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IGP Extensions for Stateful PCE Discovery
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Abstract

When a PCE is a Label Switching Router (LSR) participating in the Interior Gateway Protocol (IGP), or even a server participating in IGP, its presence and path computation capabilities can be advertised using IGP flooding. Such IGP extensions exist for OSPF and ISIS. This document specifies two new PCE capabilities advertised by IGP.

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1. Introduction

[RFC5440] describes the Path Computation Element Protocol (PCEP), which defines the communication between a Path Computation Client (PCC) and a Path Control Element (PCE), or between PCE and PCE, enabling computation of Multiprotocol Label Switching (MPLS) for Traffic Engineering Label Switched Path (TE LSP) characteristics.

Stateful PCE [I-D.ietf-pce-stateful-pce] specifies a set of extensions to PCEP to enable stateful control of TE LSPs between and across PCEP sessions in compliance with [RFC4657]. It includes mechanisms to effect LSP state synchronization between PCCs and PCEs, delegation of control of LSPs to PCEs, and PCE control of timing and sequence of path computations within and across PCEP sessions. It focuses on a model where LSPs are configured on the PCC and the LSP's path routing and the timing of its setup is delegated to the PCE. A mechanism for instantiating LSPs on a PCC using stateful PCE is specified in [I-D.crabbe-pce-pce-initiated-lsp]. Such mechanism is considered useful in applications such as Software Defined Networks (SDN), demand engineering, etc.

When PCCs are LSRs participating in the IGP (OSPF or IS-IS), and PCEs are either LSRs or servers also participating in the IGP, an effective mechanism for PCE discovery within an IGP routing domain consists of utilizing IGP advertisements. Such extension to OSPF to IS-IS exists in [RFC5088] and [RFC5089], respectively. Currently, the IGP PCE capability does not indicate whether the advertised PCE is stateful or capable to actively instantiate LSPs on a PCC. Advertising such capabilities would facilitate a PCC to learn about available stateful PCEs, as well as about a PCE's capability to instantiate LSPs. A PCC could listen to IGP updates, or use other mechanisms that carry IGP information to interested clients, such as BGP-LS ([I-D.ietf-idr-ls-distribution]). This document extends the IGP capability advertisement mechanism to include stateful PCE and PCE-based LSP instantiation capabilities.

1.1. 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 RFC 2119 [RFC2119]

2. Terminology

The following terminology is used in this document:

IGP: Interior Gateway Protocol
IS-IS: Intermediate System to Intermediate System
LSR: Label Switching Router
OSPF: Open Shortest Path First
PCC: Path Computation Client
PCE: Path Computation Element
PCEP: Path Computation Element Protocol

3. Overview of Protocol Extensions

The PCE-CAP-FLAGS sub-TLV is an optional sub-TLV used to advertise PCE capabilities. It MAY be present within the PCED sub-TLV carried by OSPF or IS-IS. [RFC5088] and [RFC5089] provide the description and processing rules for this sub-TLV when carried within OSPF and IS-IS, respectively.

The value field of the PCE-CAP-FLAGS sub-TLV is made up of an array of units of 32-bit flags numbered from the most significant as bit 0, where each bit represents one PCE capability.

The PCE-CAP-FLAGS sub-TLV has the following format:

- TYPE: 5
- LENGTH: Multiple of 4
- VALUE: This contains an array of units of 32 bit flags with the most significant bit as 0. Each bit represents one PCE capability

PCE capability bits are defined in [RFC5088]. This document defines new capability bits for the stateful PCE as follows:

Bit	Capability
9	Support stateful PCE capability
10	Support PCE-based tunnel instantiation capability

4. Backward Compatibility

An LSR that does not support the new IGP PCE capability bits specified in this document silently ignores those bits.

5. Management Considerations

TBD.

6. Security Considerations

Security considerations described in [RFC5088] are applicable to

stateful PCE capabilities. No additional security measures are required.

7. IANA Considerations

IANA is requested to allocate a new bit in "PCE Capability Flags" registry for stateful PCE capability as follows:

Bit	Meaning	Reference
9	Stateful PCE capability	This document
10	PCE-based tunnel instantiation capability	This document

Table 1

8. References

8.1. 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", Internet-Draft draft-crabbe-pce-pce-initiated-lsp-00, October 2012.

[I-D.ietf-idr-ls-distribution]
Gredler, H., Medved, J., Previdi, S., Farrel, A., and S. Ray, "North-Bound Distribution of Link-State and TE Information using BGP", Internet-Draft draft-ietf-idr-ls-distribution-01, October 2012.

[I-D.ietf-pce-stateful-pce]
Crabbe, E., Medved, J., Minei, I., and R. Varga, "PCEP Extensions for Stateful PCE", Internet-Draft draft-ietf-pce-stateful-pce-02, October 2012.

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

[RFC5088] Le Roux, JL., Vasseur, JP., Ikejiri, Y., and R. Zhang, "OSPF Protocol Extensions for Path Computation Element (PCE) Discovery", RFC 5088, January 2008.

[RFC5089] Le Roux, JL., Vasseur, JP., Ikejiri, Y., and R. Zhang, "IS-IS Protocol Extensions for Path Computation Element (PCE) Discovery", RFC 5089, January 2008.

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

8.2. Informative References

[RFC4657] Ash, J. and J.L. Le Roux, "Path Computation Element (PCE) Communication Protocol Generic Requirements", RFC 4657,

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