PCEP Extensions for Signaling Multipath Information

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Introduction

In the SR Policy architecture, the unit of signaling in both PCEP and BGP is the Candidate-Path. In BGP each update may contain multiple segment-list sub-TLVs, but in PCEP each update contains only a single ERO object. This is very limiting for SR Policy use-case, since it means PCEP cannot represent SR Candidate-Paths having more than one Segment-List.

In this draft, we propose a way for the PCE to return multiple paths that together (through ECMP/UCMP) satisfy a single objective. We keep the mechanism generic, so that it is applicable to tunneling architectures other than SR Policy (e.g. RSVP-TE). It is also applicable to stateless PCEP (PCReq/PCRep).

Motivating Example

Splitting of Requested Bandwidth

- PCC requests 100 Gbps of bandwidth, but all the links in the network have only 60 Gbps of bandwidth available. The PCE would need to return at least 2 paths to meet the objective.
- The PCE has a choice of how many paths to return and their weights. For example, the PCE can return 2 paths with 50/50 split, or the PCE can return 3 paths with 40/30/30 split, etc.
- PCC does not know in advance how many paths the PCE will return, it simply has the constraint that 100 Gbps of bandwidth is to be sent in total.

PATH-ATTRIBUTES

We introduce a new "separator" object, PATH-ATTRIBUTES:

```
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                          Flags                          | O  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                          Path ID                             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
~                        Optional TLVs                         ~
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

```
<intended-path> ::= ((<PATH-ATTRIB><ERO>)[<intended-path>])
```

```
<actual-path> ::= ((<PATH-ATTRIB><RRO>)[<actual-path>])
```
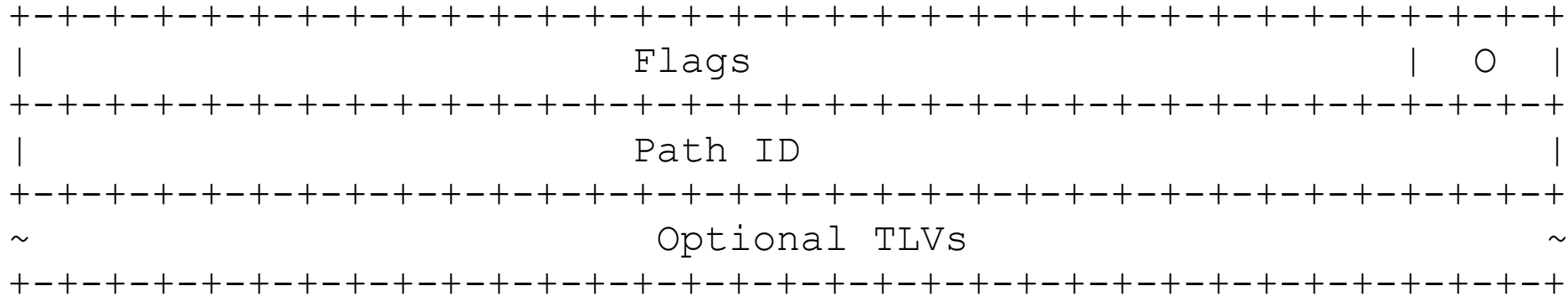
Optional TLVs can encode additional attributes/state about the path, such as weight for UCMP, protection, etc.

Capability

PCC needs specify how many multipaths it can install in forwarding. For this, we introduce the MULTIPATH-CAP TLV:

```
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                    Type                |              Length              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|      Number of Multipaths        |           Reserved          |B|W|
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

This TLV is mandatory in the OPEN object (if the PCC/PCE supports this draft) and can also be optionally carried in the LSP object to override the global values.

For example, if multipath is not desired for one particular Candidate Path, then this TLV can be included in the LSP object with Number of Multipaths set to 1.

Conclusion

Next steps:

- Request WG adoption
- Q & A