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PCEP extensions for Circuit Style Policies

Abstract

This document proposes a set of extensions for Path Computation
Element Communication Protocol (PCEP) for Circuit Style Policies -
Segment-Routing Policy designed to satisfy requirements for
connection-oriented transport services. New TLV is introduced to
control path recomputation triggers and new flag to add ability to
request path with strict hops only.

Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",
"SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and
"OPTIONAL" in this document are to be interpreted as described in
BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all
capitals, as shown here.

Status of This Memo

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1. **Introduction**

   Usage of Segment-routing and PCEP in connection-oriented transport
   services require path persistancy and hop-by-hop behavior for PCE
   computed paths.

   Circuit-Style Policy introduced in [I-D.schmutzer-pce-cs-sr-policy]
   requires PCEP extensions, which are covered in this document.

   This document:

     *Introduces possibility to request strict path from the PCE by
      extending LSP-EXTENDED-FLAG TLV

*Adding new TLV for encoding blocked path recomputation triggers
 to the PCE is introduced, to be carried inside the LSP object,
 which is defined in [RFC8231].

*Clarifies usage of existing O-flag from RP object in Segment-
 routing

PCEP extensions described in this document are applicable to RSVP-TE
and SR-TE.

2. Terminology

The following terminologies are used in this document:

ERO: Explicit Route Object

IGP: Interior Gateway Protocol

LSP: Label Switched Path.

LSPA: Label Switched Path Attributes.

OTN: Optical Transport Network.

PCC: Path Computation Client

PCE: Path Computation Element

PCEP: Path Computation Element Protocol.

SDH: Synchronous Digital Hierarchy

SID: Segment Identifier

SONET: Synchronous Optical Network

SR: Segment Routing.

SR-TE: Segment Routing Traffic Engineering.

3. Overview of Extensions to PCEP

3.1. LSP-EXTENDED-FLAG TLV

O-flag is proposed in the LSP-EXTENDED-FLAG TLV, which was
introduced in 5.1.2 of [I-D.ietf-pce-lsp-extended-flags] and
extended with E-flag in [I-D.peng-pce-entropy-label-position]

The format of the LSP-EXTENDED-FLAG is as follows:

```
 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            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                                                         |O|E|
//                    LSP Extended Flags                        //
|                                                             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
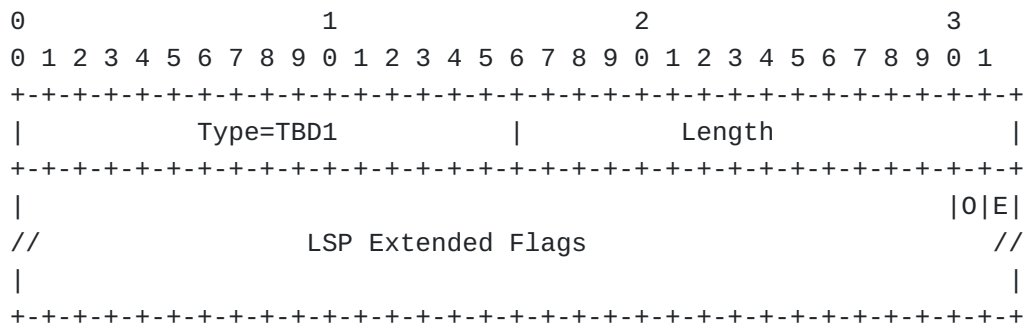
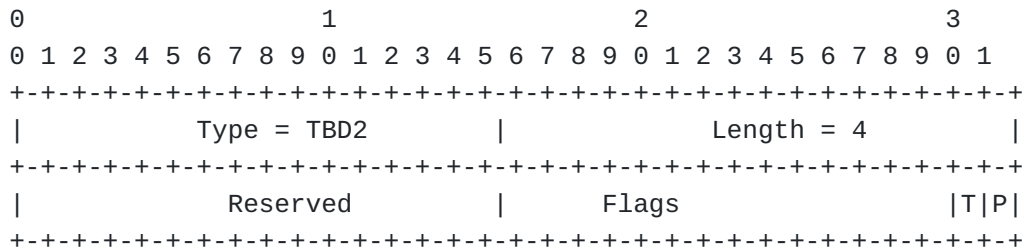   Figure 1: LSP-EXTENDED-FLAG TLV Format

   Type (16 bits): the value is TBD1 by IANA.

   Length (16 bits): multiple of 4 octets.

   O (Strict-Path): If set to 1, this indicates to the PCE that a path
   exclusively made of strict hops is required. Strict hop definition
   can be found in Section 4.1

3.2. RECOMPUTATION-TRIGGERS TLV

   This document defines new TLV for the LSP Object for encoding
   information about blocked path recomputation triggers.

```
 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         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|             Reserved           |        Flags          |T|P|
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

   Type (16 bits): the value is TBD2 by IANA.

   Length (16 bits): 4 octets

   Reserved: MUST be set to zero by the sender and MUST be ignored by
      the receiver.

   Flags: This document defines the following flag bits. The other
      bits MUST be set to zero by the sender and MUST be ignored by the
      receiver.

         *T (Topology-change): If set to 1, the PCE MUST NOT trigger
          recomputation as a result of received updated topology
          information.

         *P (Periodic-timer): If set to 1, the PCE MUST NOT trigger
          recomputation based on any periodic timer.

4. Operation

4.1. Strict path enforcement

PCC MAY set the O flag in LSP-EXTENDED-FLAG TLV in PCRpt message to
the PCE to indicate that a path exclusively made of strict hops is
required.

O flag cleared or LSP-EXTENDED-FLAG TLV not included indicates that
a loose path is acceptable.

In PCUpdate or PCInitiate messages, when the O bit is set, this
indicates that strict path is provided.

The flag is applicable only for stateful messages. Existing O flag
in RP object MAY be used to indicate similar behavior in PCReq and
PCRep messages as described in as described in Section 7.4.1 of
[RFC5440].

If O flag is set to 1 for both stateful and stateless messages for
SR paths introduced in [RFC8664], the PCE MUST use Adjacency SIDs
only.

4.2. Path computation triggers

PCC MAY set flags in RECOMPUTATION-TRIGGERS-TLV to block specific
triggers. If TLV is not included or all flags are set to 0, then the
PCE MAY use any event to start path computation.

Disabled recomputation triggered by topology event is not blocking
path computation started based PCRpt or based on updated state of
associated LSP.

If trigger blocked by specific flag is not supported or allowed on
the PCE, then PCE MAY ignore received flag value. The PCE SHOULD
reflect blocked triggers in PCUpdate message.

TLV MAY be included in PCInitiate and PCUpdate messages to indicate,
which triggers will be disabled on the PCE. PCC should reflect flag
values in PCRpt messages to forward requirement to other PCEs in the
network.

5. Security Considerations

No additional security measure is required.

6. IANA Considerations

6.1. LSP-EXTENDED-FLAG TLV

[I-D.ietf-pce-lsp-extended-flags] defines the LSP-EXTENDED-FLAG TLV. IANA is requested to make the following assignment from the "LSP-EXTENDED-FLAG TLV Flag Field" registry:

Bit	Description	Reference
TBD1	Strict-Path Flag (O)	This document

Table 1

6.2. RECOMPUTATION-TRIGGERS TLV

IANA is requested to make the assignment of a new value for the existing "PCEP TLV Type Indicators" registry as follows:

TLV Type	TLV Name	Reference
TBD2	RECOMPUTATION-TRIGGERS TLV	This document

Table 2

7. References

7.1. Normative References

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7.2. Informative References

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