TE Constraints for PCEP

draft-peng-pce-te-constraints-06

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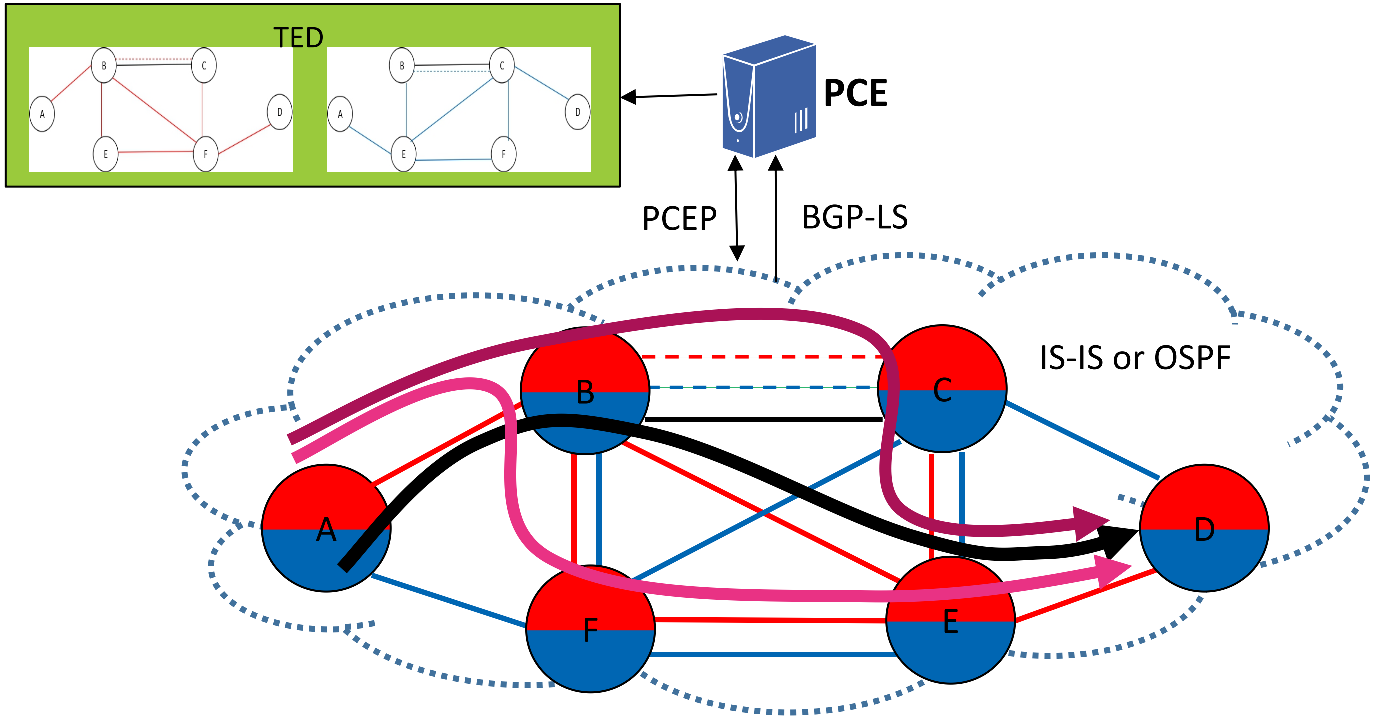
Overview

- As defined in RFC4655, the PCE MAY compute the path of a TE on the TED based on the considering the constraints such as metric, bandwidth, delay, affinity, etc.

- This document proposes a set of constraints for PCEP with the network topology information as following shown.
  - Source Protocol ID (IS-IS [RFC8202], OSPF [RFC6549], BGP-LS [RFC7752])
  - Muti-topology ID (IS-IS [RFC5120], OSPF [RFC4915], BGP-LS [RFC7752])
  - Application ID (IS-IS [RFC8919])
  - Slice ID (draft-ietf-teas-ietf-network-slice-definition)
  - Color (BGP [RFC9012])
  - FA ID (draft-ietf-lsr-flex-algo)



Constraint 1-Source Protocol ID

- Source Protocol TLV
  - Sub-topology identified by the specific source protocol ID.
  - The Source Protocol TLV is optional and is defined to carry the source protocol constraint.
  - Protocol-ID : 8 bits, as defined in RFC7752, indicates the Source Protocol identifier. IS-IS (RFC8202) and OSPF (RFC6549) MAY run multiple routing protocol instances over the same link.
  - Identifier : 64 bits, as defined in RFC7752, indicates the routing universe identifier.

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|          Type=TBD1            |           Length=12           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| Protocol-ID |                   Reserved                        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                          Identifier                           |
|                          (64 bits)                            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 1: Source Protocol TLV

Protocol-ID	NLRI information source protocol
1	IS-IS Level 1
2	IS-IS Level 2
3	OSPFv2
4	Direct
5	Static configuration
6	OSPFv3

Constraint 2-Multi-topology ID

- Multi-topology TLV
  - Sub-topology identified by the specific Multi-Topology ID within a source protocol.
  - The Multi-topology TLV is optional and is defined to carry the multi-topology protocol constraint.
  - Multi-Topology ID :
    - as defined in RFC5120, 12bits, non-zero MT ID of the topology being announced Source Protocol identifier.
    - as defined in RFC4915, 8bits, represent Multi-Topology ID.
    - as defined in RFC7752, If the value is derived fromOSPF, then the upper 9 bits MUST be set to 0.
  - R bits: set to 0 when originated and ignored on receipt.

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|          Type=TBD2            |           Length=4            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|R R R R|  Multi-Topology ID    |           Reserved            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 2: Multi-topology TLV

Constraint 3-Application ID

- Application Specific TLV
  - Sub-topology provides the Application Specific information.
  - The Application Specific TLV is optional and is defined to carry the application specific constraints.
  - Standard Application ID : 32bits, indicates a bit-position value for a single STANDARD application. IS-IS Link Attribute Application Identifiers is defined in RFC8919.
  - User Defined Application ID : 32 bits, indicates a single user defined application which is a specific implementation.

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|          Type=TBD4            |           Length=8            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                  Standard Application ID                      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                User Defined Application ID                    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 4: Application Specific TLV

Bit #	Name
0	RSVP-TE (R-bit)
1	Segment Routing Policy (S-bit)
2	Loop-Free Alternate (F-bit)
3-63	Unassigned

Constraint 4-Slice ID

- Slice-id TLV
  - Sub-topology identified by the specific Slice-id, which is independent of routing protocols such as IGP/BGP and can be applied to any of the virtual network.
  - The Slice-id TLV is optional and is defined to carry the slice specific constraint.
  - Slice-id : 32 bits, indicates the Slice identifier. The Network Slice is defined in draft-ietf-teas-ietf-network-slice-definition.

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|         Type=TBD3             |          Length=4             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                           Slice-id                            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 3: Slice-id TLV

Constraint 5-Color

- Color TLV
  - Sub-topology identified by the specific Color Template which carried specific color parameter and it is suitable for any TE instance such as RSVP-TE, SR-TE, SR-policy.
  - The Color TLV is optional and is defined to carry the color constraints.
  - Color: 32bits, indicates a TE template. It is consistent with the Color Extended Community defined in RFC9012.
  - The color of SR policy is defined in draft-ietf-spring-segment-routing-policy and the color of candidate path in the Composite Candidate Path is discussed in draft-ietf-pce-multipath.

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|          Type=TBD5            |           Length=4            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                             Color                             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 5: Color TLV

Constraint 6-FA ID

- FA-id TLV
  - Sub-topology identified by the specific FA-id to optimize segment stack depth for the IGP area partial of the entire SR policy.
  - The FA-id TLV is optional and is defined to carry the Flex-algo constraints.
  - FA-id : 8 bits, indicates an explicit FA-id mapping information defined in draft-ietf-lsr-flex-algo.
  - Flags : 8 bits, indicates the flags indicater.
  - Flag-M: Indicate mapping behavior when unset, and merging behavior when set.

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|         Type=TBD6             |            Length=4           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|   FA-id       |     Flags   |M|  Reserved                     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 6: FA-id TLV

Next Step

- Comments and discussions are very welcome!
- Ready for Adoption?

Thank you!