Extensions of BRPC and PCEP to Support Inter-AS Bidirectional LSP Path Computation

draft-wang-pce-inter-as-extentions-00

Xuerong Wang (wang.xuerong@zte.com.cn)
Xihua Fu (fu.xihua@zte.com.cn)
Yuanlin Bao (bao.yuanlin@zte.com.cn)

ZTE CORPORATION

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Problem statement

- In order for bidirectional path computation, PCE needs to get bidirectional Inter-AS TE link information.
- ASBR can't get the latest TE information (e.g., bandwidth and metrics) about reverse direction of Inter-AS TE links timely.
- [RFC5392] introduces a "proxy" for the ASBR at the edge of the other AS and generates a bidirectional TE link.
- This document extends BRPC and PCEP to support the bidirectional path computation within single procedure. Based on this mechanism, we don‘t need to introduce any 'proxy'.

Extensions of BRPC

- With the IGP advertised unidirectional Inter-AS TE properties in it's own TED, PCE(i+1) selects the Inter-AS TE links from AS (i+1) to AS(i) that satisfy the TE constraints and passes them to the previous PCE(i) in the PCRep.

- With the Inter-AS TE properties of reverse direction in it's own TE MIB, PCE(i) chooses the Inter-AS links that satisfy the required constraint in bidirectional. It does this by considering its own TED and the unidirectional Inter-AS links received from PCE(i+1).

  Then PCE(i) computes the shortest constrained paths between every exit Boundary Node and the LSP destination.

Extensions of PCEP

- New IVSPT flag in RP object

Bit Number	Name Flag
TBD	IVSPT

✓ PCReq : This flag in PCReq from PCE(i) to PCE(i+1) indicates Inter-AS TE links which satisfy the TE constraint from AS(i+1) to AS(i) must be returned.

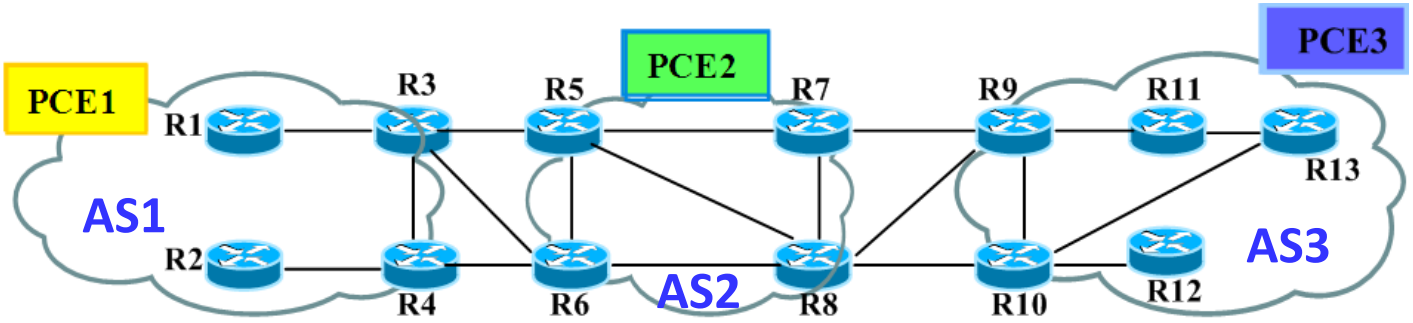
✓ PCRep : This flag in PCRep from PCE(i+1) to PCE(i) indicates that PCE(i+1) supports the enhanced BRPC procedure, and Inter-AS TE links from AS(i+1) to AS(i) satisfying TE constraints have been included in PCRep.

Extensions of PCEP

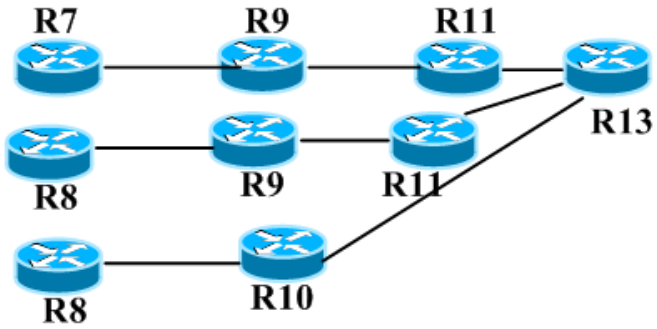
Two methods of carrying Inter-AS TE links in PCRep:

- ✓ Method 1: Extending VSPT to include Inter-AS links
- ✓ Method 2: Defining Inter-AS Virtual Shortest Path Tree (IVSPT) to describe Inter-AS links individually , and defines Constrain Route Object (CRO) to carry the IVSPT

Method 1:Extending VSPT to include Inter-AS links

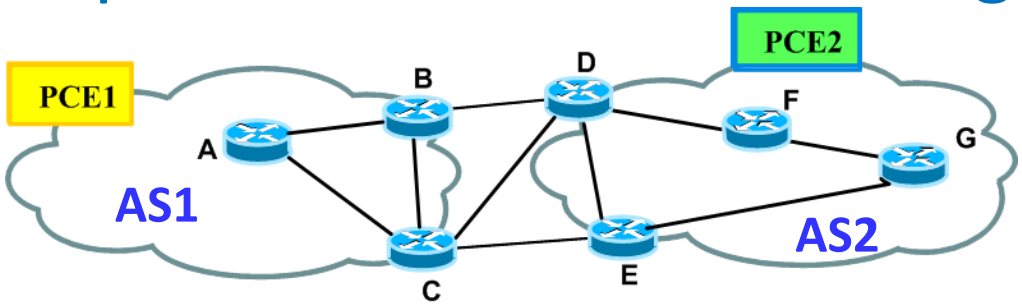


VSPT computed by PCE(3) :



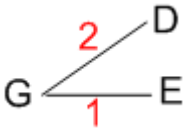
- VSPT computed by PCE(3) is extended to include Inter-AS link from AS3-AS2
  - ✓ ERO1: R7(TE Router ID)-R9(Interface IP address)-R11(Interface IP address)-R13 (TE Router ID)
  - ✓ ERO2: R8(TE Router ID)-R9(Interface IP address)-R11(Interface IP address)-R13 (TE Router ID)
  - ✓ ERO3: R8(TE Router ID)-R10(Interface IP address)-R13(TE Router ID)

Example of method1: Extending BRPC procedure

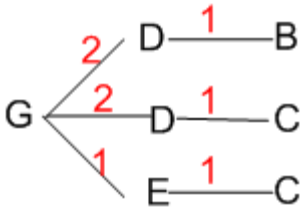


Assume inter-AS link D→B doesn't satisfy the constraints

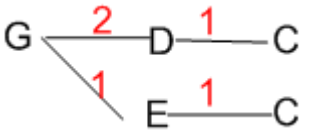
- PCE2 computes VSPT：
  - DFG cost 2；EG cost 1;



- PCE2 selects Inter-AS links and computes extended VSPT:
  - BDFG cost 3； CDFG cost 3； CEGcost 2；
- PCE2 returns VSPT to PCE1

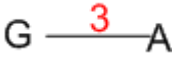


- PCE1 chooses the Inter-AS links that satisfy the TE constraints in both of the directions
  - CDFG cost 3； CEGcost 2；



- PCE1 computes shortest constrained path between each exit BN and G;
  - CEGcost 2；

- PCE1 computes an e2e path ：
  - ACEGcost 3



Method 2: defining IVSPT to carry Inter-AS links

Route Object-CRO) carried in PCRep. The format of CRO is identical to the ERO defined in [RFC5440].

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PCRep message is updated as follows:

<PCRep Message> ::= <Common Header>

<PCRep Message> ::= <Common Header>

<response-list>

<response-list>::=<response>[<response-list>]

<response>::=<RP>[<NO-PATH>]

[<attribute-list>]

[<path-list>]

[<attribute-list>] [<CRO-list>]

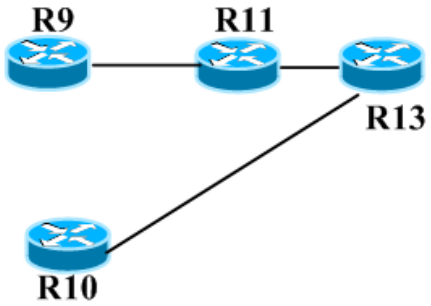
<path-list><ERO><attribute-list>[<path-list>]

<CRO-list><CRO><attribute-list>[<CRO-list>]

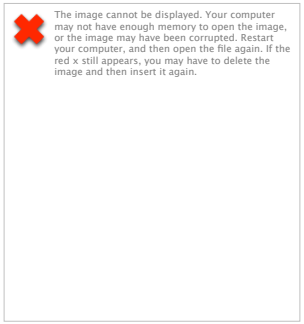
New definition

to carry Inter-AS links

VSPT computed by PCE(3) :



IVSPT computed by PCE(3) :



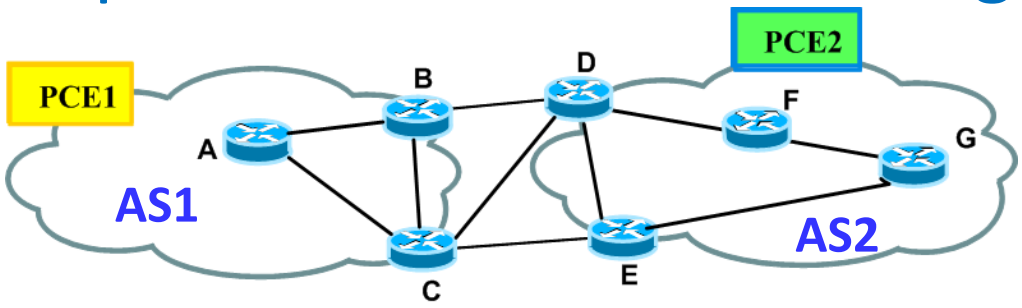
separately, and returns PCRep including VSPT and IVSPT . IVSPT selected by

CRO1: R9(Interface IP address),R7(TE Router ID)

✓ CRO2: R9(Interface IP address),R8(TE Router ID)

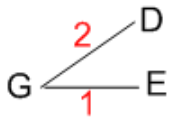
✓ CRO3: R10(Interface IP address),R8(TE Router ID)

Example of method2: Extending BRPC procedure

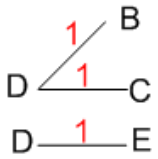


doesn't satisfy the constraints

- PCE2 computes VSPT :
  - DFG cost 2; EG cost 1;



- PCE2 selects Inter-AS links (IVSPT):
  - BD cost 1; CD cost 1; CE cost 1;



- PCE2 returns VSPT and IVSPT to PCE1;
- PCE1 chooses the Inter-AS links that satisfy the TE constraints in both of the directions
  - CD cost 1; CE cost 1;
- PCE1 computes shortest constrained path between each exit BN and G;
  - CEGcost 2;

- PCE1 computes end to end path：
  - ACEGcost 3

Next Steps/Issues

the meeting or mailing list。

Comments?

Thank You