messages to support defragmentation

- Spectrum Defragmentation Request Message
- Spectrum Defragmentation Reply Message

Spectrum Defragmentation Request Message

<SDReq Message>::= <Common Header>

<SDTO-list>

[LSPA Object]

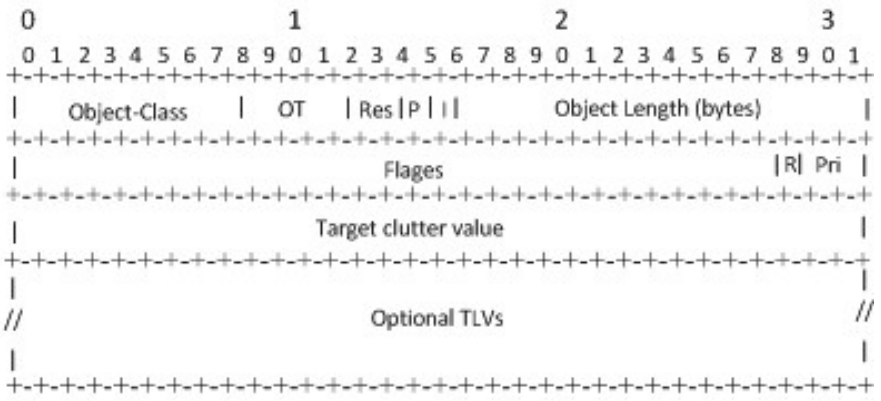
[<RAEO-list>]

Spectrum Defragmentation Reply Message

<SDRep Message>::= <Common Header>

<SDTO-list>

SDTO: Spectrum Defragmentation Target Object
"Target Clutter Value" stand for the goal of defragmentation.
"R" means whether the network MUST make it.

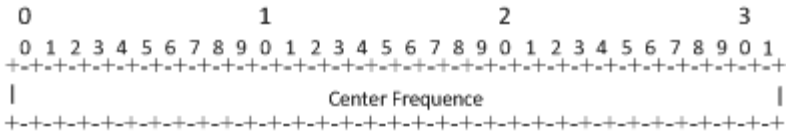


<Reroute>::=<RP Object>

<path><Center Frequency><Bandwidth>

<path><Center Frequency><Bandwidth>

where Center Frequency is



Next Steps

- ✓ Improve the document according to the feedback from meeting or mailing list
- ✓ Comments are always appreciated

Thank you