PCE WG
Internet-Draft
Intended status: Standards Track
Expires: March 29, 2021

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September 25, 2020

PCEP Procedures and Protocol Extensions for Using PCE as a Central Controller (PCECC) of BIER
draft-chen-pce-pcep-extension-pce-controller-bier-00

Abstract

This draft specify the procedures and PCEP protocol extensions for using the PCE as the central controller for BIER.

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 March 29, 2021.

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1. Introduction

[RFC8283]introduces the architecture for PCE as a central controller as an extension of the architecture described in[RFC4655] and assumes the continued use of PCEP as the protocol used between PCE and PCC. [RFC8283]further examines the motivations and applicability for PCEP as a Southbound Interface (SBI), and introduces the implications for the protocol.

[I-D.ietf-pce-pcep-extension-for-pce-controller]specify the procedures and PCEP protocol extensions for using the PCE as the central controller for static LSPs, where LSPs can be provisioned as explicit label instructions at each hop on the end-to-end path. Each router along the path must be told what label-forwarding instructions to program and what resources to reserve. The PCE-based controller keeps a view of the network and determines the paths of the end-to-end LSPs, and the controller uses PCEP to communicate with each router along the path of the end-to-end LSP.

[RFC8279] defines a Bit Index Explicit Replication (BIER) architecture where all intended multicast receivers are encoded as a bitmask in the multicast packet header within different encapsulations such as described in [RFC8296]. A router that receives such a packet will forward the packet based on the bit position in the packet header towards the receiver(s) following a precomputed tree for each of the bits in the packet. Each receiver is represented by a unique bit in the bitmask.

This document specifies the procedures and PCEP protocol extensions when a PCE-based controller is also responsible for configuring the forwarding actions on the routers (BIER information distribution in this case).

2. Conventions used in this document

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.

3. PCECC BIER Requirements

Following key requirements for PCECC-BIER should be considered when`designing the PCECC based solution:

- PCEP speaker supporting this draft needs to have the capability to advertise its PCECC-BIER capability to its peers.
- PCEP speaker not supporting this draft needs to be able to reject PCECC-BIER related message with a reason code that indicates no support for PCECC.
- PCEP procedures needs to provide a means to update (or cleanup) the BIER related informations (BIER subdomain-id, BFR-id and BSL etc) to the PCC.
- PCEP procedures needs to provide a means to synchronize the BIER related informations (BIER subdomain-id, BFR-id and BSL etc) between PCE to PCC in the PCEP messages.

4. Procedures for Using the PCE as the Central Controller (PCECC) in BIER

4.1. Stateful PCE Model

Active stateful PCE is described in [RFC8231]. PCE as a central controller (PCECC) reuses existing Active stateful PCE mechanism as much as possible to control the LSP.

4.2. New Functions

This document uses the same PCEP messages and its extensions which are described in [I-D.ietf-pce-pcep-extension-for-pce-controller]for PCECC-BIER as well.

PCEP messages PCRpt, PCInitiate, PCUpd are also used to send LSP Reports, LSP setup and LSP update respectively. The extended PCInitiate message described in [I-D.ietf-pce-pcep-extension-for-pce-controller] is used to download or cleanup central controller's instructions (CCIs) (BIER related informations in scope of this document). The extended PCRpt message described in [I-D.ietf-pce-pcep-extension-for-pce-controller] is also used to report the CCIs (BIER related informations) from PCC to PCE.

[I-D.ietf-pce-pcep-extension-for-pce-controller]specify an object called CCI for the encoding of central controller's instructions.This document extends the CCI by defining another object-type for BIER.

4.3. PCECC Capability Advertisement

During PCEP Initialization Phase, PCEP Speakers (PCE or PCC) advertise their support of PCECC extensions. A PCEP Speaker includes the "PCECC Capability" sub-TLV, described in [I-D.ietf-pce-pcep-extension-for-pce-controller].

This document adds B-bit in PCECC-CAPABILITY sub-TLV for BIER.

4.4. BIER Path Operations

The PCEP messages pertaining to PCECC-BIER MUST include PATH-SETUP-TYPE TLV [RFC8408] with PST=TBD in the SRP object to clearly identify the PCECC-BIER LSP is intended.

4.4.1. PCECC Bit Index Explicit Replication (BIER)

BIER as described in [RFC8402] defines an architecture where all intended multicast receivers are encoded as a bitmask in the multicast packet header within different encapsulations such as described in [RFC8296].

[RFC8401] defines IS-IS extensions to distribute the BIER information(BIER subdomain-id, BFR-id and BSL etc).This document proposes a new mechanism where PCE allocates centrally and uses PCEP to advertise the BIER information(BIER subdomain-id, BFR-id and BSL etc). In some deployments PCE (and PCEP) are better suited than IGP because of centralized nature of PCE and direct TCP based PCEP session to the node.

4.4.1.1. PCECC BIER information allocation

Each node (PCC) is allocated BIER information by the PCECC.The BIER information mainly includes BIER subdomain-id, BFR-id, BSL, BFR prefix, BSL, Encapsulation Type, BIFT ID,Max SI and BFR nexthop.

The PCECC allocate the BIER subdomain-id, BFR-id , BFR prefix, BSL, Encapsulation Type, BIFT ID, and Max SI to the PCC, On receiving the BIER information allocation, each node (PCC) uses IGP protocol to distribute BIER related information to other nodes. The node calculate the nexthop.

4.4.1.2. Redundant PCEs

[I-D.litkowski-pce-state-sync] describes synchronization mechanism between the stateful PCEs. The BIER informations allocated by a PCE MUST also be synchronized among PCEs for PCECC BIER state synchronization.

4.4.1.3. Re Delegation and Cleanup

[I-D.ietf-pce-pcep-extension-for-pce-controller] describes the action needed for CCIs for the Basic PCECC LSP on this terminated session.Similarly actions should be applied for the BIER information as well.

4.4.1.4. Synchronization of BIER information Allocations

[I-D.ietf-pce-pcep-extension-for-pce-controller]describes the synchronization of Central Controller's Instructions (CCI) via LSP state synchronization as described in [RFC8231] and [RFC8232].Same procedures should be applied for BIER information as well.

4.5. PCEP messages

4.5.1. The OPEN Object

4.5.1.1. PCECC Capability sub-TLV

[I-D.ietf-pce-pcep-extension-for-pce-controller] defined the PCECCCAPABILITY TLV. A new B-bit is defined in PCECC-CAPABILITY sub-TLV for PCECC-BIER:

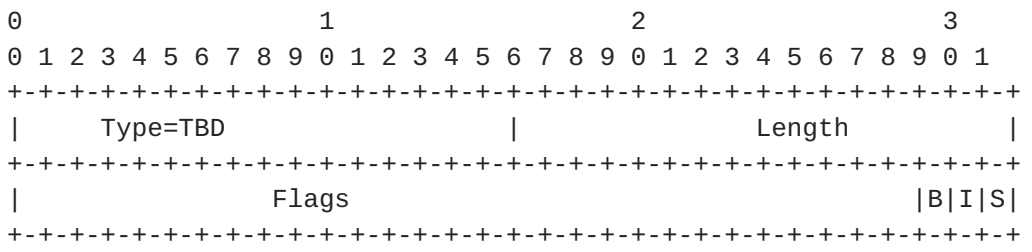

Figure 1

B (PCECC-BIER-CAPABILITY - 1 bit): If set to 1 by a PCEP speaker, it indicates that the PCEP speaker is capable for PCECC-BIER capability and PCE would allocate BIER information on this session.

4.5.2. PATH-SETUP-TYPE TLV

The PATH-SETUP-TYPE TLV is defined in [RFC8408]. PST = TBD is used when Path is setup via PCECC BIER mode.On a PCRpt/PCUpd/PCInitiate message, the PST=TBD indicates that this path was setup via a PCECC-BIER based mechanism where either the BIER informations were allocated/instructed by PCE via PCECC mechanism.

4.5.3. CCI object

The Central Control Instructions (CCI) Object is used by the PCE to specify the forwarding instructions is defined in [I-D.ietf-pce-pcep-extension-for-pce-controller]. This document defines another object-type for BIER purpose.

CCI Object-Type is TBD for BIER as below

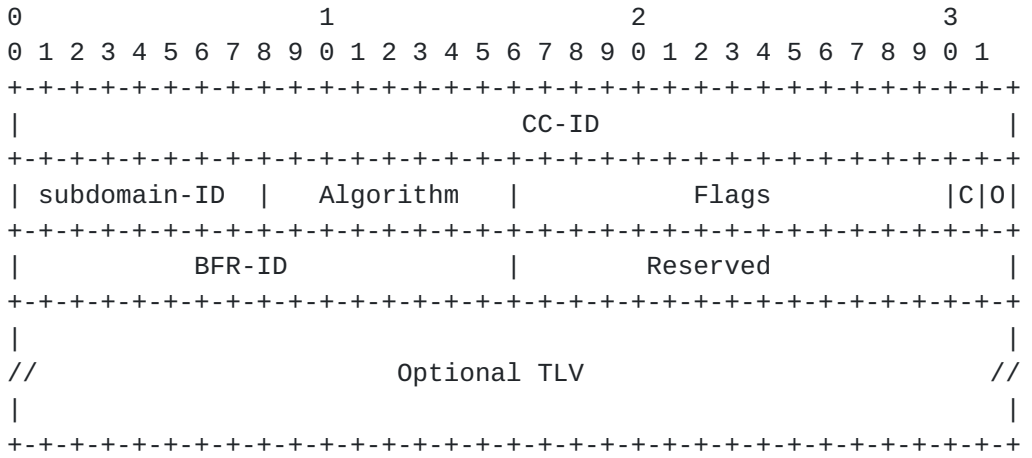

Figure 2

The field CC-ID is as described in [I-D.ietf-pce-pcep-extension-for-pce-controller].

BIER subdomain-ID: Unique value identifying the BIER subdomain. (as defined in [RFC8401].

The 0 and C bit was defined in [I-D.ietf-pce-pcep-extension-for-pce-controller].

BFR-ID: A 2-octet field encoding the BFR-id, as documented in [RFC8279].

Optional TLV: There are two optional TLV are defined in this draft.

4.5.3.1. BIER Encapsulation Sub TLV

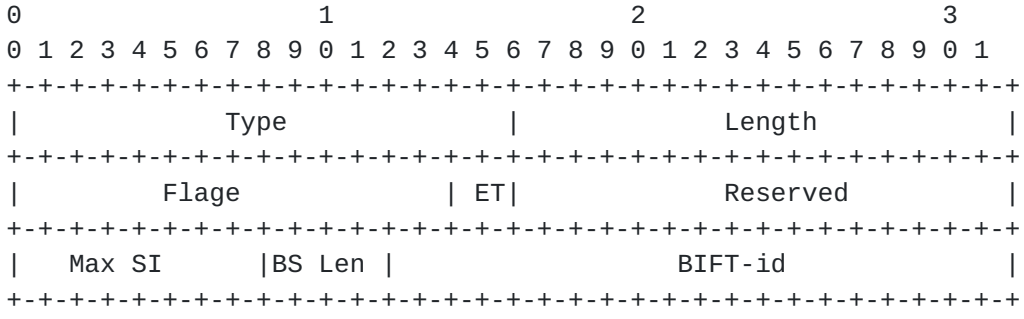

Figure 3

The code point for the TLV type is to be defined by IANA.

Length:4

ET-Flag:ET(Encapsulation type) Flag,There are two Encapsulation Types:

- 0b00-MPLS encapsulation.
- 0b01-Non-MPLS encapsulation.

Max SI: A 1 octet field encoding the Maximum Set Identifier(Section 1 of [RFC8279]) used in the encapsulation for this BIER subdomain for this BitString length.

Local BitString Length (BS Len): Encoded BitString length as per [RFC8296].

BIFT-id: A 20 bit field encoding the first BIFT-id of the BIFT-id range.

4.5.4. FEC Object

BIER information is always associated with a host prefix, so we reuse FEC Object 1'IPv4 Node ID' and FEC Object-Type 2 'IPv6 Node ID' defined in [I-D.zhao-pce-pcep-extension-pce-controller-sr] to carry the BFR prefix.

5. Security Considerations

TBD.

6. IANA Considerations

TBD.

7. Contributors

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8. Acknowledgements

TBD.

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