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Label Switched Path (LSP) Object Flag Extension for Stateful PCE

Abstract

RFC 8231 describes a set of extensions to Path Computation Element Communication Protocol (PCEP) to enable stateful control of MPLS-TE and GMPLS Label Switched Paths (LSPs) via PCEP. One of the extensions is the LSP object which includes a Flag field with a length of 12 bits. However, all bits of the Flag field have already been assigned in RFC 8231, RFC 8281, RFC 8623 and I-D.ietf-pce-binding-label-sid.

[Note to RFC Editor - Replace I-D.ietf-pce-binding-label-sid to RFC XXXX, once the RFC number is assigned.]

This document proposes to define a new LSP-EXTENDED-FLAG TLV for the LSP object for an extended flag field.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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This Internet-Draft will expire on 26 April 2023.

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1. Introduction

[RFC5440] describes the Path Computation Element (PCE) Communication Protocol (PCEP) which is used between a PCE and a Path Computation Client (PCC) (or other PCE) to enable computation of Multi-protocol Label Switching for Traffic Engineering (MPLS-TE) Label Switched Path (LSP).

PCEP Extensions for the Stateful PCE Model [RFC8231] describes a set of extensions to PCEP to enable active control of MPLS-TE and Generalized MPLS (GMPLS) tunnels. One of the extensions is the LSP object, which contains a flag field; bits in the flag field are used to indicate delegation, synchronization, removal, etc.

As defined in [RFC8231], the length of the flag field is 12 bits and the values from bit 5 to bit 11 are used for operational, administrative, remove, synchronize and delegate bits respectively. The bit value 4 is assigned in [RFC8281] to identify the PCE-Initiated LSPs. The bits from 1 to 3 are assigned in [RFC8623] for Explicit Route Object (ERO)-compression, fragmentation and Point-to-Multipoint (P2MP) respectively. The bit 0 is assigned in [I-D.ietf-pce-binding-label-sid] to PCE-allocation. All bits of the Flag field have been assigned already. This document extends the flag field of the LSP Object for other use.

This document proposes to define a new LSP-EXTENDED-FLAG TLV for an extended flag field in the LSP object.

2. Conventions used in this document

2.1. Terminology

The terminology is defined as [RFC5440] and [RFC8231].

2.2. 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.

3. PCEP Extension

The LSP Object is defined in Section 7.3 of [RFC8231]. This document proposes to define a new LSP-EXTENDED-FLAG TLV for an extended flag field in the LSP object.

3.1. The LSP-EXTENDED-FLAG TLV

The format of the LSP-EXTENDED-FLAG TLV follows the format of all PCEP TLVs as defined in [RFC5440] and is shown in Figure 1.

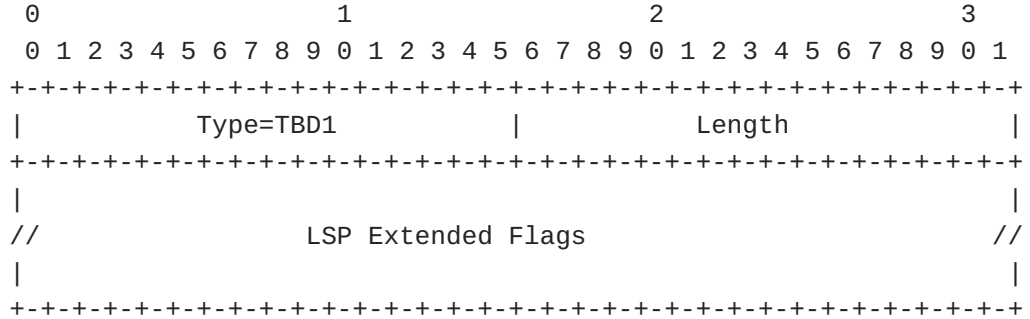

Figure 1: Figure 1: LSP-EXTENDED-FLAG TLV Format

Type (16 bits): TBD1.

Length (16 bits): indicates the length of the value portion in bytes. It MUST be in multiples of 4 and greater than 0.

LSP Extended Flags: this contains an array of units of 32-bit flags numbered from the most significant as bit zero, where each bit represents one LSP flag (for operation, feature, or state). The LSP Extended Flags field SHOULD use the minimal amount of space needed to encode the flag bits. Currently, no bits are assigned. Unassigned bits MUST be set to zero on transmission and MUST be ignored on receipt.

As an example of usage of the LSP-EXTENDED-FLAG TLV, the E-flag is requested for entropy label configuration as proposed in [I-D.peng-pce-entropy-label-position].

3.2. Processing

The LSP Extended Flags field is an array of units of 32 flags, to be allocated starting from the most significant bit. The bits of the LSP Extended Flags field will be assigned by future documents. This document does not define any flags. Flags that an implementation is not supporting MUST be set to zero on transmission. Implementations that do not understand any particular flag MUST ignore the flag.

Note that PCEP peers MUST handle varying lengths of the LSP-EXTENDED-FLAG TLV.

If a PCEP speaker receives the LSP-EXTENDED-FLAG TLV of a length more than it currently supports or understands, it MUST ignore the bits beyond that length.

If a PCEP speaker receives the LSP-EXTENDED-FLAG TLV of a length less than the one supported by the implementation, it MUST treat the bits beyond the length to be unset.

4. Advice for Specification of New Flags

Following the model provided in [RFC8786] Section 3.1, we provide the following advice for new specifications that define additional flags. Each such specification is expected to describe the interaction between these new flags and any existing flags. In particular, new specifications are expected to explain how to handle the cases when both new and pre-existing flags are set. They are also expected to discuss any security implications of the additional flags (if any) and their interactions with existing flags.

5. Backward Compatibility

The LSP-EXTENDED-FLAG TLV defined in this document does not introduce any backward compatibility issues. An implementation that does not understand or support the LSP-EXTENDED-FLAG TLV MUST ignore the TLV as per [RFC5440]. It is expected that future documents that define bits in the LSP-EXTENDED-FLAG TLV will also define the error case handling required for missing LSP-EXTENDED-FLAG TLV if it MUST be present.

Further, any additional bits in the LSP-EXTENDED-FLAG TLV that are not understood by an implementation MUST be ignored. It is expected that future documents that define bits in the LSP-EXTENDED-FLAG TLV will take that into consideration.

6. IANA Considerations

6.1. LSP Object

6.1.1. PCEP TLV Type Indicators

IANA is requested to allocate the following TLV Type Indicator value within the "PCEP TLV Type Indicators" subregistry of the "Path Computation Element Protocol (PCEP) Numbers" registry:

Value	Description	Reference
TBD1	LSP-EXTENDED-FLAG	[This document]

Table 1

6.1.2. LSP Extended Flags Field

IANA is requested to create a new subregistry called "LSP-EXTENDED-FLAG TLV Flag Field", within the "Path Computation Element Protocol (PCEP) Numbers" registry to manage the LSP Extended Flags field of the LSP-EXTENDED-FLAG TLV. New values are assigned by Standards Action [RFC8126]. Each bit should be tracked with the following qualities:

- Bit number (counting from bit 0 as the most significant bit)
- Capability description
- Defining RFC

No values are currently defined. Bits 0-31 should initially be marked as "Unassigned". Bits with a higher ordinal than 31 will be added to the registry in future documents if necessary.

7. Implementation Status

[NOTE TO RFC EDITOR : This whole section and the reference to [RFC7942] is to be removed before publication as an RFC]

This section records the status of known implementations of the protocol defined by this specification at the time of posting of this Internet-Draft, and is based on a proposal described in [RFC7942]. The description of implementations in this section is intended to assist the IETF in its decision processes in progressing drafts to RFCs. Please note that the listing of any individual implementation here does not imply endorsement by the IETF. Furthermore, no effort has been spent to verify the information presented here that was supplied by IETF contributors. This is not intended as, and must not be construed to be, a catalog of available implementations or their features. Readers are advised to note that other implementations may exist.

According to [RFC7942], "this will allow reviewers and working groups to assign due consideration to documents that have the benefit of running code, which may serve as evidence of valuable experimentation and feedback that have made the implemented protocols more mature. It is up to the individual working groups to use this information as they see fit".

At the time of posting this version of this document, there are no known implementations of this TLV. It is believed that this would be implemented alongside the documents that allocate flags in the TLV.

8. Management Considerations

Implementations receiving set LSP Extended Flags that they do not recognize MAY log this. That could be helpful for diagnosing backward compatibility issues with future features that utilize those flags.

9. Security Considerations

[RFC8231] sets out security considerations for PCEP when used for communication with a stateful PCE. This document does not change those considerations. For LSP Object processing, see [RFC8231].

The flags for the LSP object and their associated security considerations are specified in [RFC8231], [RFC8281], [RFC8623], and [I-D.ietf-pce-binding-label-sid].

This document provides for the future addition of flags in the LSP Object. Any future document that specifies new flags must also discuss any associated security implications. No additional security issues are raised in this document beyond those that exist in the

referenced documents. Note that the [RFC8231] recommends that the stateful PCEP extension are authenticated and encrypted using Transport Layer Security (TLS) [RFC8253], as per the recommendations and best current practices in [RFC7525]. Assuming that recommendation is followed, then the flags will be protected by TLS.

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Appendix A. WG Discussion

The WG discussed the idea of a fixed length (with 32 bits) for LSP-EXTENDED-FLAG TLV. Though 32 bits would be sufficient for quite a while, the use of variable length with a multiple of 32-bits allows for future extensibility where we would never run out of flags and there would not be a need to define yet another TLV in the future. Further, note that [RFC5088] and [RFC5089] use the same approach for the PCE-CAP-FLAGS Sub-TLV and are found to be useful.

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