



Connect IPv4 Islands over IPv6 Core (4PE)

draft-mishra-idr-v4-islands-v6-core-4pe-06

IETF 118



Gyan Mishra, Verizon
Jeff Tantsura, Microsoft
Mankamana Mishra, Cisco
Sudha Madhavi, Juniper
Adam Simpson, Nokia
Shuanglong Chen, Huawei



Motivation for 4PE Document

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 informational document 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 have the option to **bind a label to all the IPv4 prefixes** per RFC 8277 BGP-LU, **2 Level label stack, single PE-PE LSP label with all customer prefixes unlabeled, per CE label table interface LSP with customer prefixes unlabeled.**
- 4PE provides a lot more flexibility to the network designers than its 6PE predecessor.
- 4PE design supports RFC 4364 Inter AS Option A, B, C, AB.
- 4PE design supports MPLS, SR-MPLS & SRv6 data planes.



4PE Draft Updates (10-22-23)

- Draft changed from Standards Track to Informational. The 4PE draft provides flexibility that its predecessor 6PE did not provide which had rigid requirements where this draft now provides flexibility that is configurable for the network designer.
- Inter-AS Option AB is moved from normative to informative reference.
- SR Policy draft was split for segment types extensions, so SR Segtypes extension draft added as normative reference.
- Topmost label has 3 options:
 - Arbitrary label
 - Implicit-null label
 - Explicit-null label
- 4PE router Customer IPv4 prefix tunneled over IPv6 LSP have 3 options for the advertisements:
 - All Customer prefixes are labeled, similar to IP-VPN per prefix label allocation mode. Not as scalable.
 - Ingress PE to Egress PE loopback to PE Loopback LSP, all customer prefixes unlabeled, similar to IP-VPN per VRF label allocation mode, BGP PIC Edge “like” optimal convergence, where single PE LSP needs to be withdrawn for all prefixes to withdrawn.
 - Per CE next hop LSP is created that contains all the per CE prefixes unlabeled, similar to IP-VPN per-CE or per-Next Hop label allocation mode, BGP PIC Edge “like” optimal convergence, where when single CE LSP is withdrawn all CE related customer IPv4 prefixes are withdrawn.
 - Implementation section added for vendors Cisco, Juniper, Nokia & Huawei

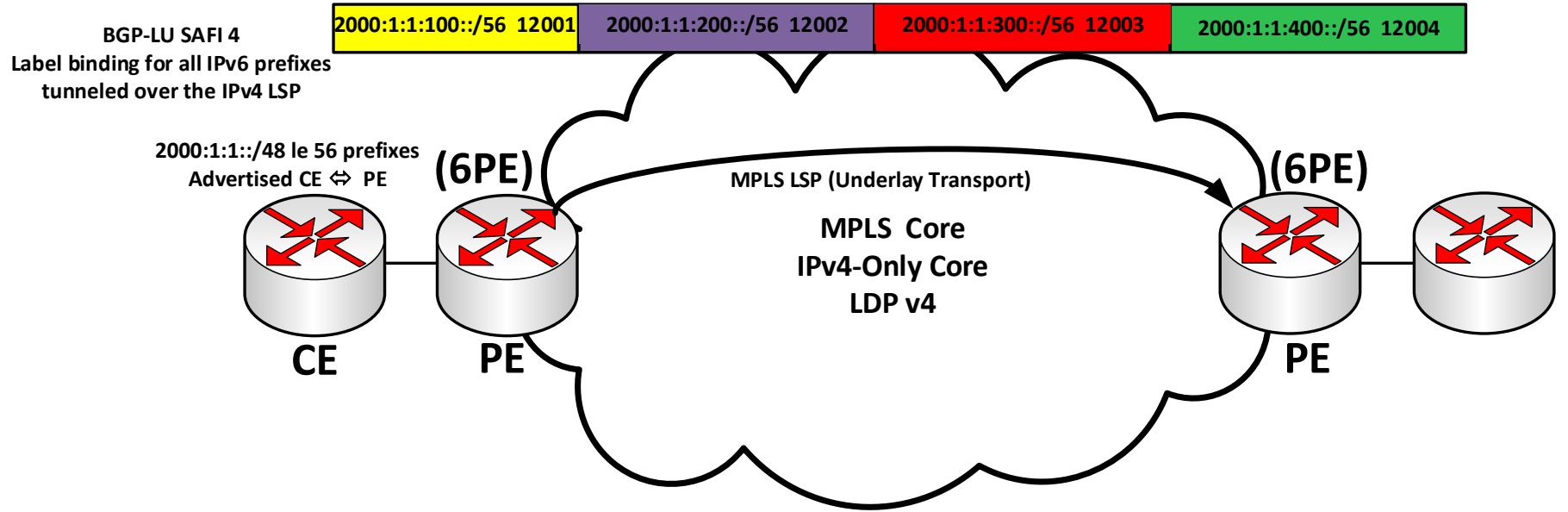


In Queue for WG Adoption

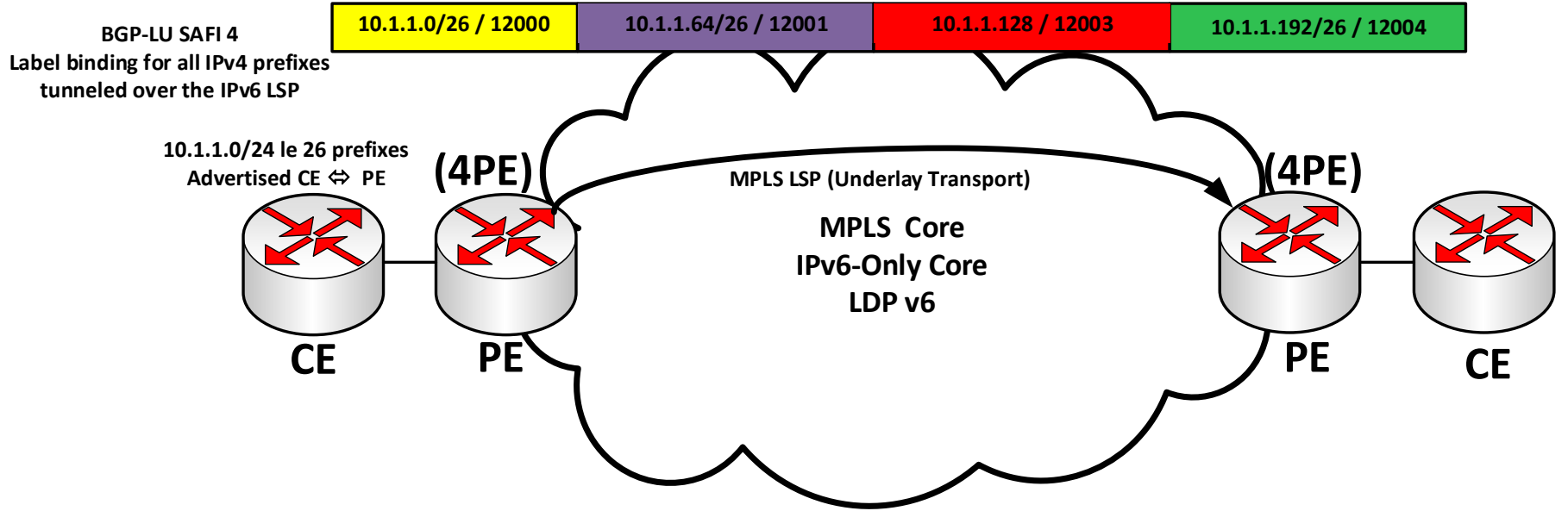
Thank You!



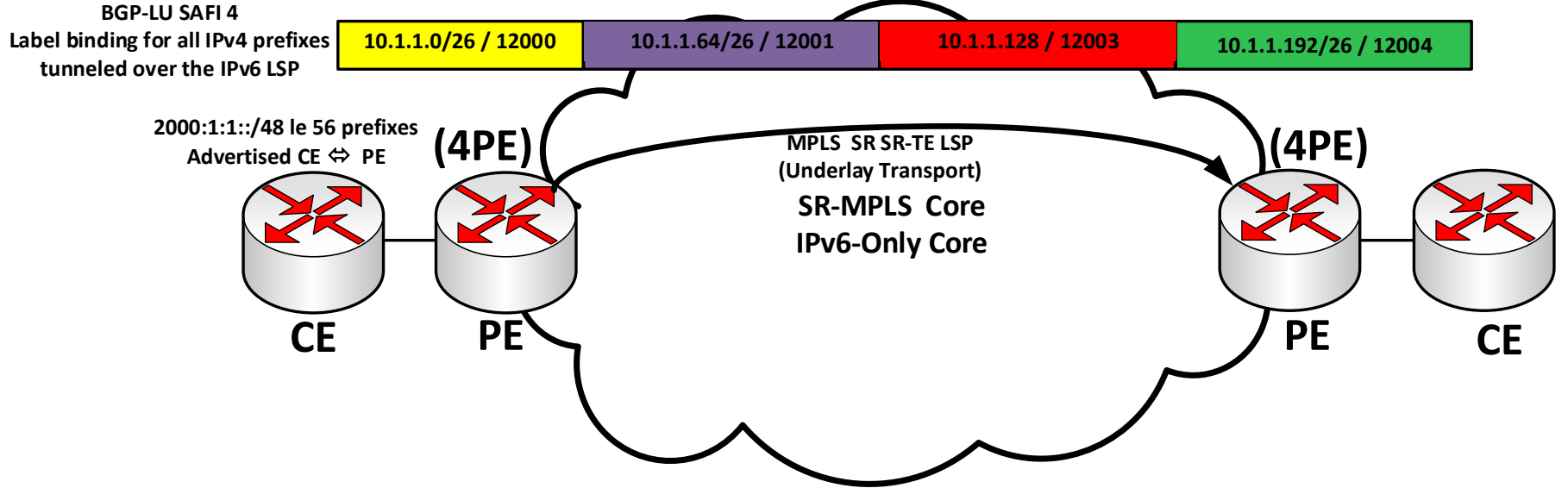
RFC 4798 –Connecting IPv6 islands over IPv4 MPLS using IPv6 Provider Edge Routers (6PE)



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



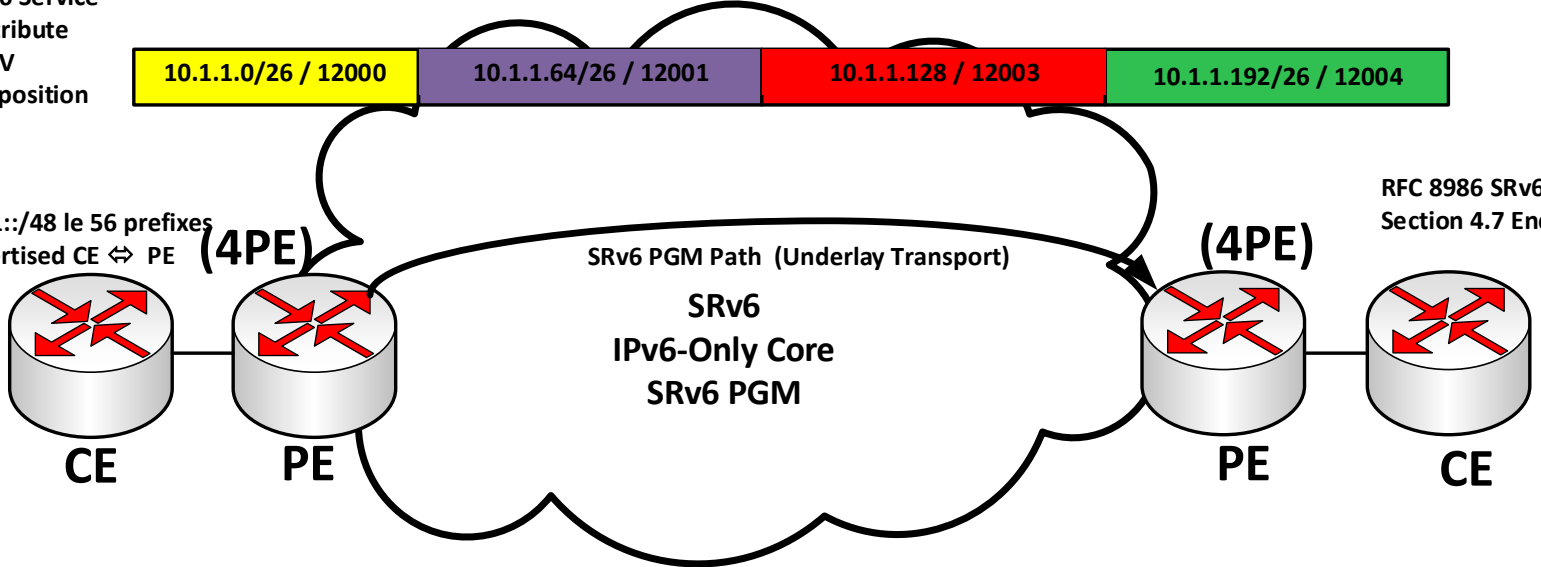
(4PE) –Connecting IPv4 islands over IPv6 SR-MPLS using IPv4 Provider Edge Routers



(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

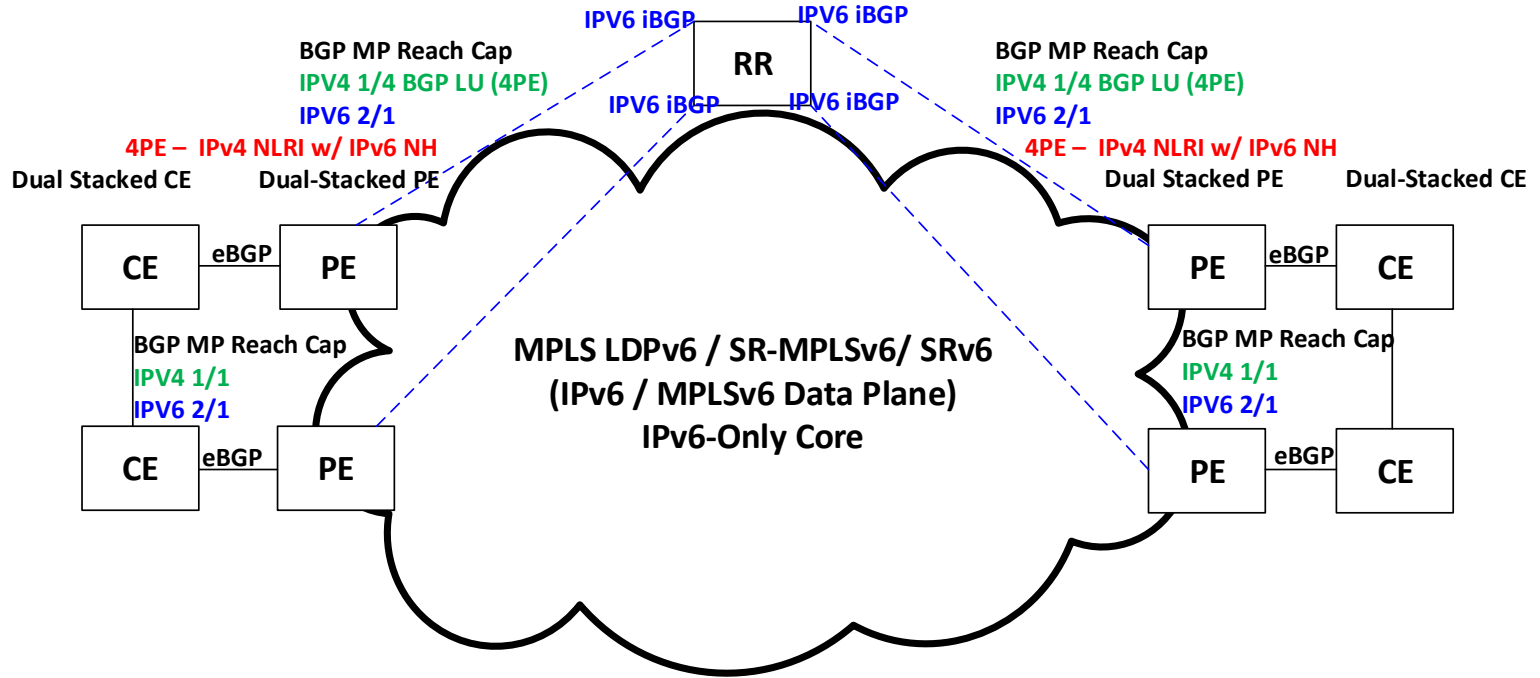
2000:1:1::/48 le 56 prefixes
Advertised CE ↔ PE



RFC 8986 SRv6 PGM
Section 4.7 End.DT4

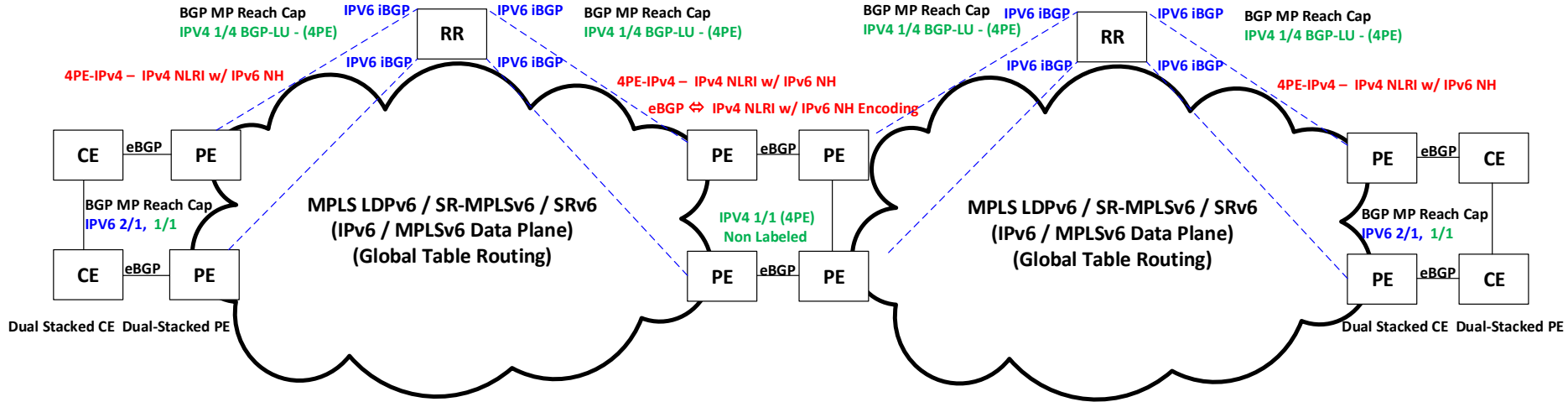
(4PE) –Control Plane & Data Plane Intra-AS

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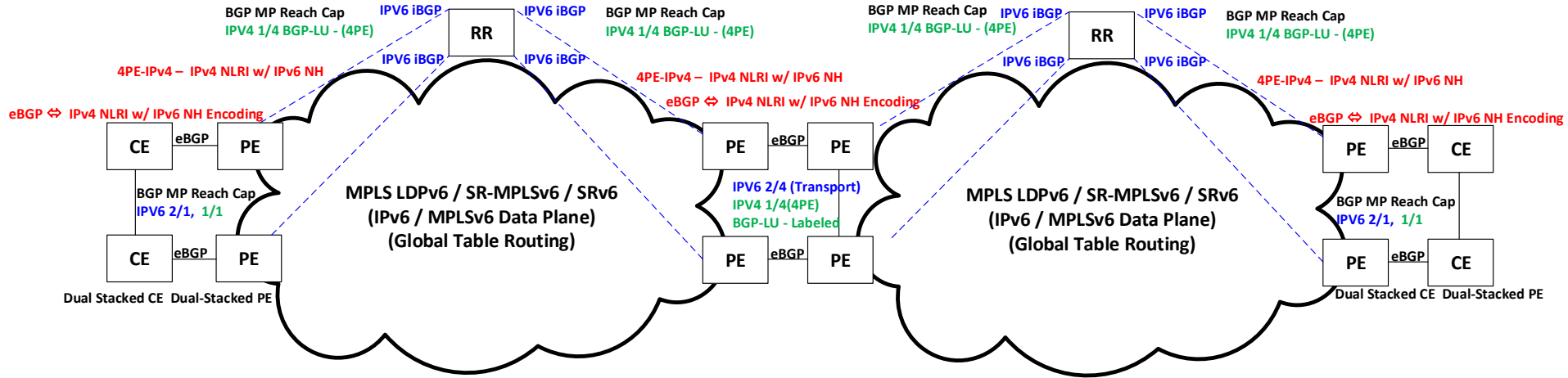
(4PE) –Control Plane & Data Plane Inter-AS Option A Procedure

(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

