



Connect IPv4 Islands over IPv6 Core (4PE)

draft-mishra-idr-v4-islands-v6-core-4pe-04

IETF 116



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Motivation for a Standards Track 4PE Specification

IETF standard exists for connecting IPv6 islands over an IPv4 core (**RFC 4798**), however a standard does **NOT exist** for connecting IPv4 islands over an IPv6 core.

This draft provides the specification for connecting **IPv4 islands over an IPv6 core**.

As operators migrate to a single protocol IPv6-Only core per RFC 5565 **Softwire Mesh Framework** which involves **6to4 tunnel** of IPv6 packets over an IPv4 core called “**6PE**”, and now with this draft **4to6 tunnel** of IPv4 packets over an IPv6 core now called “**4PE**”.

The name “**6PE**” termed to define the tunneling of **IPv6 labeled packets** over an **IPv4 core** and now the name “**4PE**” is termed to define the tunneling of **IPv4 labeled packets** over an **IPv6 core**.



Recap of 4PE

- 4PE routers exchange IPv4 reachability **transparently tunneled** over an IPv6 core using MP-BGP IPv6 RFC 2545 using the BGP next hop field to convey the IPv6 address of the 4PE router so that the dynamically established **IPv6 signaled MPLS LSP** can be utilized without explicit tunnel configuration. (**Signal Topmost transport label LSP**)
- 4PE uses RFC 8950 for the **16 or 32 byte next hop** encoding.
- Ingress & Egress 4PE routers must **bind a label to all the IPv4 prefixes** per RFC 8277 BGP-LU (Service Label BOS (Bottom of Stack) S bit set. **2 Level label stack**.
- 4PE supports **Explicit Null Signaling** for Diff-Serv PIPE mode model.
- 4PE design supports RFC 4364 Inter AS Option A, B, C, AB.
- 4PE design supports MPLS, SR-MPLS & SRv6.



Updates from post IETF 115 ML discussion

- The authors received feedback on ML and all updates have been incorporated into the draft.
- When RFC 7948 was written, Segment Routing did not exist. The 4PE draft provides a detailed interworking of how 4PE is implemented with Segment Routing both SR-MPLS & SRv6. I have cleaned up the related text in the draft on Segment Routing support to make it more clear.
- Per Robert Raszuk comments I added additional text related RFC 8950 next hop encoding interaction with 4PE and the importance of 4PE procedures and that RFC 8950 is strictly about the next hop encoding of IPv4 NLRI over an IPv6 next hop peer. Also acknowledged comments related to alternatives to 4PE that exist to connect IPv4 islands over an IPv6 core and why 4PE is the desired solutions as compare to alternatives that exist today.
- Extensive discussion on BGP LU RFC 8277 labeled unicast for 4PE as is used for 6PE for labeling the tunneled IPv4 prefixes due to QOS EXP scheduling being broken on the PHP node. I have relaxed the requirement for labeled unicast per feedback from Igor Malyushkin as long as explicit null Pipe mode is used as described in RFC 3270 MPLS support for QOS. Also added option for 2nd level next hop label and 3rd level prefix label and combinations of options for labeling or not labeling the customer prefixes.
- Updated contributors section and many thanks for all the feedback on the draft.

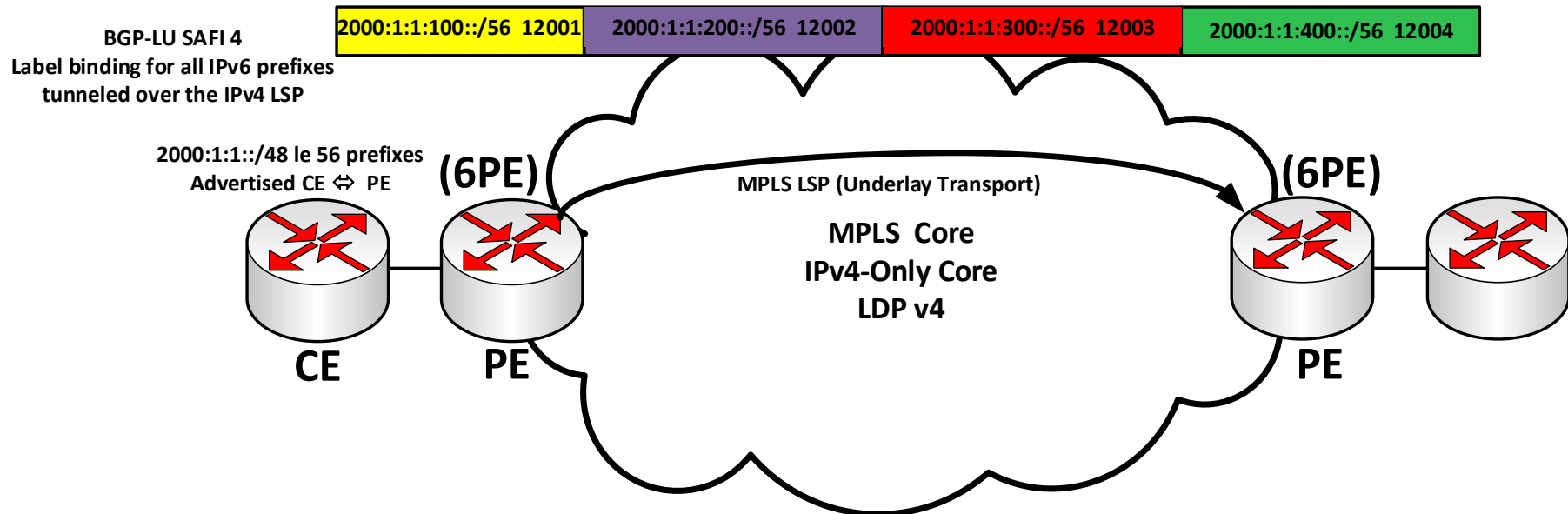


**BESS Working Group ⇔ We
would like to ask for WG
Adoption??**

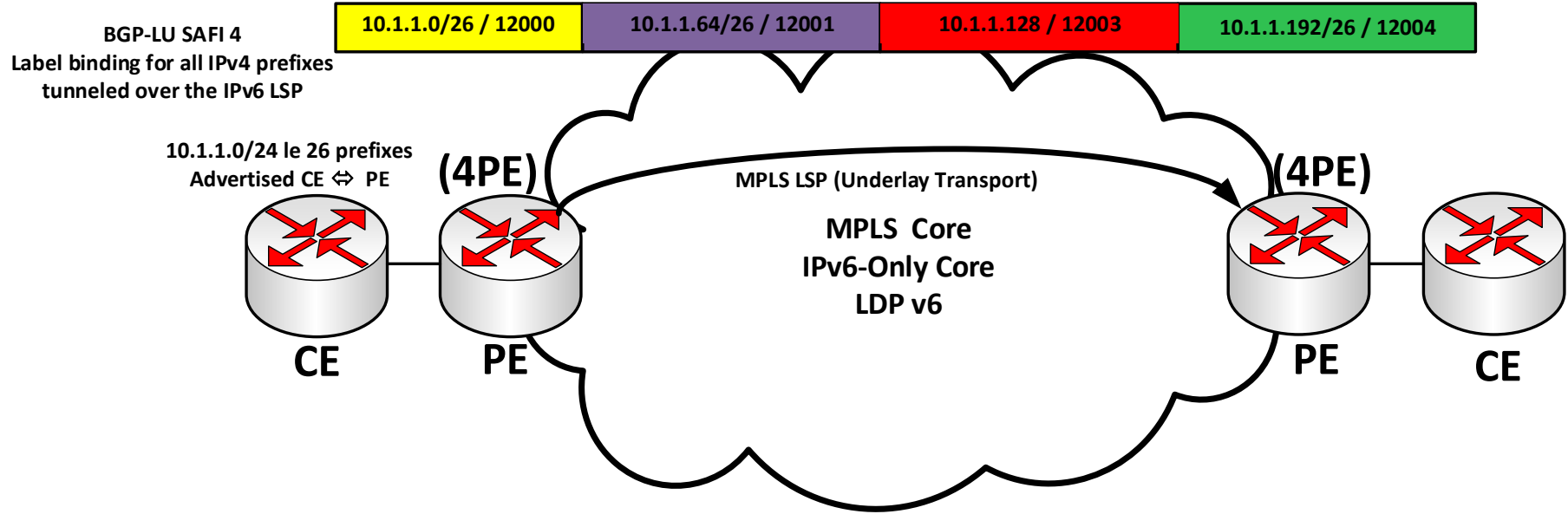
Thank You!



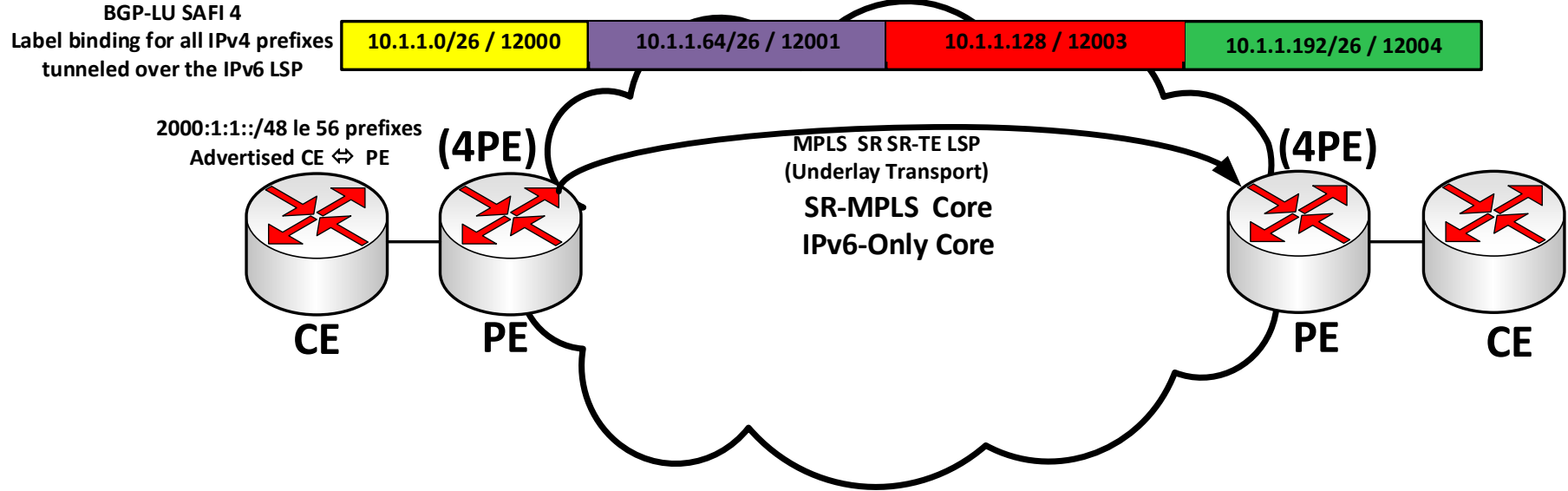
RFC 4798 –Connecting IPv6 islands over IPv4 MPLS using IPv6 Provider Edge Routers (6PE)



(4PE) –Connecting IPv4 islands over IPv6 MPLS using IPv4 Provider Edge Routers



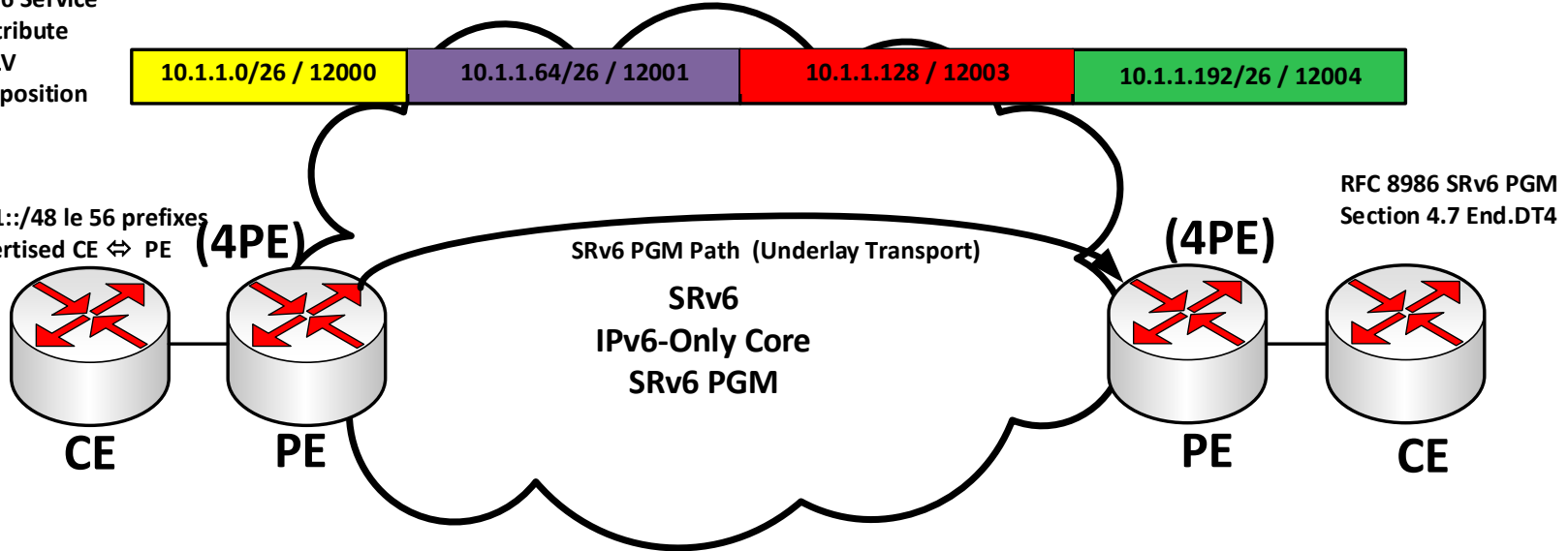
(4PE) –Connecting IPv4 islands over IPv6 SR-MPLS using IPv4 Provider Edge Routers



(4PE) –Connecting IPv4 islands over IPv6 SR-MPLS using IPv4 Provider Edge Routers

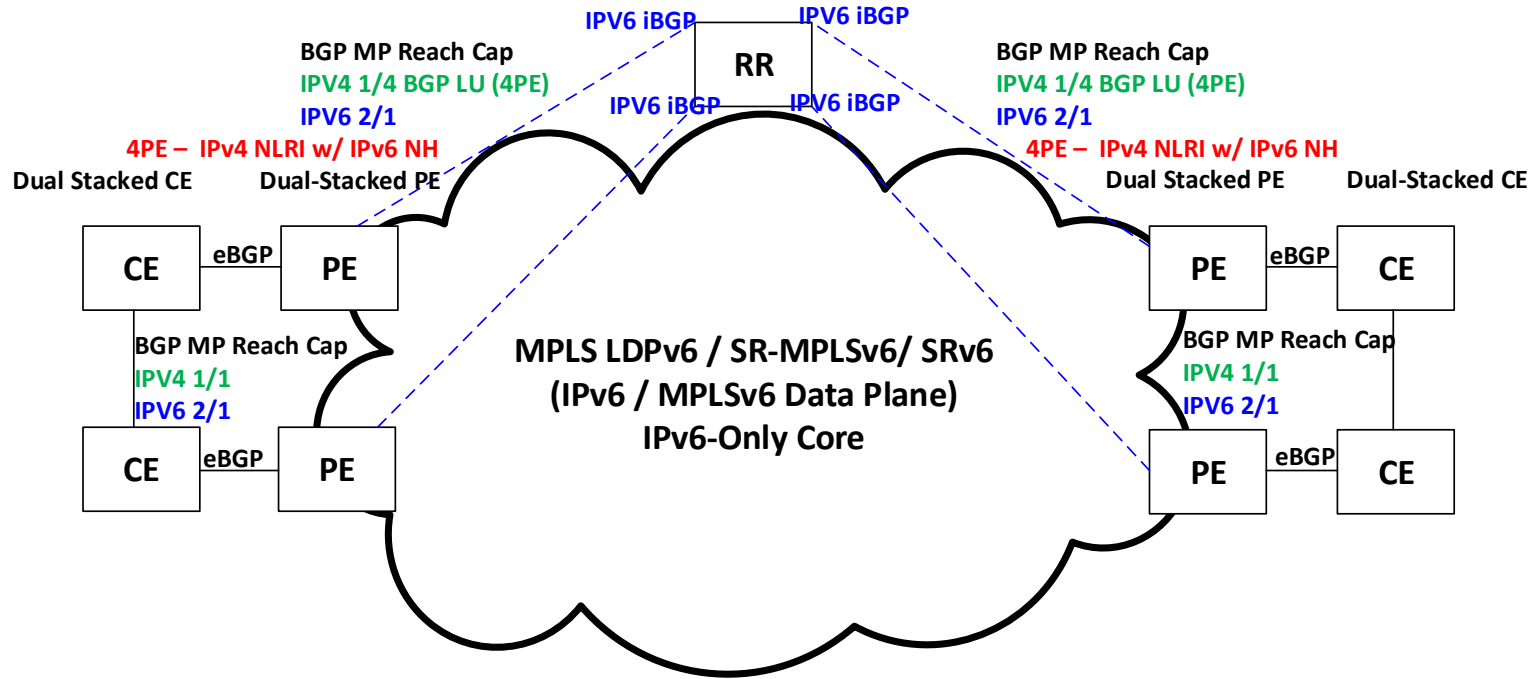
RFC 9252 BGP SRv6 Service
BGP Prefix-SID Attribute
SRv6 L3 Service TLV
MPLS labels Transposition
to Func/Arg
Section 5.3

2000:1:1::/48 le 56 prefixes
Advertised CE ↔ PE



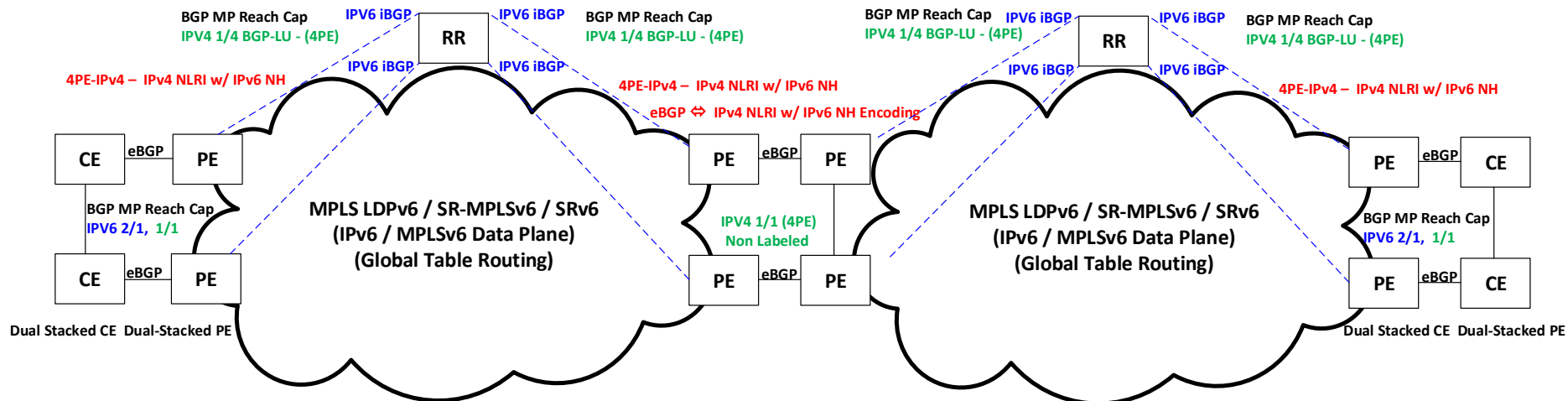
(4PE) –Control Plane & Data Plane Intra-AS

MPLS LDPv6 / SR-MPLSv6 / SRv6 – Software Mesh Framework 4to6 (4PE)
(4PE Control Plane)
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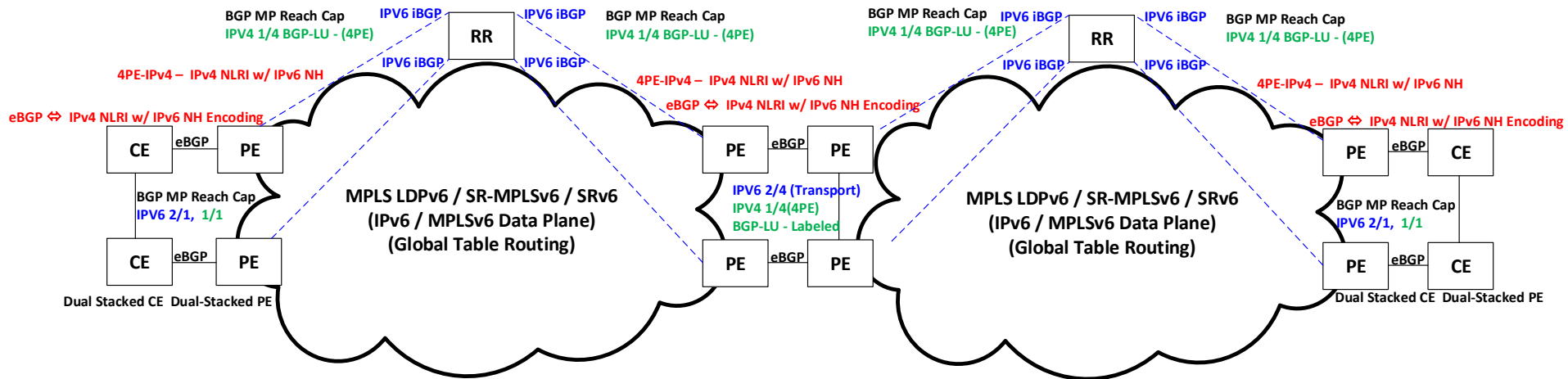
(4PE) –Control Plane & Data Plane Inter-AS Option A Procedure

(4PE) - Inter-AS Option A



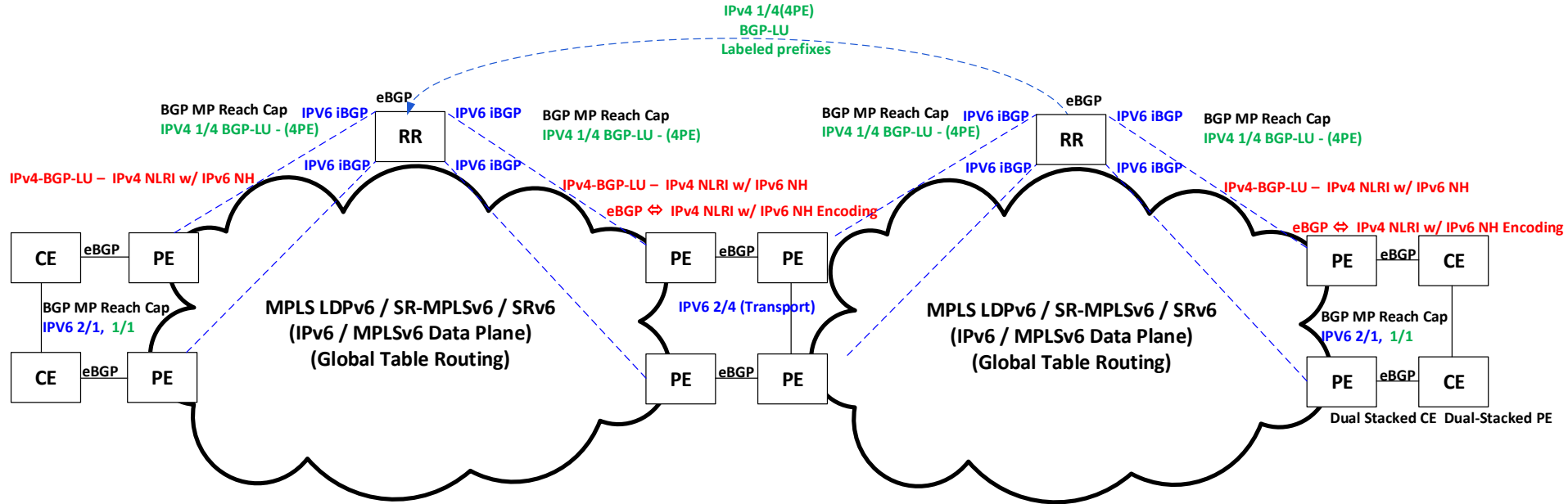
(4PE) –Control Plane & Data Plane Inter-AS Option B Procedure

(4PE) - Inter-AS Option B



(4PE) –Control Plane & Data Plane Inter-AS Option C Procedure

(4PE) - Inter-AS Option C



(4PE) –Control Plane & Data Plane Inter-AS Option AB Procedure

4PE - Inter-AS Option AB (Same as Opt B)

