

Internet Engineering Task Force (IETF)
Request for Comments: 8786
Updates: 8231
Category: Standards Track
ISSN: 2070-1721

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May 2020

Updated Rules for Processing Stateful PCE Request Parameters Flags

Abstract

Extensions to the Path Computation Element Communication Protocol (PCEP) to support stateful Path Computation Elements (PCEs) are defined in RFC 8231. One of the extensions is the Stateful PCE Request Parameters (SRP) object. That object includes a Flags field that is a set of 32 bit flags, and RFC 8281 defines an IANA registry for tracking assigned flags. However, RFC 8231 does not explain how an implementation should set unassigned flags in transmitted messages, nor how an implementation should process unassigned, unknown, or unsupported flags in received messages.

This document updates RFC 8231 by defining the correct behaviors.

Status of This Memo

This is an Internet Standards Track document.

This document is a product of the Internet Engineering Task Force (IETF). It represents the consensus of the IETF community. It has received public review and has been approved for publication by the Internet Engineering Steering Group (IESG). Further information on Internet Standards is available in Section 2 of RFC 7841.

Information about the current status of this document, any errata, and how to provide feedback on it may be obtained at <https://www.rfc-editor.org/info/rfc8786>.

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1. Introduction

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

[RFC8231] specifies a set of extensions to PCEP to enable stateful control of LSPs within and across PCEP sessions in compliance with [RFC4657]. It includes mechanisms to effect Label Switched Path (LSP) State Synchronization between PCCs and PCEs, delegation of control over LSPs to PCEs, and PCE control of timing and sequence of path computations within and across PCEP sessions.

One of the extensions defined in [RFC8231] is the Stateful PCE Request Parameters (SRP) object. That object includes a Flags field that is a set of 32 bit flags, and RFC 8281 defines an IANA registry for tracking assigned flags. However, RFC 8231 does not explain how an implementation should set unassigned flags in transmitted messages, nor how an implementation should process unassigned or unknown flags in received messages.

Furthermore, [RFC8231] gives no guidance to the authors of future specifications about how to describe the interaction between flags that have already been defined and flags being defined in the new specifications.

This document updates RFC 8231 by defining the correct behaviors.

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. Updated Procedures

3.1. Advice for Specification of New Flags

Section 7 of [RFC8231] introduces changes to existing PCEP objects and defines new PCEP objects and TLVs in support of stateful PCE functionality. That text does not advise future specifications on how to describe the interaction between flags that may be defined.

The text in Section 7 of [RFC8231] is updated to read as follows:

The PCEP objects defined in this document are compliant with the PCEP object format defined in [RFC5440]. The P and I flags of the PCEP objects defined in the current document MUST be set to 0 on transmission and SHOULD be ignored on receipt since they are exclusively related to path computation requests.

The sections that follow define PCEP objects and TLVs that contain Flags fields, and some flag values are defined. Future specifications may define further flags, and each new specification that defines additional flags 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.

3.2. Flags Field of the SRP Object

Section 7.2 of [RFC8231] defines the PCEP SRP object. It describes the Flags field as:

Flags (32 bits): None defined yet.

This document updates that text as follows:

Flags (32 bits): This document does not define any flags. Unassigned flags MUST be set to zero on transmission and MUST be ignored on receipt. Implementations that do not understand any particular flag MUST ignore the flag.

4. Compatibility Considerations

While one of the main objectives of the changes made by this document is to enable backward compatibility, there remains an issue of compatibility between existing implementations of RFC 8231 and implementations that are consistent with this document.

It should be noted that common behavior for Flags fields is as described by the updated text presented in Section 3. Thus, many implementations, lacking guidance from RFC 8231, will still have implemented a consistent and future-proof approach. However, for completeness, it is worth noting how behaviors might interact between implementations.

SRP objects generated by an implementation of this document will set all unknown flag bits to zero and will therefore cause no issues to an older implementation even if it inspects those bits. Similarly, an implementation of this document will not inspect any unknown flag bits and will therefore be unaffected by older implementations no matter how they set the flags.

There will remain an issue with compatibility between implementations and how they set the flags. An implementation of RFC 8231 might set any of the unassigned flags, but an implementation of a future or current specification (such as [RFC8281] or [RFC8741]) assigns specific meanings to a flag if set. That problem cannot be fixed in old implementations by any amount of documentation and can only be handled for future specifications by obsoleting the Flags field and using a new technique. Fortunately, however, most implementations will have been constructed to set unused flags to zero, which is consistent with the behavior described in this document, and so the risk of bad interactions is sufficiently small that there is no need to obsolete the existing Flags field.

5. Management Considerations

Implementations receiving set SRP 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.

6. Security Considerations

[RFC8231] sets out security considerations for PCEP when used for communication with a stateful PCE. This document does not change those considerations.

However, by defining the expected behavior of implementations, this document may improve the stability of networks and thus reduce the attack surface. That is, by reminding implementations to ignore unset bits, it is less possible to attack them by randomly tweaking bits. Furthermore, by reminding implementations to leave undefined bits unset, the network is future-proofed against new definitions of previously undefined bits.

7. IANA Considerations

IANA maintains a registry called the "Path Computation Element Protocol (PCEP) Numbers" registry with a subregistry called "SRP Object Flag Field". IANA has updated the reference for that subregistry to list this document in addition to [RFC8281].

8. References

8.1. Normative References

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- [RFC4657] Ash, J., Ed. and J.L. Le Roux, Ed., "Path Computation Element (PCE) Communication Protocol Generic Requirements", RFC 4657, DOI 10.17487/RFC4657, September 2006, <<https://www.rfc-editor.org/info/rfc4657>>.
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Acknowledgements

Thanks to the authors of [RFC8741] for exposing the need for this work. Thanks to Dhruv Dhody and Julien Meuric for discussing the solution. Additional thanks to Hariharan Ananthakrishnan for his Shepherd's review. Thanks to Benjamin Kaduk and Alvaro Retana for helpful comments during IESG review.

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