     Extension for Stateful PCE to allow Optional Processing of PCEP Objects
              draft-dhody-pce-stateful-pce-optional-05

Abstract

   This document introduces a mechanism to mark some of the Path
   Computation Element (PCE) Communication Protocol (PCEP) objects as
   optional during PCEP messages exchange for the Stateful PCE model to
   allow relaxing some constraints. The introduction of relaxation in
   this document updates RFC8231.

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Table of Contents

1. Introduction

   [RFC5440] describes the Path Computation Element communication
   Protocol (PCEP) which enables the communication between a Path
   Computation Client (PCC) and a Path Control Element (PCE), or between
   two PCEs based on the PCE architecture [RFC4655].

   PCEP Extensions for Stateful PCE Model [RFC8231] describes a set of
   extensions to PCEP to enable active control of Multiprotocol Label
   Switching Traffic Engineering (MPLS-TE) and Generalzied MPLS (GMPLS)
   tunnels. [RFC8281] describes the setup and teardown of PCE-initiated

LSPs under the active stateful PCE model, without the need for local
configuration on the PCC, thus allowing for a dynamic network.

[RFC5440] defined P flag (Processing-Rule) as part of Common Object
Header to allow a PCC to specify in a Path Computation Request
(PCReq) message sent to a PCE whether the object must be taken into
account by the PCE during path computation or is just optional. The
I flag (Ignore) is used by a PCE in a Path Computation Reply (PCRep)
message to indicate to a PCC whether or not an optional object was
processed. Stateful PCE [RFC8231] specified that P and I flags of
the PCEP objects defined in [RFC8231] is to be set to zero on
transmission and ignored on receipt since they are exclusively
related to path computation requests. The behavior for P and I flag
in other messages defined in [RFC5440] and other extension was not
specified. This document clarifies how the P and I flag could be
used in the stateful PCE model to identify optional objects in the
Path Computation State Report (PCRpt) [RFC8231], the Path Computation
Update Request (PCUpd) [RFC8231], and the LSP Initiate Request
(PCInitiate) [RFC8281] message.

This document updates [RFC8231] with respect to usage of P and I flag
as well as the handling of unknown objects in the stateful PCEP
message exchange.

1.1. 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.

2. Overview

[RFC5440] describes the handling on unknown objects as per the
setting of the P flag for the PCReq message. Further [RFC8231]
defined the usage of LSP Error Code TLV in PCRpt message in response
to failed LSP Update Request via PCUpd message (for example, due to
an unsupported object/TLV).

This document clarifies the procedure for marking some objects as
'optional to be processed' by the PCEP peer in the stateful PCEP
messages. Furthermore this document updates the procedure for
handling unknown objects in the stateful PCEP messages based on the P
flag.

2.1. Usage Example

   The PCRpt message is used to report the current state of an LSP. As
   part of the message both the <intended-attribute-list> and <actual-
   attribute-list> is encoded (see [RFC8231]). For example, the
   <intended-attribute-list> could include the METRIC object to indicate
   a limiting constraint (B flag set) for the Path Delay Variation
   metric [RFC8233]. In some scenarios it would be useful to state that
   this limiting constraint can be relaxed by the PCE in case it cannot
   find a path. Similarly in case of an association groups
   [I-D.ietf-pce-association-group] such as Disjoint Association
   [I-D.ietf-pce-association-diversity], the PCE may need to completely
   relax the disjointness constraint in order to provide a path to all
   the LSPs that are part of the association. In these case it would be
   useful to mark the objects as 'optional' and it could be ignored by
   the PCEP peer. Also it would be used for the PCEP speaker to learn
   if the PCEP peer has relaxed the constraint and ignored the
   processing of the PCEP object.

   Thus, this document simply clarifies, how the already existing P and
   I flag in the PCEP common object header could be used during the
   stateful PCEP message exchanges.

3. PCEP Extension

3.1. STATEFUL-PCE-CAPABILITY TLV

   A PCEP speaker indicates its ability to support for handling P and I
   flag during the stateful PCEP message exchanges during the PCEP
   initialization phase, as follows. When the PCEP session is created,
   it sends an Open message with an OPEN object that contains the
   STATEFUL-PCE-CAPABILITY TLV, as defined in [RFC8231]. A new flag,
   the R (RELAX) flag, is introduced to this TLV to indicate support for
   relaxing the processing of some objects via the use of P and I flag
   in the PCEP common object header.

   R (RELAX bit - TBD1): If set to 1 by a PCEP Speaker, the R flag
   indicates that the PCEP Speaker is willing to send and receive PCEP
   objects with handling of P and I flags in the PCEP common object
   header for stateful PCE messages. In case the bit is unset, it
   indicates that the PCEP Speaker would not handle P and I flags in the
   PCEP common object header for stateful PCE messages.

   The R flag MUST be set by both a PCC and a PCE to indicate support
   for handling of P and I flag in the PCEP common object header to
   allow relaxing some constraints by marking objects as optional to
   process. If the PCEP speaker that did not set R flag but receives

PCEP objects with P or I bit set, MUST behave as per the processing
rule in [RFC8231] i.e., the bits are simply ignored.

3.2. Handling of P flag

3.2.1. The PCRpt message

The P flag in the PCRpt message [RFC8231] allows a PCC to specify to
a PCE whether the object must be taken into account by the PCE
(during path computation or re-optimization) or is just optional.
When the P flag is set in PCRpt message received on a PCEP session on
which R bit was set by both peers, the object MUST be taken into
account by the PCE. Conversely, when the P flag is cleared, the
object is optional and the PCE is free to ignore it. The P flag for
the mandatory objects LSP and ERO (intended path) MUST be set in the
PCRpt message. If the mandatory object is received with the P flag
set incorrectly according to the rules stated above, the receiving
peer MUST send a PCErr message with Error-Type=10 (Reception of an
invalid object) and Error-value=1 (reception of an object with P flag
not set). By default, the PCC SHOULD set the P flag, unless a local
configuration or local policy indicates that some constraints
(corresponding PCEP objects) can be marked as optional and could be
ignored by the PCE.

3.2.2. The PCUpd message and the PCInitiate message

The P flag in the PCUpd message [RFC8231] and the PCInitiate message
[RFC8281] allows a PCE to specify to a PCC whether the object must be
taken into account by the PCC (during path setup) or is just
optional. When the P flag is set in PCUpd/PCInitiate message
received on a PCEP session on which R bit was set by both peers, the
object MUST be taken into account by the PCC. Conversely, when the P
flag is cleared, the object is optional and the PCC is free to ignore
it. The P flag for the mandatory objects SRP, LSP and ERO MUST be
set in the PCUpd/PCInitiate message. If the mandatory object is
received with the P flag set incorrectly according to the rules
stated above, the receiving peer MUST send a PCErr message with
Error-Type=10 (Reception of an invalid object) and Error-value=1
(reception of an object with P flag not set). By default, the PCE
SHOULD set the P flag, unless a local configuration or local policy
indicates that some constraints (corresponding PCEP objects) can be
marked as optional and could be ignored by the PCC.

3.3. Handling of I flag

3.3.1. The PCUpd message

   The I flag in the PCUpd message [RFC8231] allows a PCE to indicate to
   a PCC whether or not an optional object was processed. The PCE MAY
   include the ignored optional object in its update request and set the
   I flag to indicate that the optional object was ignored. When the I
   flag is cleared, the PCE indicates that the optional object was
   processed.

3.3.2. The PCRpt message

   The I flag in the PCRpt message [RFC8231] allows a PCC to indicate to
   a PCE whether or not an optional object was processed in response to
   an LSP Update Request (PCUpd) or LSP Initiate Request (PCInitiate).
   The PCC MAY include the ignored optional object in its report and set
   the I flag to indicate that the optional object was ignored at PCC.
   When the I flag is cleared, the PCC indicates that the optional
   object was processed. The I flag has no meaning if the PCRpt message
   is not in response to a PCUpd or PCInitiate message (i.e. without the
   SRP object in the PCRpt message).

3.3.3. The PCInitiate message

   The I flag has no meaning in the PCinitiate message [RFC8281] and is
   ignored.

3.4. Delegation

   Delegation is an operation to grant a PCE temporary rights to modify
   a subset of LSP parameters on one or more LSPs of a PCC as described
   in [RFC8051]. Note that for the delegated LSPs, the PCE can update
   and mark some object as ignored even when the PCC had set the P flag
   during delegation. Similarly, the PCE can update and mark some
   object as a must to process even when the PCC had not set the P flag
   during delegation.

   The PCC MUST acknowledge this by sending the PCRpt message with the P
   flag set as per the PCE expectation for the corresponding object. In
   case PCC cannot except this, it would react as per the processing
   rules of unacceptable update in [RFC8231].

3.5. Unknown Object Handling

   This document updates the handling of unknown objects in stateful
   PCEP messages as per the setting of P flag in the common object
   header in a similar way as [RFC5440], i.e. if a PCEP speaker does not
   understand an object with the P flag set or understands the object
   but decides to ignore the object, the entire stateful PCEP message

   MUST be rejected and the PCE MUST send a PCErr message with Error-
   Type="Unknown Object" or "Not supported Object" [RFC5440]. In case
   the P flag is not set, the PCEP speaker is free to ignore the object
   and continue with the message processing as defined.

   [RFC8231] defined LSP Error Code TLV to be carried in PCRpt message
   in the LSP object to convey error information. This document does
   not change that procedure.

4. Security Considerations

   This documents clarifies how the already existing P and I flag in
   PCEP common object header could be used during stateful PCEP
   exchanges. It updates the unknown object error handling in stateful
   PCEP message exchange. These changes on its own do not add any new
   security concerns. The security considerations identified in
   [RFC5440], [RFC8231], and [RFC8281].

   As per [RFC8231], it is RECOMMENDED that these PCEP extensions only
   be activated on authenticated and encrypted sessions across PCEs and
   PCCs belonging to the same administrative authority, using Transport
   Layer Security (TLS) [RFC8253] as per the recommendations and best
   current practices in [RFC7525] (unless explicitly set aside in
   [RFC8253]).

5. IANA Considerations

5.1. STATEFUL-PCE-CAPABILITY TLV

   [RFC8231] defines the STATEFUL-PCE-CAPABILITY TLV; per that RFC, IANA
   created a "STATEFUL-PCE-CAPABILITY TLV Flag Field" subregistry to
   manage the value of the STATEFUL-PCE-CAPABILITY TLV's Flag field.
   IANA is requested to allocate a new bit in the subregistry, as
   follows:

   Bit   Description   Reference

   TBD1   RELAX bit   [This-I.D.]

6. Manageability Considerations

6.1. Control of Function and Policy

   An operator MUST be allowed to configure the capability to support
   relaxation of constraints in the stateful PCEP message exchange.
   They SHOULD also allow configuration of related LSP constraints (or
   parameters) that are optional to process.

6.2. Information and Data Models

   An implementation SHOULD allow the operator to view the capability
   defined in this document. To serve this purpose, the PCEP YANG
   module [I-D.ietf-pce-pcep-yang] could be extended in future.

6.3. Liveness Detection and Monitoring

   Mechanisms defined in this document do not imply any new liveness
   detection and monitoring requirements in addition to those already
   listed in [RFC5440].

6.4. Verify Correct Operations

   Mechanisms defined in this document do not imply any new operation
   verification requirements in addition to those already listed in
   [RFC5440].

6.5. Requirements On Other Protocols

   Mechanisms defined in this document do not imply any new requirements
   on other protocols.

6.6. Impact On Network Operations

   Mechanisms defined in this document do not have any impact on network
   operations in addition to those already listed in [RFC5440].

7. Acknowledgments

   Thanks to Jonathan Hardwick for discussion and suggestions around
   this draft.

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8.1. Normative References

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