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PCEP Extension for Native IP Network
draft-ietf-pce-pcep-extension-native-ip-03

Abstract

This document defines the PCEP extension for CCDR application in Native IP network. The scenario and architecture of CCDR in native IP is described in [I-D.ietf-teas-native-ip-scenarios] and [I-D.ietf-teas-pce-native-ip]. This draft describes the key information that is transferred between PCE and PCC to accomplish the end2end traffic assurance in Native IP network under central control mode.

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1. Introduction

Traditionally, MPLS-TE traffic assurance requires the corresponding network devices support MPLS or the complex RSVP/LDP/Segment Routing etc. technologies to assure the end-to-end 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 end2end traffic assurance in Native IP network via Dual/Multi BGP solution. This draft describes the corresponding 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. CCI Objects

Draft [I-D.ietf-pce-pcep-extension-for-pce-controller] introduces the CCI object which is included in the PCInitiate and PCRpt message to transfer the centrally control instruction and status between PCE and PCC. This object is extended to include the construction for native IP solution. Additional TLVs are defined and included in this extended CCI object.

CCI Object-Class is TBD, should be same as that defined in draft [I-D.ietf-pce-pcep-extension-for-pce-controller]

CCI Object-Type is TBD for Native IP network

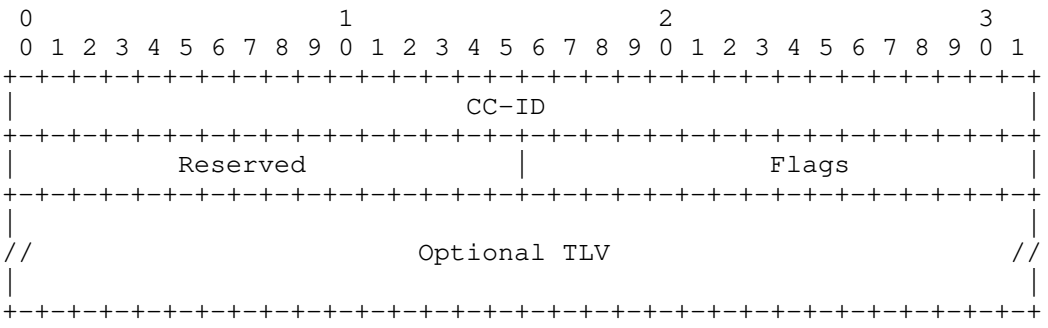

Figure 1: CCI Object Format

The fields in the CCI object are as follows:

CC-ID: A PCEP-specific identifier for the CCI information. A PCE creates an CC-ID for each instruction, the value is unique within the scope of the PCE and is constant for the lifetime of a PCEP session. The values 0 and 0xFFFFFFFF are reserved and MUST NOT be used.

Flags: Is used to carry any additional information pertaining to the CCI.

Optional TLV: Additional TLVs that are associated with the Native IP construction.

4. CCI Object associated TLV

Three new TLVs are defined in this draft:

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

4.1. Peer Address List TLV

The Peer Address List TLV is defined to specify the IP address of peer that the received network device should establish the BGP relationship with. This TLV should only be included and sent to the head and 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.

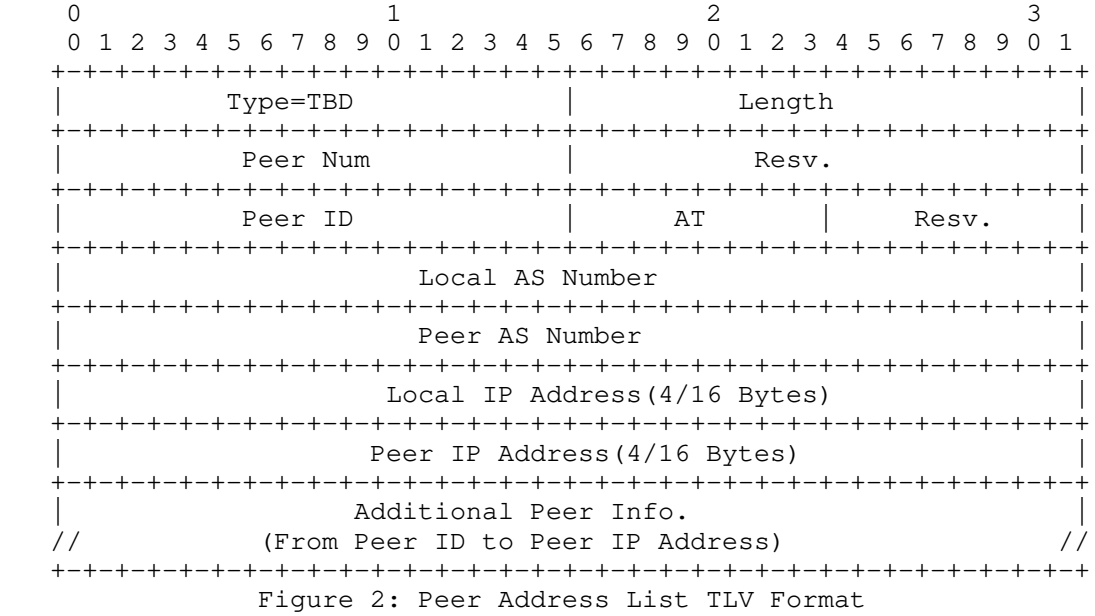

Figure 2: Peer Address List TLV Format

Type: 2 Bytes, value is TBD.

Length: 2 Bytes, the length of the following fields.

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.

AT: 1 Bytes, Address Type. To indicate the address type of Peer. Equal to 4, if the following IP address of peer is belong to IPv4; Equal to 6 if the following IP address of peer is belong to IPv6.

Resv: 1 Bytes, Reserved for future use.

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.

Local IP Address(4/16 Bytes): IPv4 address of the local router, used to peer with other end router. When AT equal to 4, length is 32bit; when AT equal to 16, length is 128bit.

Peer IP Address(4/16 Bytes): IPv4 address of the peer router, used to peer with the local router. When AT equal to 4, length is 32bit; IPv6 address of the peer when AT equal to 16, length is 128bit;

4.2. Peer Prefix Association TLV

The Peer Prefix Association TLV is defined to specify the IP prefixes that should be advertised by the corresponding Peer. This TLV 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.

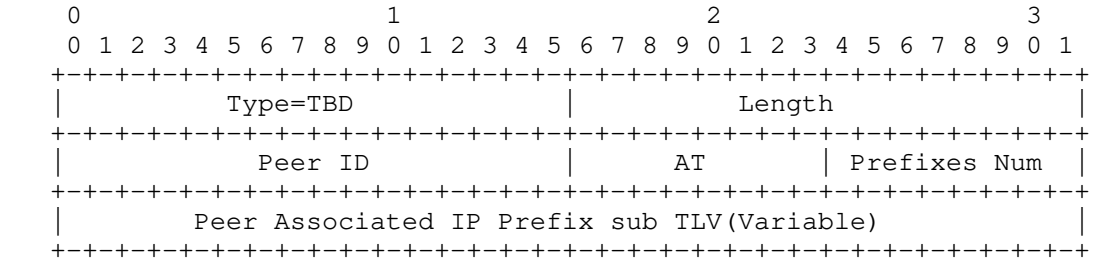

Figure 3: Peer Prefix Association TLV Format

Type: 2 Bytes, value is TBD

Length: 2 Bytes, the length of the following fields.

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.

AT: 2 Bytes, Address Type. To indicate the address type of Peer. Equal to 4, if the following IP address of peer is belong to IPv4; Equal to 6 if the following IP address of peer is belong to IPv6.

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.

Peer Associated IP Prefix sub TLV: Variable Length, indicate the advertised IP Prefix.

4.2.1. Prefix sub TLV

Prefix sub TLV is used to carry the prefix information, which has the following format:

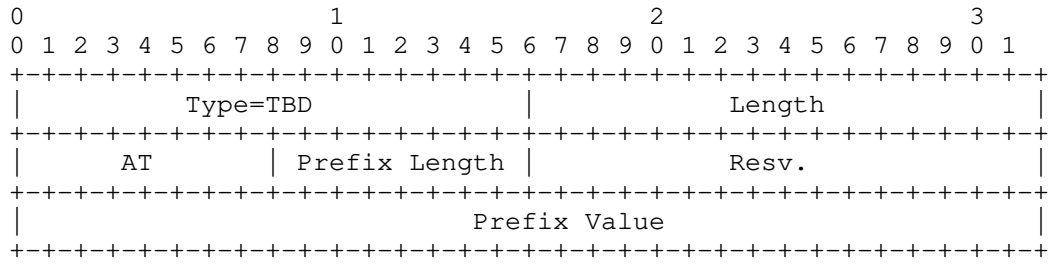

Figure 4: Prefix sub TLV Format

Type: 2 Bytes, value is TBD

Length: 2 Bytes, the length of the following fields.

AT: 1 Byte, Address Type. To indicate the address type of Peer. Equal to 4, if the following "Prefix address" belong to IPv4; Equal to 6 if the following "Prefix address" belong to IPv6.

Prefix Length: 1 Byte, the length of the following prefix. For example, for 10.0.0.0/8, this field will be equal to 8.

Prefix Value: Variable length, the value of the prefix. For example, for 10.0.0./8, this field will be 10.0.0.0

4.3. Explicit Peer Route TLV

The Explicit Peer Route TLV is defined to specify the explicit peer route to the corresponding peer address on each device that is on the end2end assurance path. This TLV should be sent to all the devices that locates on the end2end assurance path that calculated by PCE.

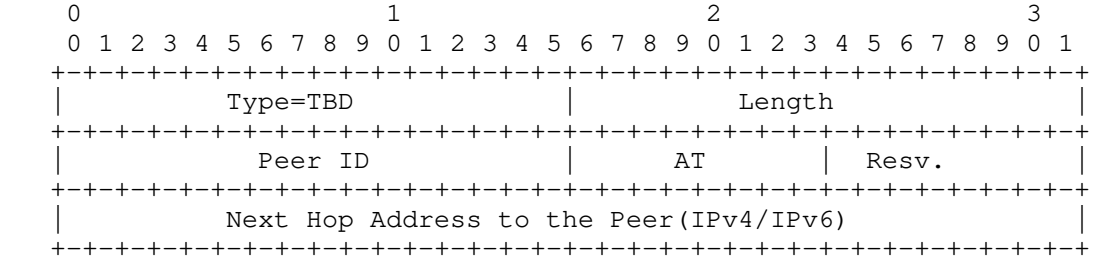

Figure 5: Explicit Peer Route TLV

Type: 2 Bytes, value is TBD

Length: 2 Bytes, the length of following fields.

Peer-ID: 2 Bytes, to indicate the peer that the following next hop address point to. This value is assigned in the Peer Address List object and is referred in this object.

AT: 1 Byte, Address Type. To indicate the address type of explicit peer route. Equal to 4, if the following next hop address to the peer belongs to IPv4; Equal to 6 if the following next hop address to the peer belongs to IPv6.

Resv.: 1 Byte, reservation for future use.

Next Hop Address to the Peer: Variable Length, to indicate the next hop address to the corresponding peer that indicated by the Peer-ID. If AT=4, the length will be 4 bytes, if AT=6, the length will be 16 bytes.

5. Management Consideration

TBD

6. Security Considerations

TBD

7. IANA Considerations

7.1. CCI Object Type

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

Object-Type Value	CCI Object Name	Reference
3	Native IP	This document

7.2. CCI Object Associated TLV

IANA is requested to confirm the early allocation of the following TLV Type Indicator values within the "PCEP TLV Type Indicator" sub-registry of the PCEP Numbers registry, and to update the reference in the registry to point to this document, when it is an RFC:

Value	Meaning	Reference
TBD	Peer Address List TLV	This document
TBD	Peer Prefix Association TLV	This document
TBD	Explicit Peer Route TLV	This document
TBD	Prefix sub TLV	This document

8. Acknowledgement

Thanks Dhruv Dhody for his valuable suggestions and comments.

9. Normative References

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Zhao, Q., Li, Z., Negi, M., and C. Zhou, "PCEP Procedures and Protocol Extensions for Using PCE as a Central Controller (PCECC) of LSPs", draft-ietf-pce-pcep-extension-for-pce-controller-01 (work in progress), February 2019.

[I-D.ietf-teas-native-ip-scenarios]
Wang, A., Huang, X., Qou, C., Li, Z., and P. Mi, "Scenario, Simulation and Suggestion of PCE in Native IP Network", draft-ietf-teas-native-ip-scenarios-02 (work in progress), October 2018.

[I-D.ietf-teas-pce-native-ip]
Wang, A., Zhao, Q., Khasanov, B., Chen, H., and R. Mallya, "PCE in Native IP Network", draft-ietf-teas-pce-native-ip-02 (work in progress), October 2018.

[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>.

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