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.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at https://datatracker.ietf.org/drafts/current/.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on May 20, 2019.

Copyright Notice

Copyright (c) 2018 IETF Trust and the persons identified as the document authors. All rights reserved.
This document is subject to BCP 78 and the IETF Trust’s Legal Provisions Relating to IETF Documents (https://trustee.ietf.org/license-info) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Simplified BSD License text as described in Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Simplified BSD License.

Table of Contents

1. Introduction ............................................. 2
2. Conventions used in this document ......................... 2
3. CCI Objects .............................................. 3
4. CCI Object associated TLV ................................. 3
   4.1. Peer Address List TLV ............................... 4
   4.2. Peer Prefix Association TLV ......................... 5
       4.2.1. Prefix sub TLV .................................. 6
   4.3. Explicit Peer Route TLV ............................. 6
5. Management Consideration ................................ 7
6. Security Considerations .................................. 7
7. IANA Considerations ..................................... 7
8. Normative References .................................... 7
Authors’ Addresses ......................................... 8

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 extension 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. Additionally TLVs are defined and included in this extend 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

<table>
<thead>
<tr>
<th>0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>+------------------------------------------</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

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
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.

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>9</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

```
| Type=TBD | Length               |
+----------+---------------------|
| Peer Num | Resv.               |
+----------+---------------------|
| Peer ID  | AT      | Resv.               |
+----------+---------+---------------------|
| Local AS Number                          |
| Peer AS Number                           |
| Local IP Address(4/16 Bytes)             |
| Peer IP Address(4/16 Bytes)              |
+----------+---------+---------------------|
| Peer ID  | AT      | Resv.               |
+----------+---------+---------------------|
| Local AS Number                          |
| Peer AS Number                           |
| Local IP Address(4/16 Bytes)             |
| Peer IP Address(4/16 Bytes)              |
```

Type: TBD

Length: The length of the following fields.

Peer Num: Peer Address Number on the advertised router.

Peer-ID: 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: 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: Reserved for future use.

Local AS Number: To indicate the AS number of the Local Peer.

Peer AS Number: 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.

```
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|          Type=TBD             |          Length               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|            Peer ID            |      AT       | Prefixes Num  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                Peer Associated IP Prefix sub TLV              |
|                Peer Associated IP Prefix sub TLV              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Type: TBD

Length: The length of the following fields.

Peer-ID: 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: 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: 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:

```
  0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|          Type=TBD             |            Length             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|      AT       | Prefix Length |            Resv.              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                            Prefix Value                       |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Type: TBD

Length: The length of the following fields.

AT: 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.

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

Prefix Value: The value of the prefix. For example, for 10.0.0.0/8, 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.
Type: TBD

Length: The length of following fields.

Peer-ID: 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: Address Type. To indicate the address type of explicit peer route. Equal to 4, if the following next hop address to the peer is belong to IPv4; Equal to 6 if the following next hop address to the peer is belong to IPv6. Resv(16 bits): Reserved 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
TBD

8. Normative References

[I-D.ietf-pce-pcep-extension-for-pce-controller]
[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,

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,

Authors’ Addresses

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

Email: wangaj.bri@chinatelecom.cn

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

Email: khasanov.boris@huawei.com
Sudhir Cheruathur  
Juniper Networks  
1133 Innovation Way  
Sunnyvale, California 94089  
USA  
Email: scheruathur@juniper.net

Chun Zhu  
ZTE Corporation  
50 Software Avenue, Yuhua District  
Nanjing, Jiangsu 210012  
China  
Email: zhu.chun1@zte.com.cn

Sheng Fang  
Huawei Technologies, Co., Ltd  
Huawei Bld., No.156 Beiqing Rd.  
Beijing  
China  
Email: fsheng@huawei.com