PCE Working Group
Internet-Draft
Intended status: Standards Track
Expires: February 19, 2021

A. Wang
China Telecom
B. Khasanov
S. Fang
Huawei
C. Zhu
ZTE Corporation

August 18, 2020

PCEP Extension for Native IP Network
draft-ietf-pce-pcep-extension-native-ip-06

Abstract

This document defines the Path Computation Element Communication Protocol (PCEP) extension for Central Control Dynamic Routing (CCDR) based application in Native IP network. The scenario and framework of CCDR in native IP is described in [RFC8735] and [I-D.ietf-teas-pce-native-ip]. This draft describes the key information that is transferred between Path Computation Element (PCE) and Path Computation Clients (PCC) to accomplish the End to End (E2E) traffic assurance in Native IP network under central control mode.

Table of Contents

1. Introduction

Traditionally, Multiprotocol Label Switching Traffic Engineering (MPLS-TE) traffic assurance requires the corresponding network devices support Multiprotocol Label Switching (MPLS) or the complex Resource ReSerVation Protocol (RSVP)/Label Distribution Protocol (LDP) /Segment Routing etc. technologies to assure the End-to-End (E2E) traffic performance. But in native IP network, there will be no such signaling protocol to synchronize the action among different network devices. It is necessary to use the central control mode that described in [RFC8283] to correlate the forwarding behavior among different network devices. Draft [I-D.ietf-teas-pce-native-ip] describes the architecture and solution philosophy for the E2E traffic assurance in Native IP network via Dual/Multi Border Gateway Protocol (BGP) solution. This draft describes the corresponding Path Computation Element Communication Protocol (PCEP) extensions to transfer the key information about peer address list, peer prefix association and the explicit peer route on on-path router.

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 RFC 2119 [RFC2119].

3. Terminology

.This document uses the following terms defined in [RFC5440]: PCE, PCEP

The following terms are defined in this document:

- CCDR: Central Control Dynamic Routing
- E2E: End to End
- EPR: Explicit Peer Route
- PAL: Peer Address List
- PPA: Peer Prefix Association
- QoS: Quality of Service

4. New Objects Extension

Three new objects are defined in this draft:

- PAL Object: Peer Address List Object, used to tell the network device which peer it should be peered with dynamically.
- PPA Object: Peer Prefix Association Object, used to tell which prefixes should be advertised via the corresponding peer.
- EPR Object: Explicit Peer Route object, used to point out which route should be taken into to arrive to the peer.

5. Objects Formats

Each extension object takes the similar format, that is to say, it began with the common object header defined in [RFC5440] as the following:

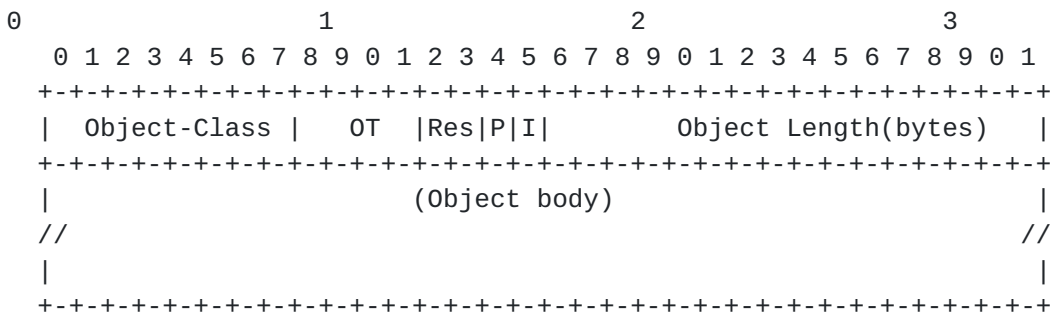

Figure 1: PCEP Object Format

Different object-class, object type and the corresponding object body is defined separately in the following section .

5.1. Peer Address List Object

The Peer Address List object is used in a PCE Initiate message [RFC8281] defined to specify the IP address of peer that the received network device should establish the BGP relationship with. This Object should only be included and sent to the head and end router of the E2E path in case there is no Route Reflection (RR) involved. If the RR is used between the head and end routers, then such information should be sent to head router, RR and end router respectively.

Peer Address List Object-Class is TBD

Peer Address List Object-Type is 1 for IPv4 and 2 for IPv6

The format of the Peer Address List object body for IPv4(Object-Type=1) is as follows:

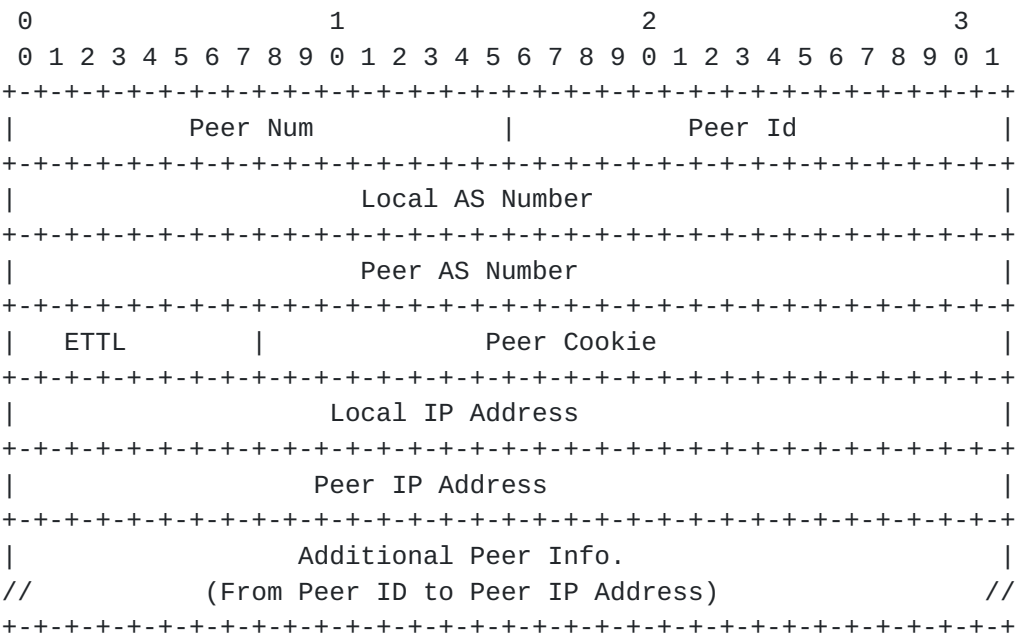

Figure 2: Peer Address List Object Body Format for IPv4

The format of the Peer Address List object body for IPv6(Object-Type=2) is as follows:

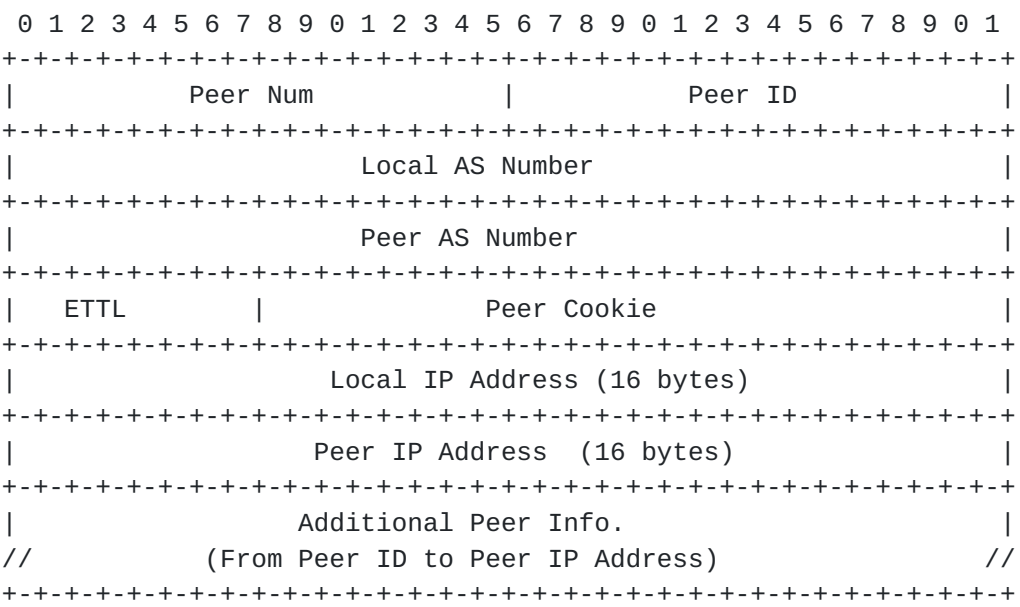

Figure 3: Peer Address List Object Body Format for IPv6

Peer Num : 2 Bytes, Peer Address Number on the advertised router.

Peer-ID: 2 Bytes, to distinguish the different peer pair, will be referenced in Peer Prefix Association, if the PCE use multi-BGP solution for different QoS assurance requirement.

Local AS Number: 4 Bytes, to indicate the AS number of the Local Peer.

Peer AS Number: 4 Bytes, to indicate the AS number of Remote Peer.

ETTL: 1 Bytes, to indicate the multi hop count for EBGP session. It should be 0 and ignored when Local AS and Peer AS is same.

Peer Cookie: Used for establishing the secure BGP session between two peers. The PCEP client should use the MD5 algorithm to generate the encrypted message.

Local IP Address(4/16 Bytes): IP address of the local router, used to peer with other end router. When Object-Type is 1, length is 4 bytes; when Object-Type is 2, length is 16 bytes.

Peer IP Address(4/16 Bytes): IP address of the peer router, used to peer with the local router. When Object-Type is 1, length is 4 bytes; when Object-Type is 2, length is 16 bytes;

5.2. Peer Prefix Association Object

The Peer Prefix Association object is defined to specify the IP prefixes that should be advertised by the corresponding Peer. This object should only be included and sent to the head/end router of the end2end path in case there is no RR involved. If the RR is used between the head and end routers, then such information should be sent to head router,RR and end router respectively.

Peer Prefix Association Object-Class is TBD

Peer Prefix Association Object-Type is 1 for IPv4 and 2 for IPv6

The format of the Peer Prefix Association object body is as follows:

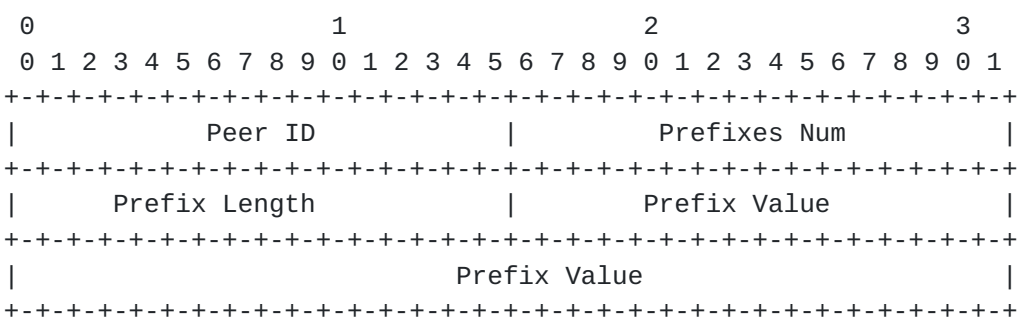

Figure 4: Peer Prefix Association Object Body Format

Peer-ID: 2 Bytes, to indicate which peer should be used to advertise the following IP Prefix TLV. This value is assigned in the Peer Address List object and is referred in this object.

Prefixes Num: 2 Bytes, number of prefixes that advertised by the corresponding Peer. It should be equal to number of the following IP prefix sub TLV.

Prefix Length: 2 Bytes, the prefix length. For example, for 10.0.0.0/8, this field will be equal to 8; for 2001:DB8::/32, this field will be equal to 32.

Prefix Value: Variable length, the value of the prefix. For example, for 10.0.0.0/8, this field will be 10.0.0.0; for 2001:DB8::/32, this field will be equal to 2001:DB8::.

5.3. Explicit Peer Route Object

The Explicit Peer Route object is defined to specify the explicit peer route to the corresponding peer address on each device that is on the E2E assurance path. This Object should be sent to all the devices that locates on the E2E assurance path that calculated by PCE.

Explicit Peer Route Object-Class is TBD.

Explicit Peer Route Object-Type is 1 for IPv4 and 2 for IPv6

The format of Explicit Peer Route object body for IPv4(Object-Type=1) is as follows:

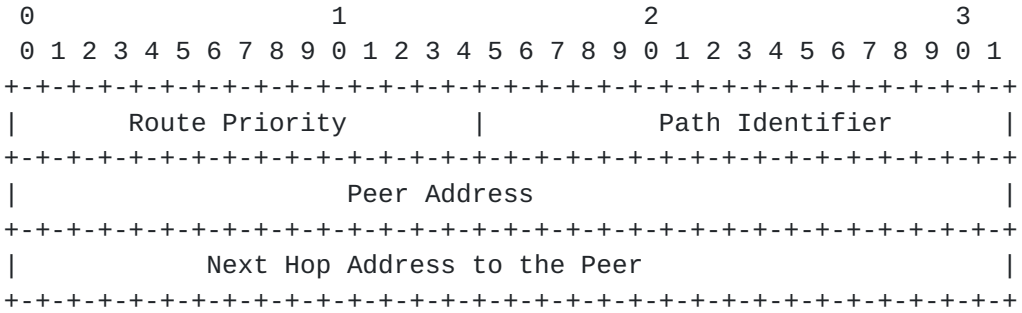

Figure 6: Explicit Peer Route Object Body Format for IPv4

The format of Explicit Peer Route object body for IPv6(Object-Type=2) is as follows:

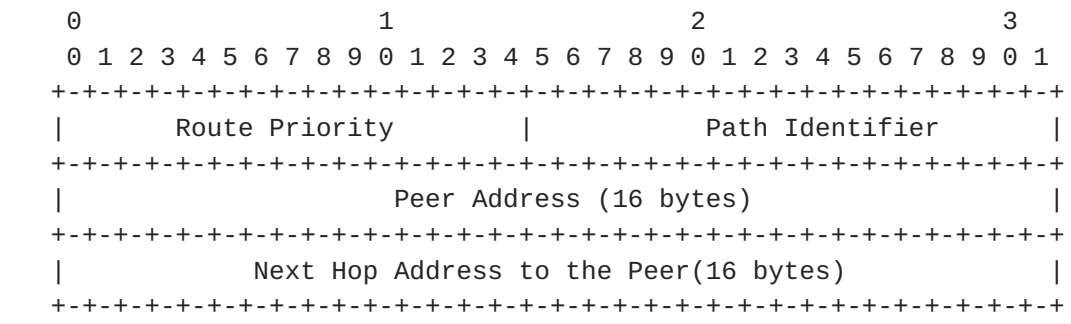

Figure 6: Explicit Peer Route Object Body Format for IPv4

Route Priority: 2 Bytes, The priority of this explicit route. The higher priority should be preferred by the device.

Path Identifier: To indicate the path to peer address, especially for the same peer.

Peer Address: To indicate the peer address.

Next Hop Address to the Peer: To indicate the next hop address to the corresponding peer.

6. Management Consideration

The information transferred in this draft is mainly used for the light weight BGP session setup, the prefix distribution and the explicit route deployment. The planning, allocation and distribution of the peer addresses within IGP should be accomplished in advanced and they are out of the scope of this draft.

7. Security Considerations

Service provider should consider the protection of PCE and their communication with the underlay devices, which is described in document [RFC5440] and [RFC8253]

8. IANA Considerations

8.1. PCEP Object Types

IANA is requested to allocate new registry for the PCEP Object Type:

Object-Type Value	Name	Reference
TBD	Peer Address List Object-Type 1: IPv4 address 2: IPv6 address	This document
TBD	Peer Prefix Association Object-Type 1: IPv4 address 2: IPv6 address	This document
TBD	Explicit Peer Route Object-Type 1: IPv4 address 2: IPv6 address	This document

9. Acknowledgement

Thanks Dhruv Dhody for his valuable suggestions and comments.

10. Normative References

[I-D.ietf-teas-pce-native-ip]
Wang, A., Khasanov, B., Zhao, Q., and H. Chen, "PCE in Native IP Network", draft-ietf-teas-pce-native-ip-10 (work in progress), August 2020.

[RFC5440] Vasseur, JP., Ed. and JL. Le Roux, Ed., "Path Computation Element (PCE) Communication Protocol (PCEP)", RFC 5440, DOI 10.17487/RFC5440, March 2009, <https://www.rfc-editor.org/info/rfc5440>.

[RFC8253] Lopez, D., Gonzalez de Dios, O., Wu, Q., and D. Dhody, "PCEPS: Usage of TLS to Provide a Secure Transport for the Path Computation Element Communication Protocol (PCEP)", RFC 8253, DOI 10.17487/RFC8253, October 2017, <https://www.rfc-editor.org/info/rfc8253>.

[RFC8281] Crabbe, E., Minei, I., Sivabalan, S., and R. Varga, "Path Computation Element Communication Protocol (PCEP) Extensions for PCE-Initiated LSP Setup in a Stateful PCE Model", RFC 8281, DOI 10.17487/RFC8281, December 2017, <https://www.rfc-editor.org/info/rfc8281>.

[RFC8283] Farrel, A., Ed., Zhao, Q., Ed., Li, Z., and C. Zhou, "An Architecture for Use of PCE and the PCE Communication Protocol (PCEP) in a Network with Central Control", RFC 8283, DOI 10.17487/RFC8283, December 2017, <https://www.rfc-editor.org/info/rfc8283>.

[RFC8735] Wang, A., Huang, X., Kou, C., Li, Z., and P. Mi, "Scenarios and Simulation Results of PCE in a Native IP Network", RFC 8735, DOI 10.17487/RFC8735, February 2020, <https://www.rfc-editor.org/info/rfc8735>.

Authors' Addresses

Aijun Wang
China Telecom
Beiqijia Town, Changping District
Beijing, Beijing 102209
China

Email: wangaj3@chinatelecom.cn

Boris Khasanov
Huawei Technologies,Co.,Ltd
Moskovskiy Prospekt 97A
St.Petersburg 196084
Russia

Email: khasanov.boris@huawei.com

Sheng Fang
Huawei Technologies, Co.,
Ltd
Huawei Bld., No.156 Beiqing Rd.
Beijing
China

Email: fsheng@huawei.com

Chun Zhu
ZTE Corporation
50 Software Avenue, Yuhua District
Nanjing, Jiangsu 210012
China

Email: zhu.chun1@zte.com.cn