Hierarchical PCE Discovery

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Introduction

• Hierarchical PCE Architecture in RFC 6805

• Extensions to PCEP for
  ➢ Parent to obtain info about its child PCEs (ID, Domain, Position)
  ➢ Child PCE to get info about its parent (ID of parent, )
Message Extensions and Discovery Procedures

Message Extensions:

- **Open Message**
  
  New H-PCE Cap TLV in OPEN Object of **Open Message**

- **Notification (PCNtf) Message**
  
  New H-PCE Cap TLV in NOTIFICATION Object

Discovery Procedures:

- **Using Open messages in Initialization phase**
  
  - If session exists already, bring it down and then up. Thus procedure is triggered in Initialization phase

- **Using Notification (PCNtf) messages over existing session**
  
  - The existing session is not interrupted
H-PCE Capability TLV

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<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<tr>
<td>0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1</td>
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<td></td>
<td>Type = TBD1</td>
<td>Length</td>
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<td></td>
<td>P</td>
<td>C</td>
<td>Capability Flags</td>
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<td>Optional Sub-TLVs</td>
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- **P** (Parent - 1 bit): It is set to 1 indicating a parent.
- **C** (Child - 1 bit): It is set to 1 indicating a child.

Sub-TLVs for

- Domain Sub-TLV for a domain (child responsible)
- PCE ID Sub-TLV for ID of PCE
- PCE IPv4/IPv6 Address Sub-TLV (for ID of PCE)
New Sub-TLVs

Domain Sub-TLV:

```
+-----------------+-----------+-----------------+-----------
| Type (stTBD1)   |          | Length           |
| +-----------------+-----------+-----------------+-----------
| AS Number (4 bytes) |          |
~                     |          |
+-----------------+-----------+-----------------+-----------
```

PCE ID Sub-TLV:

```
+-----------------+-----------+-----------------+-----------
| Type (stTBD3)   |          | Length (4)       |
| +-----------------+-----------+-----------------+-----------
| PCE ID (4 bytes) |          |
+-----------------+-----------+-----------------+-----------
```

PCE IPv4 Address Sub-TLV:

```
+-----------------+-----------+-----------------+-----------
| Type (stTBD4)   |          | Length (4)       |
| +-----------------+-----------+-----------------+-----------
| I Pv4 Address (4 bytes) |          |
+-----------------+-----------+-----------------+-----------
```

PCE IPv6 Address Sub-TLV:

```
+-----------------+-----------+-----------------+-----------
| Type (stTBD5)   |          | Length (16)      |
| +-----------------+-----------+-----------------+-----------
| I Pv6 Address (16 bytes) |          |
~                     |          |
+-----------------+-----------+-----------------+-----------
```
• Using Open Messages with capability TLV
  – flag P: Parent PCE, flag C: Child PCE

- An example sequence of events for H-PCE discovery during initialization

PCE A -> PCE B

A sends B a Open message with P=1 and A's ID

B is configured as Child

Receive Open from B:
Remote B is Child and is same as configured,
Form Parent-Child relation (B is A's child) and obtain child B's ID and B's domain

Open (P=1, A’s ID)

B sends A a Open message with C=1, B's ID and B's domain

A is configured as Parent

Receive Open from A:
Remote A is Parent and is same as configured,
Form Child-Parent relation (A is B's parent) and obtain parent A's ID

Open (C=1, B’s ID, B’s Domain)
New Notification-type/value (NT/NV)

NT=5 (TBD): Discovery of H-PCE
NV=1: The information about a parent PCE or a child PCE
NT=5 and NV=1 indicates that the PCE sends its remote the information about it and a TLV containing the information is in NOTIFICATION object. The format and contents of the TLV is the same as the H-PCE capability TLV described above. The only difference may be the type of the TLV.

The format of the NOTIFICATION body object:

```
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 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|   Reserved    |     Flags     |     NT (5)    |     NV (1)    |
|               |               |               |               |
|~  Optional TLVs |               |               |               |
|               |               |               |               |
|               |               |               |               |
```

TLV: H-PCE capability TLV equivalent
Discovery Procedures – Notification Message

- Using Notification (PCNtf) Messages with capability TLV over existing PCEP session between two PCEs
  - An example sequence of events for H-PCE discovery over existing session

```
Configure B as Child

Configure A as Parent

A sends B a PCNtf with P=1 and A’s ID after B is configured as its child

Receive PCNtf from B: Remote B is Child and is same as configured, Form Parent-Child relation (B is A’s child) and obtain child B’s ID and B’s domain

PCNtf (P=1, A’s ID)

PCNtf (C=1, B’s ID, B’s Domain)

B sends A a PCNtf with C=1, B’s ID and B’s domain after A is configured as its parent

Receive PCNtf from A: Remote A is Parent and is same as configured, Form Child-Parent relation (A is B’s parent) and obtain parent A’s ID
```
Summary

Presented

• **Message Extensions**
  - New H-PCE Cap TLV in OPEN Object of **Open Message**
  - New NT, NV, and H-PCE Cap TLV in NOTIFICATION Object of **PCNtf Message**

• **Discovery Procedures**
  - Discover H-PCE in Initialization using Open Message
  - Discover H-PCE over existing session using PCNtf Message

Do we need extensions to Open and PCNtf messages?
Which one is preferred if one is selected?
Next Step

• Request for comments and suggestions