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Conveying path setup type 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 path setup methods over a given 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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## 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 a path subject to various constraints and optimization criteria from a PCE. The PCE responds to the PCC with a hop-by-hop path in an Explicit Route Object (ERO). The PCC uses the ERO 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 a 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 ERO. The PCC uses this ERO 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 an LSP on a PCC by sending the ERO and characteristics of the LSP. The PCC signals the LSP using the ERO and other attributes sent by the PCE.

So far, the PCEP protocol and its extensions implicitly assume that the TE paths are label switched, and are established via the RSVP-TE protocol. However, other methods of LSP setup are not precluded. When a new path setup method (other than RSVP-TE) is introduced for setting up a path, a new capability TLV pertaining to the new path setup method MAY be advertised when the PCEP session is established. Such capability TLV MUST be defined in the specification of the new path setup type. When multiple path setup methods are deployed in a network, a given PCEP session may have to simultaneously support more than one path setup types. In this case, the intended path setup method needs to be either explicitly indicated or implied in the appropriate PCEP messages (when necessary) so that both the PCC and the PCE can take the necessary steps to set up the path. This document introduces a generic TLV called "PATH-SETUP-TYPE TLV" and specifies the base procedures to facilitate such operational model.

## 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.  
 TLV: Type, Length, and Value.

## 3. Path Setup Type TLV

When a PCEP session is used to set up TE paths using different methods, the corresponding PCE and PCC must be aware of the path setup method used. That means, a PCE must be able to specify paths in the correct format and a PCC must be able take control and take forwarding plane actions appropriate to the path setup type.

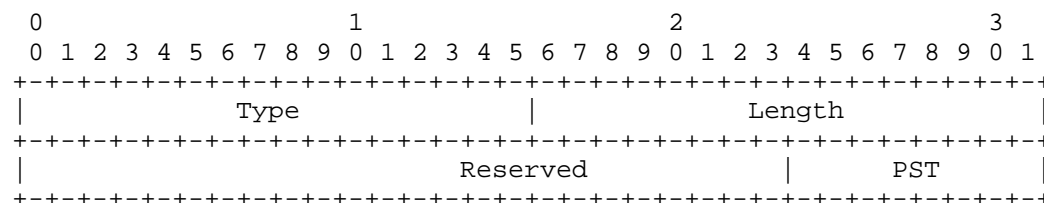


Figure 1: PATH-SETUP-TYPE TLV

PATH-SETUP-TYPE TLV is an optional TLV associated with the RP ([RFC5440]) and the 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 Path Setup Type (PST). This document specifies the following PST value:

- o PST = 0: Path is setup via RSVP-TE signaling protocol(default).

The absence of the PATH-SETUP-TYPE TLV is equivalent to an PATH-SETUP-TYPE TLV with an PST value of 0. It is recommended to omit the TLV in the default case. If the RP or SRP object contains more than one PATH-SETUP-TYPE TLVs, only the first TLV MUST be processed and the rest MUST be ignored.

If a PCEP speaker does not recognize the PATH-SETUP-TYPE TLV, it MUST ignore the TLV in accordance with ([RFC5440]). If a PCEP speaker recognizes the TLV but does not support the TLV, it MUST send PCErr with Error-Type = 2 (Capability not supported).

#### 4. Operation

When requesting a path from a PCE using a PCReq message ([RFC5440]), a PCC MAY include the PATH-SETUP-TYPE TLV in the RP object. If the PCE is capable of expressing the path in a format appropriate to the setup method used, it MUST use the appropriate ERO format in the PCRep message. If the path setup type cannot be inferred from the ERO or any other object or TLV in the PCRep message, PATH-SETUP-TYPE TLV may be included in the RP object of the PCRep message. Regardless of whether PATH-SETUP-TYPE TLV is used or not, if the PCE does not support the intended path setup type it MUST send PCErr with Error-Type = TBD (Traffic engineering path setup error) (recommended value is 21) and Error-Value = 1 (Unsupported path setup type) and close the PCEP session. If the path setup types corresponding to the PCReq and PCRep messages do not match, the PCC MUST send a PCErr with Error-Type = 21 (Traffic engineering path setup error) and Error-Value = 2 (Mismatched path setup type) and close the PCEP session.

In the case of stateful PCE, if the path setup type cannot be unambiguously inferred from ERO or any other object or TLV, PATH-SETUP-TYPE TLV MAY be used in PCRpt and PCUpd messages. If PATH-SETUP-TYPE TLV is used in PCRpt message, the SRP object MUST be present even in cases when the SRP-ID-number is the reserved value of 0x00000000. Regardless of whether PATH-SETUP-TYPE TLV is used or not, if a PCRpt message is triggered due to a PCUpd message (in this case SRP-ID-number is not equal to 0x00000000), the path setup types corresponding to the PCRpt and PCUpd messages should match. Otherwise, the PCE MUST send PCErr with Error-Type = 21 (Traffic engineering path setup error) and Error-Value = 2 (Mismatched path setup type) and close the connection.

In the case of PCE initiated LSPs, a PCE MAY include PATH-SETUP-TYPE TLV in PCInitiate message if the message does not have any other means of indicating path setup type. If a PCC does not support the path setup type associated with the PCInitiate message, the PCC MUST send PCErr with Error-Type = 21 (Traffic engineering path setup error) and Error-Value = 1 (Unsupported path setup type) and close the PCEP session. Similarly, as mentioned above, if the path setup type cannot be unambiguously inferred from ERO or any other object or TLV, the PATH-SETUP-TYPE TLV MAY be included in PCRpt messages triggered by PCInitiate message. Regardless of whether PATH-SETUP-TYPE TLV is used or not, if a PCRpt message is triggered by a PCInitiate message, the path setup types corresponding to the PCRpt and the PCInitiate messages should match. Otherwise, the PCE MUST send PCErr message with Error-Type = 21 (Traffic engineering path setup error) and Error-Value = 2 (Mismatched path setup type). If PATH-SETUP-TYPE TLV is used in PCRpt message, SRP object MUST be included in PCRpt message even if SRP-ID-number is the reserved value of 0x00000000.

## 5. Security Considerations

No additional security measure is required.

## 6. IANA Considerations

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

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

Value	Description	Reference
0	Traffic engineering path is setup using RSVP signaling protocol	This document

Table 1

This document also defines a new Error-Type (recommended 21) and new Error-Values for the following new error conditions:

Error-Type	Meaning
21	Invalid traffic engineering path setup type
Error-value=1:	Unsupported path setup type
Error-value=2:	Mismatched path setup type

## 7. Acknowledgements

We like to thank Marek Zawodsky for valuable comments.

## 8. 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-03 (work in progress), October 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-07 (work in progress), October 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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