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LSP setup method in PCEP messages
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Abstract

A path computation element can compute traffic engineering paths (TE paths) through a network that are subject to various constraints. Currently, TE paths are label switched paths (LSPs) which are set up using the RSVP-TE signaling protocol. However, other TE path setup methods are possible within the PCE architecture. This document proposes an extension to PCEP to allow support for different LSP setup methods over a single PCEP session.

Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [[RFC2119](#)].

Status of This Memo

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LSP setup method

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[1.](#) Introduction

[RFC5440] describes the Path Computation Element Protocol (PCEP) for communication between a Path Computation Client (PCC) and a Path Control Element (PCE) or between one a pair of PCEs. A PCC requests from a PCE the computation of a path subject to various constraints and optimization criteria. The PCE responds to the PCC with a hop-by-hop path in an ER object. The PCC uses the ER0 object to set up the path in the network.

[I-D.ietf-pce-stateful-pce] specifies extensions to PCEP that allow a PCC to delegate its LSPs to the PCE. The PCE can then update the state of LSPs delegated to it. In particular, the PCE may modify the path of an LSP by sending a new ER0. The PCC uses this ER0 to re-route the LSP in a make-before-break fashion.

[I-D.crabbe-pce-pce-initiated-lsp] specifies a mechanism allowing a PCE to dynamically instantiate LSPs on a PCC by sending the path and characteristics of the LSP. The PCC signals the LSP using the ER0

(and other attributes) sent by the PCE.

So far, the PCEP protocol and its extensions implicitly assume that the TE paths are label-switched paths (LSPs), which are established via the RSVP-TE protocol. However, other methods of LSP setup are

not precluded. Most recently, Segment Routing has emerged as another technology for setting up source-routed TE paths. Other methods for setting up TE paths are possible in the future.

[\[I-D.sivabalan-pce-segment-routing\]](#) specifies the ERO format for LSPs set up using SR (SR-ERO). However, it should be noted that when the LSP setup method over a given PCEP session is not the RSVP-TE signaling protocol, a new capability MUST be advertised when the PCEP session is established. A given PCEP session can be used to compute, initiate, and maintain LSPs which are set up using different setup methods. To facilitate this, the intended LSP setup method needs to be indicated in the appropriate PCEP messages, and the path of the LSP needs to be encoded in a format that is appropriate for the setup type. This document defines a new TLV called "LSP-SETUP-TYPE TLV" for this purpose.

[2.](#) Terminology

The following terminologies are used in this document:

ERO: Explicit Route Object.
LSR: Label Switching Router.
PCC: Path Computation Client.
PCE: Path Computation Element
PCEP: Path Computation Element Protocol.
SR: Segment Routing.
SR-ERO: Segment Routed Explicit Route Object.
TLV: Type, Length, and Value.

[3.](#) LSP Setup Type TLV

A PCC can simultaneously support setting up LSPs using different methods. To enable meaningful interaction with a PCE, the PCE must encode the LSP path in a format that is appropriate for the setup method used. To do so, the PCE must be made aware of the setup method used by the PCC for a particular LSP.

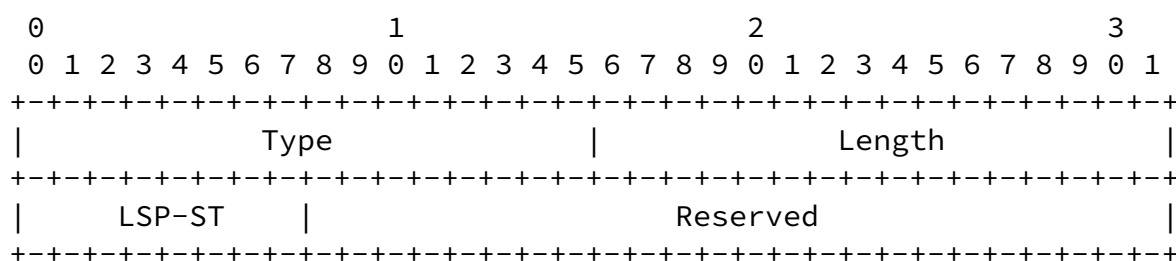


Figure 1: LSP-SETUP-TYPE TLV

LSP-SETUP-TYPE TLV is an optional TLV for use in the RP ([RFC5440]) and SRP ([I-D.ietf-pce-stateful-pce]) objects. Its format is shown

in the above figure. The type of the TLV is to be defined by IANA. The one octet value contains the LSP Setup Type (LSP-ST). This document specifies the following LSP-ST values:

- o ST = 0: LSP is setup via RSVP-TE signaling protocol(default).
- o ST = 1: LSP is setup via Segment Routing.

In the absence of this TLV, RSVP-TE is assumed as the setup method. If an RP or SRP object contains more than one LSP-SETUP-TYPE TLV, only the first TLV MUST be processed and the rest MUST be ignored.

4. Operation

When requesting the computation of a path from a PCE using a PCReq message ([RFC5440]), a PCC MAY include the LSP-SETUP-TYPE TLV in the RP object. If the PCE is capable of expressing the LSP path in a format appropriate for the setup method used, it MUST use the appropriate ERO format in the PCRep message. If the PCE does not support the intended LSP establishment type, but it does recognize the LSP-SETUP-TYPE TLV, it MUST send PCErr with Error-Type = TBD (LSP setup error) (recommended value is 19) and Error-Value = 1 (Unsupported LSP setup type,) and close the PCEP session. If an LSP setup type specified in PCRep message does not match that of the PCReq message, the PCC MUST send a PCErr with Error-Type = 19 (LSP setup error) and Error-Value = 2 (Mismatched LSP setup type) and close the PCEP session.

In the case of stateful PCE, a PCC MUST report the setup type of all LSPs in PCRpt messages both in the synchronization phase and in

subsequent updates. The absence of the LSP-SETUP-TYPE TLV is equivalent to an LSP_SETUP-TYPE TLV with an LSP-ST value of 0 (RSVP-TE), and it is recommended to omit including it when this is the case. If the LSP-SETUP-TYPE TLV needs to be included, the SRP object MUST be present even in cases when the SRP-ID-number is the reserved value of 0x00000000. A PCRpt message whose SRP-ID-number is not equal to 0x00000000 MUST match the path-type of the PCUpd message that triggered its generation. Otherwise, the PCE MUST send PCErr with Error-Type = 19 (LSP setup error) and Error-Value = 2 (Mismatched LSP setup type) and close the connection.

In the case of PCE initiated LSPs, if a PCC does not support the path-type specified in PCInitiate message, the PCC MUST send PCErr with Error-Type = 19 (LSP setup error) and Error-Value = 1 (Unsupported LSP setup type) and close the PCEP session. The path-type in PCRpt messages generated as a result of a PCUpd or PCInitiate message MUST match the path-type of the message that triggered it. Otherwise, the PCE MUST send PCErr with Error-Type = 19 (LSP setup error) and Error-Value = 2 (Mismatched LSP setup type). For LSPs

that are not setup up using RSVP-TE signaling protocol, the path-type MUST be included in the SRP object, and the SRP object MUST be included even if the SRP-ID-number is the reserved value of 0x00000000.

If a PCEP speaker does not support LSP-SETUP-TYPE TLV, it MUST send PCErr with Error-Type = 3 (Unknown Object) and Error-Value = 3 (Unsupported TLV).

[5.](#) IANA Considerations

IANA is requested to allocate a new TLV type (recommended value is TBD) for LSP-SETUP-TYPE TLV specified in this document.

This document requests that a registry is created to manage the value of the LSP Setup Type field in the LSP-SETUP-TYPE TLV.

Value Description		Reference
0	LSP is setup using RSVP signaling protocol	This document
1	LSP is Segment Routed	This document

Table 1

This document also defines a new Error-Type (recommended 19) and new Error-Values for the following new error conditions:

Error-Type	Meaning
19	Invalid LSP setup type
	Error-value=1: Unsupported LSP setup type
	Error-value=2: Mismatched LSP setup type

This document also defines a new Error-Value for the existing Error-Type 3 (Unknown Object):

Error-Type	Meaning
3	Unknown Object
	Error-value=3: Unsupported TLV

[6.](#) Normative References

- [I-D.crabbe-pce-pce-initiated-lsp]
Crabbe, E., Minei, I., Sivabalan, S., and R. Varga, "PCEP Extensions for PCE-initiated LSP Setup in a Stateful PCE Model", [draft-crabbe-pce-pce-initiated-lsp-02](#) (work in progress), July 2013.
- [I-D.ietf-pce-stateful-pce]
Crabbe, E., Medved, J., Minei, I., and R. Varga, "PCEP Extensions for Stateful PCE", [draft-ietf-pce-stateful-pce-06](#) (work in progress), August 2013.
- [I-D.sivabalan-pce-segment-routing]
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R. Raszuk, "PCEP Extensions for Segment Routing", [draft-sivabalan-pce-segment-routing-01](#) (work in progress), July 2013.

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.

[RFC5440] Vasseur, JP. and JL. Le Roux, "Path Computation Element (PCE) Communication Protocol (PCEP)", [RFC 5440](#), March 2009.

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