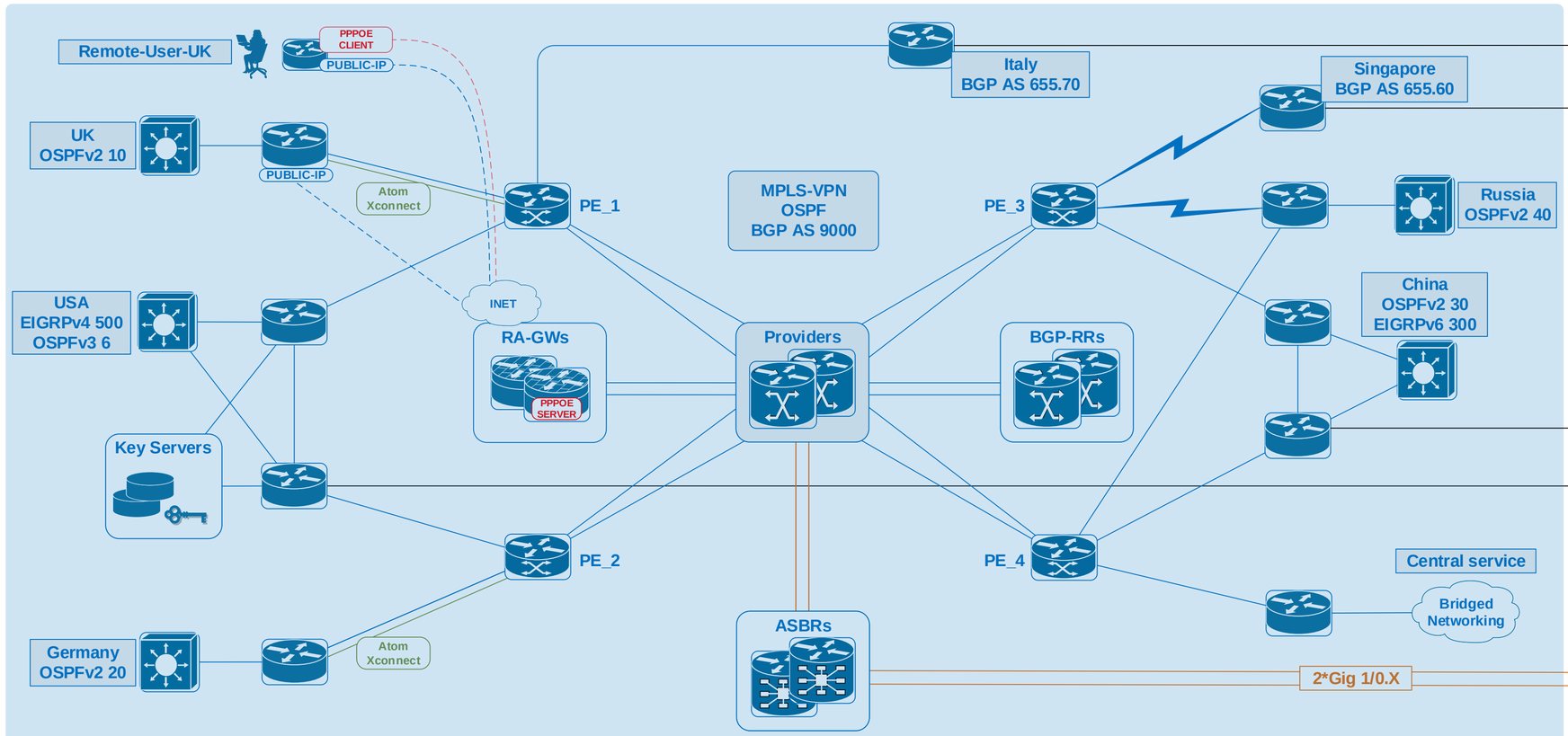
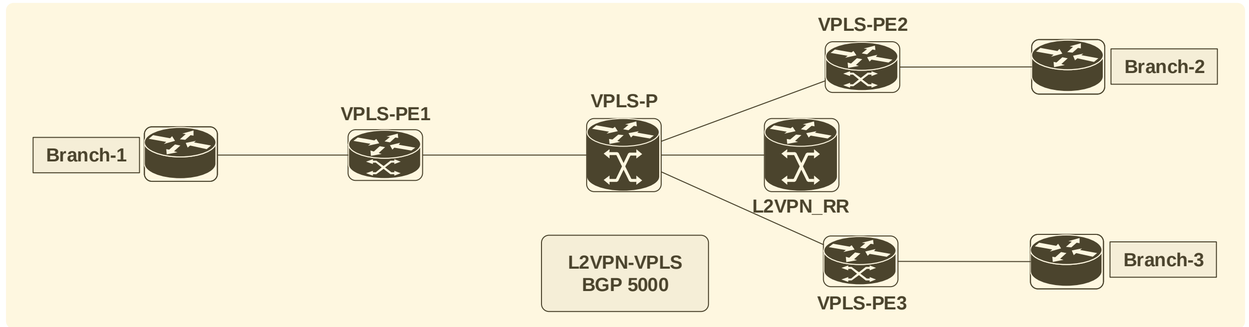
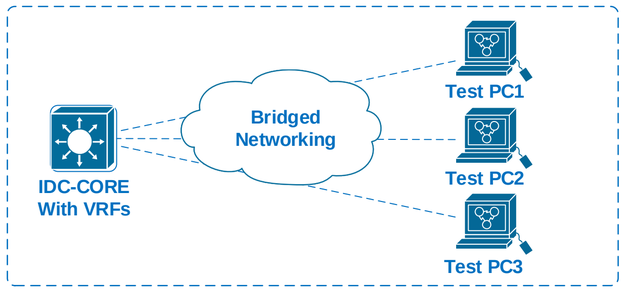
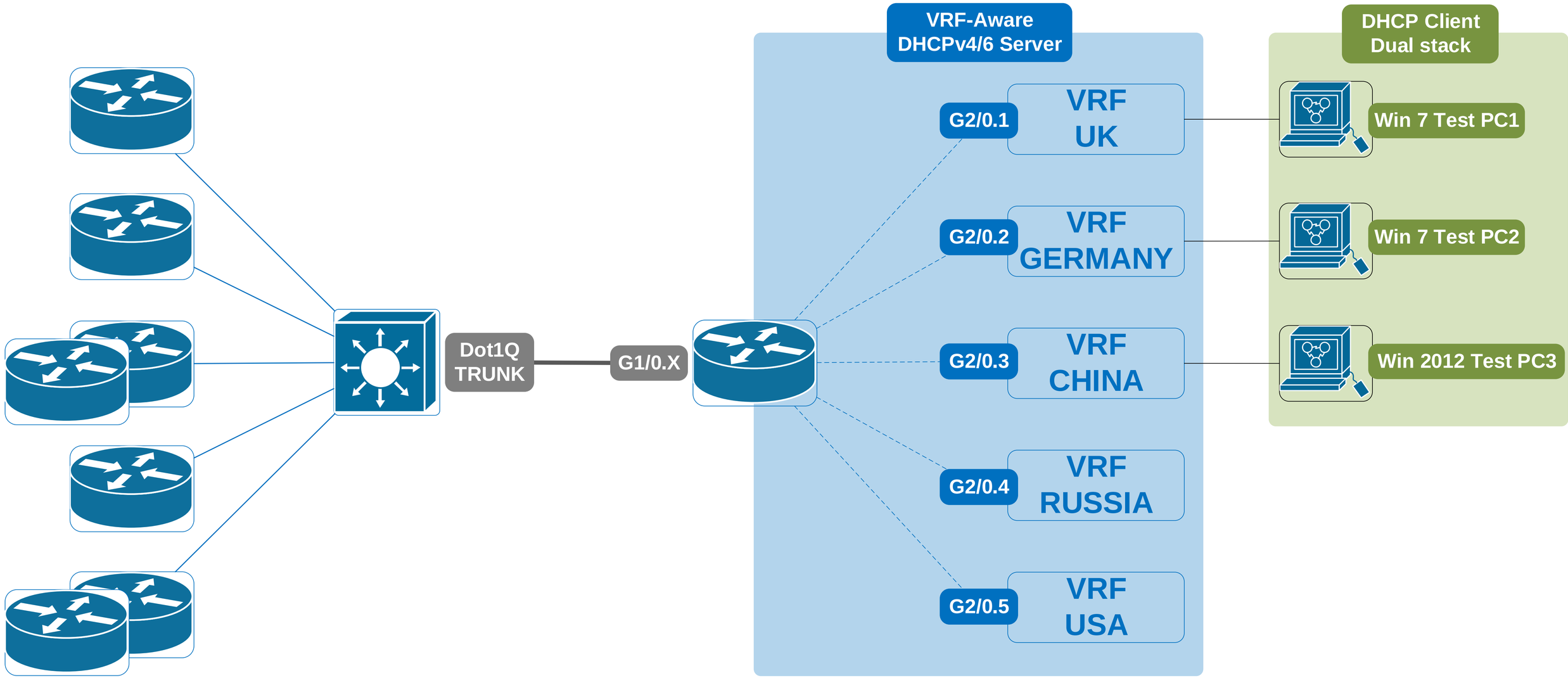
LAB Topology



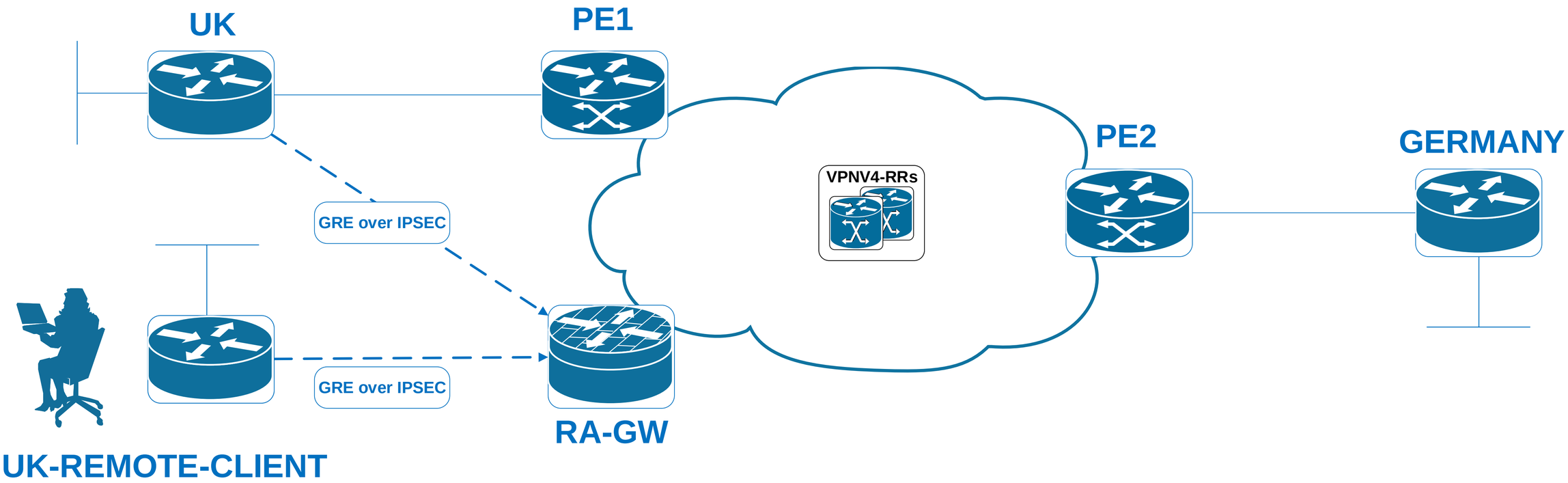




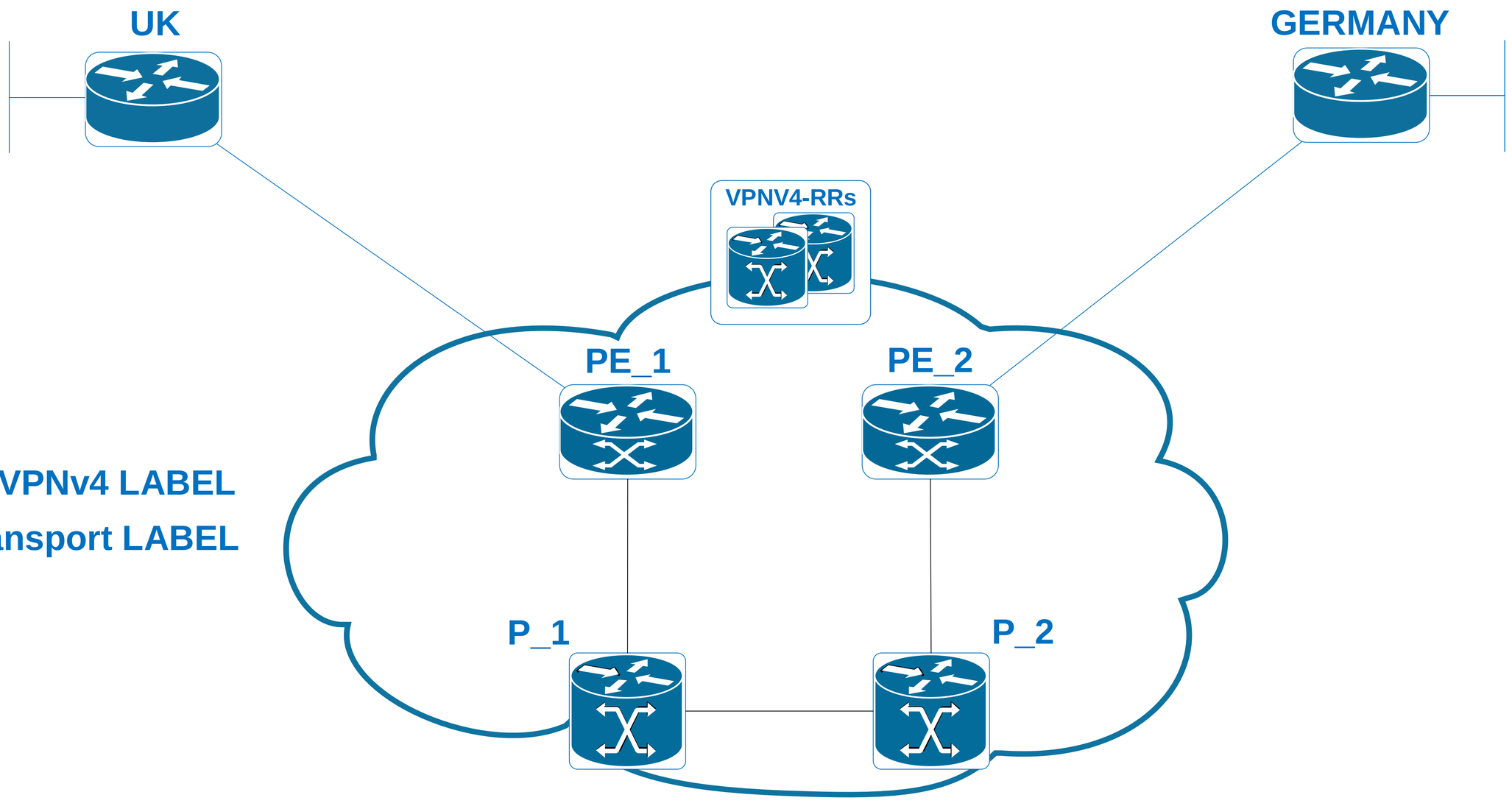
VRF Lite


VRF-Aware
DHCPv4/6 Server
DHCP Client
Dual stack
G2/0.1
VRF
UK
G2/0.2
VRF
GERMANY
G2/0.3
VRF
CHINA
G2/0.4
VRF
RUSSIA
G2/0.5
VRF
USA
Win 7 Test PC1
Win 7 Test PC2
Win 2012 Test PC3
Dot1Q
TRUNK
G1/0.X

UK-Germany


UK
PE1
VPNV4-RRs
PE2
GERMANY
GRE over IPSEC
GRE over IPSEC
RA-GW
UK-REMOTE-CLIENT

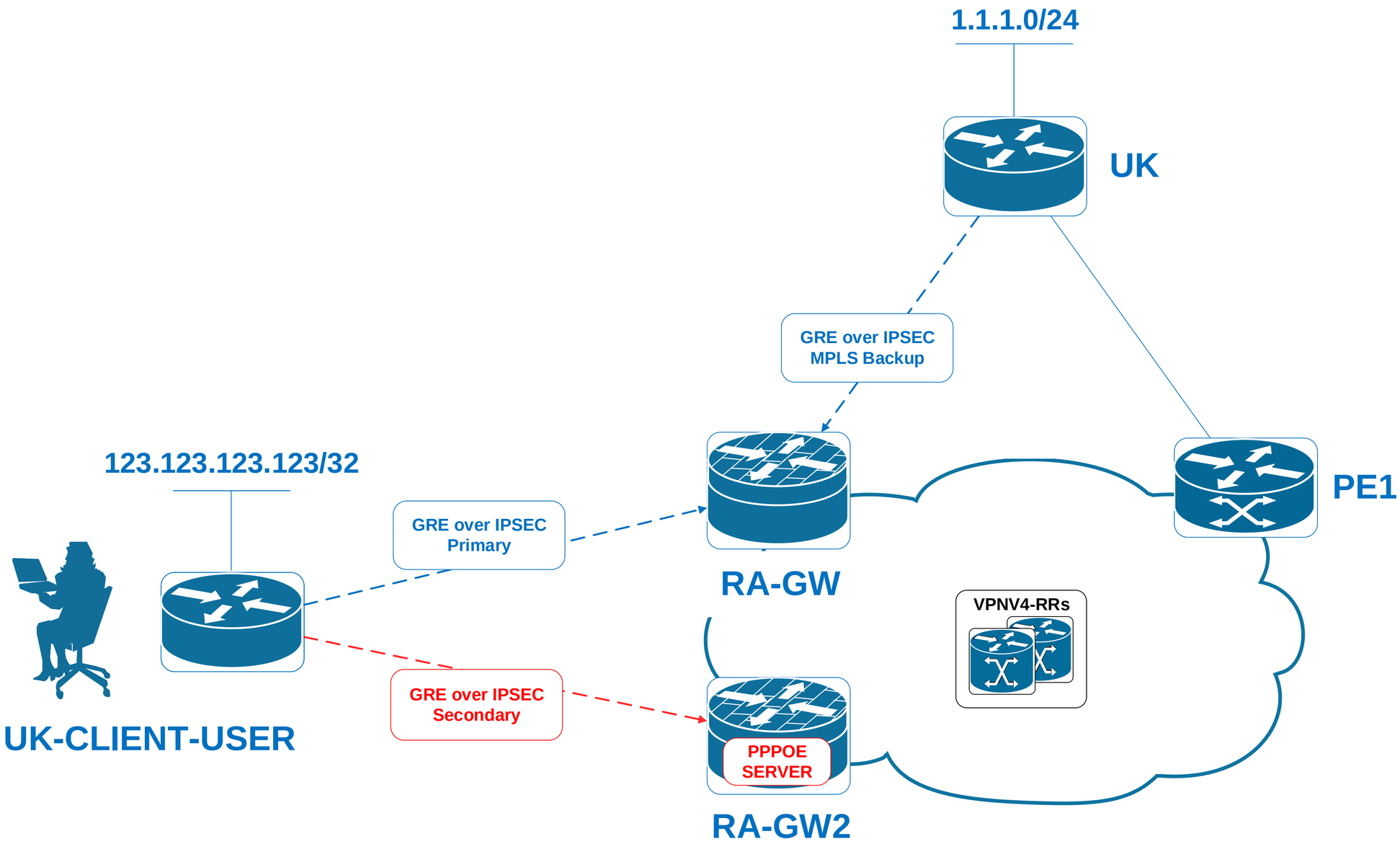
MPLS Label exchange



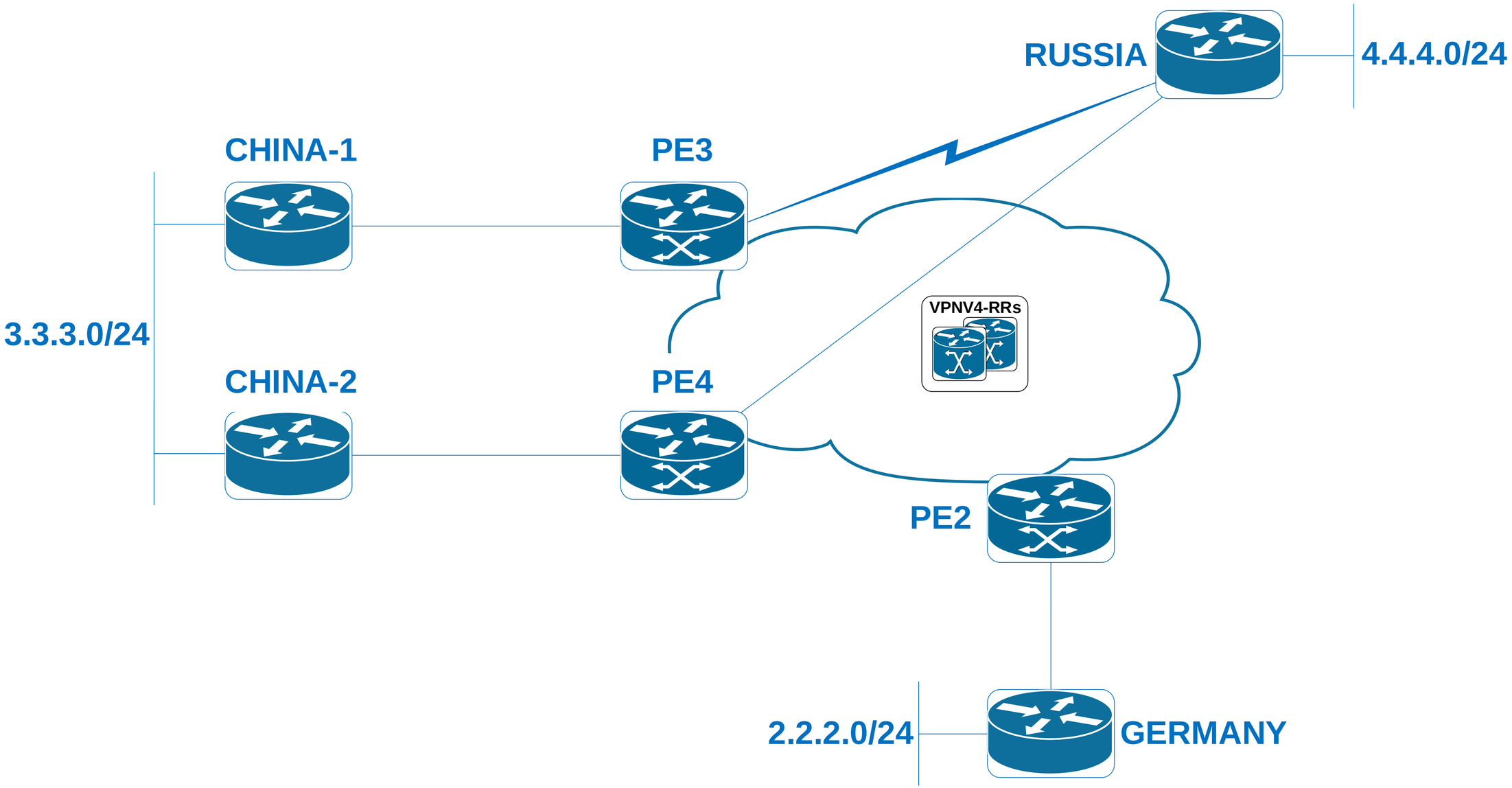
VPNv4 LABEL

LDP transport LABEL

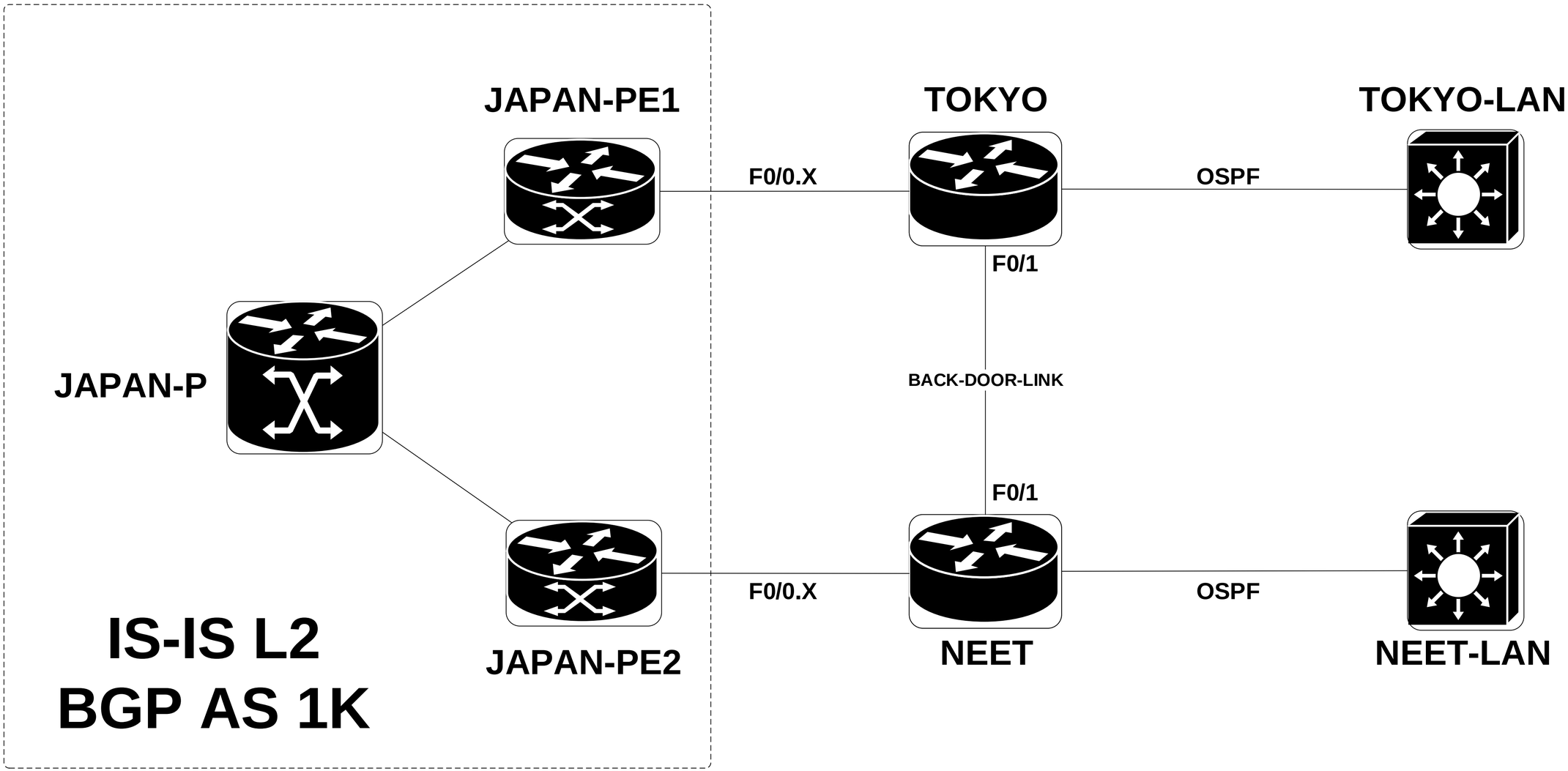
Remote access gateway Redundancy Design



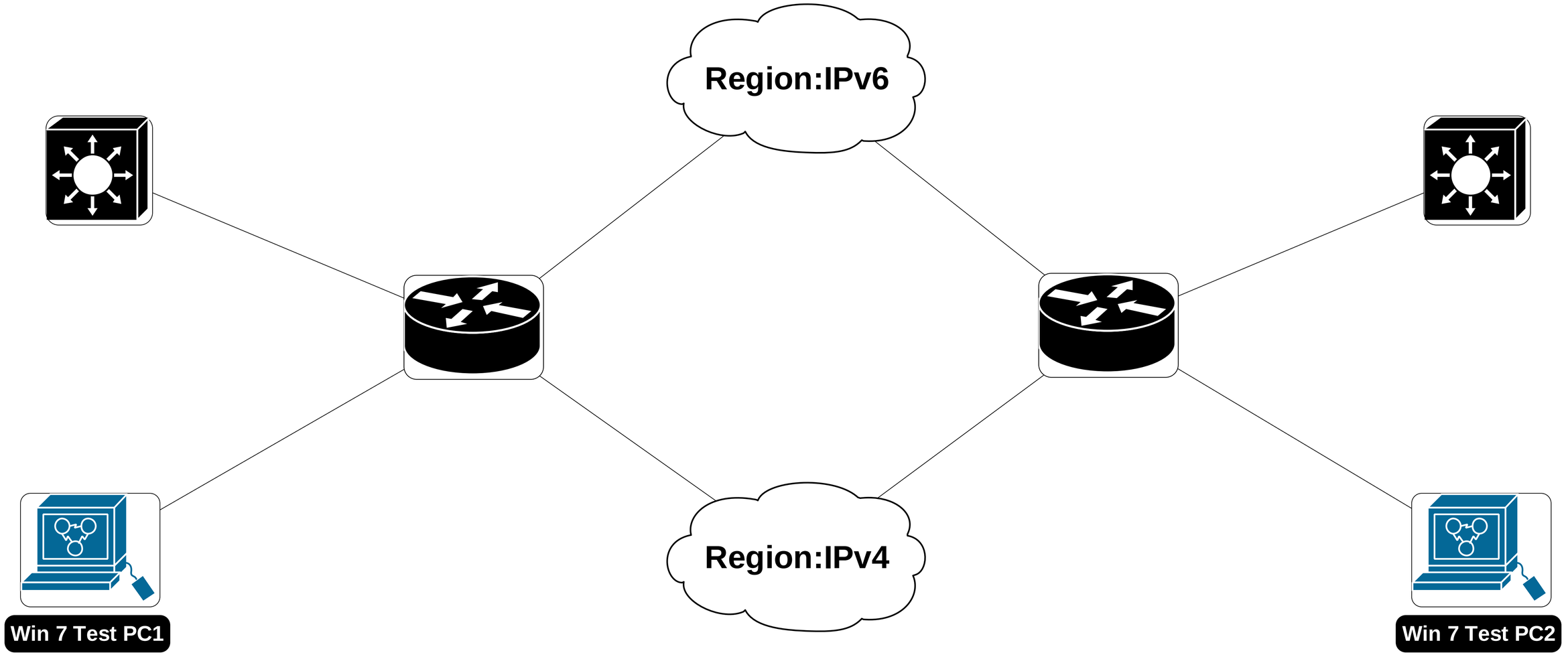
BGP Link-Bandwidth



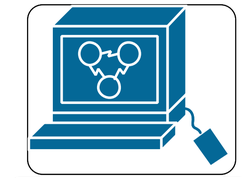
MPLS L3 VPN Topology



IPv4/6 Tunneling
6to4
4to6



IPSEC-VPN [DUAL STACK]



Win 7 Test PC1
EZVPN client

192.168.1.0/24

NAT Device

Public IP

202.100.2.0/24

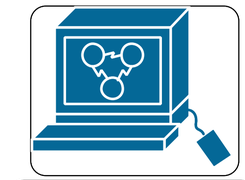
Dual stack
INET

61.128.2.0/24

Public IP

NAT Device

192.168.2.0/24



Win 7 Test PC2
EZVPN client

172.16.3.0/24

202.100.1.0/24

Public IP

61.128.1.0/24

Public IP

172.16.4.0/24

- Lan T0 Lan
- GRE OVER IPSEC
- Dynamic GRE OVER IPSEC
- Static VTI
- EZVPN/Dynamic VTI
- IPSEC VRF-Aware

IPV6 prefix

- Private IP= FC00:IPV4/64
- Global IP=2000:IPV4/64

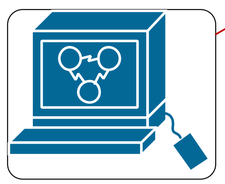
Global routing table

150.150.1.0/24

172.16.1.0/24

172.16.2.0/24

150.150.2.0/24



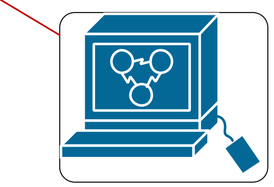
Win 7 Test PC1

Loopback 0

VRF
SITE_A

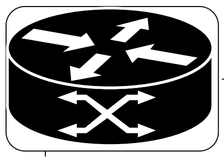
VRF
SITE_B

Loopback 0



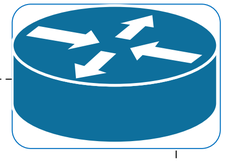
Win 7 Test PC2

PE-CE Routing Protocols



VRF Definition

Global Routing Table



Multi-Protocol BGP process

VRF Aware EBGP neighbor

EBGP neighbor

VRF Aware Static routing

Too many routes

Static routing

EIGRP/RIP VRF Aware

Metric issue

EIGRP/RIP

OSPF VRF Aware

LSA3/5
Loop prevention

OSPF

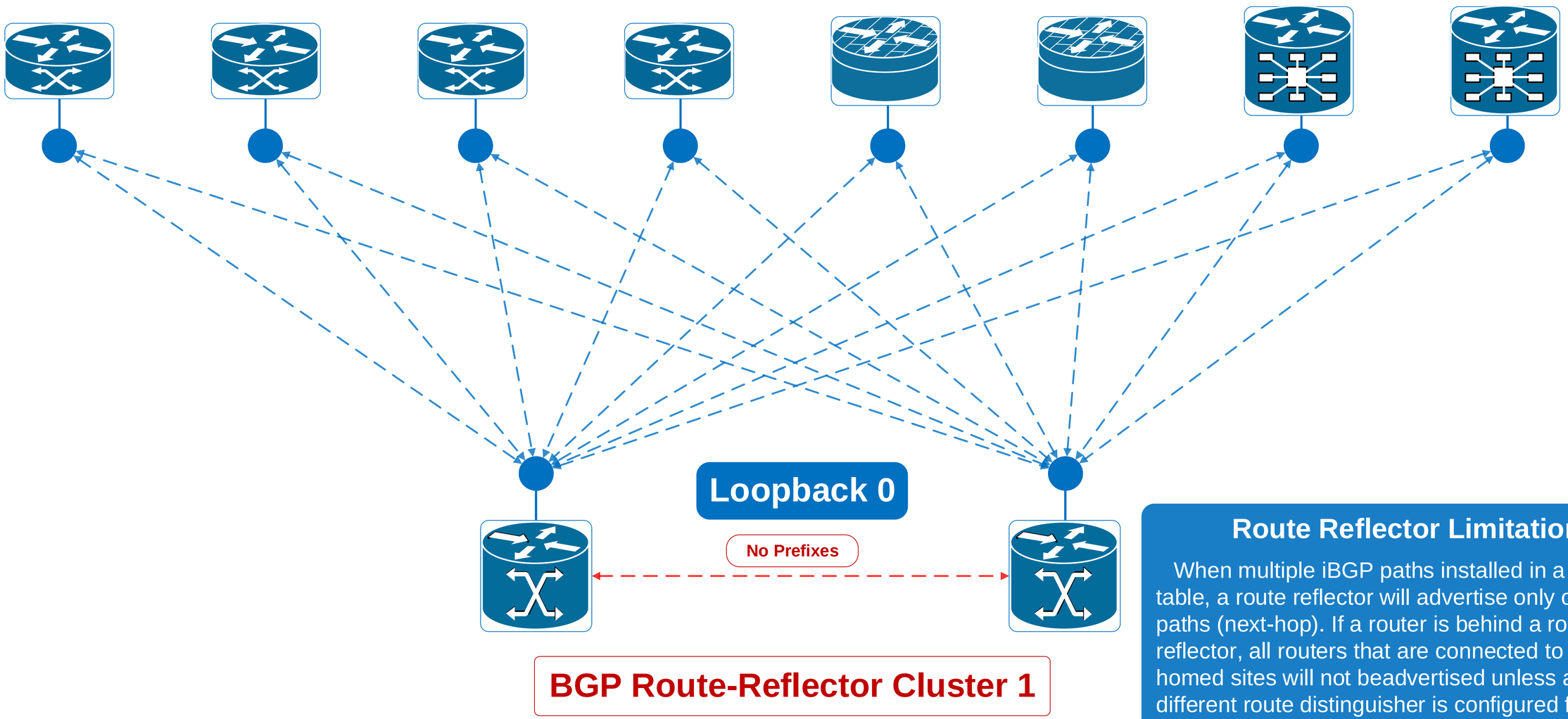
IS-IS VRF Aware

Out of fashion

IS-IS

IGP
Routing process
Static Routing

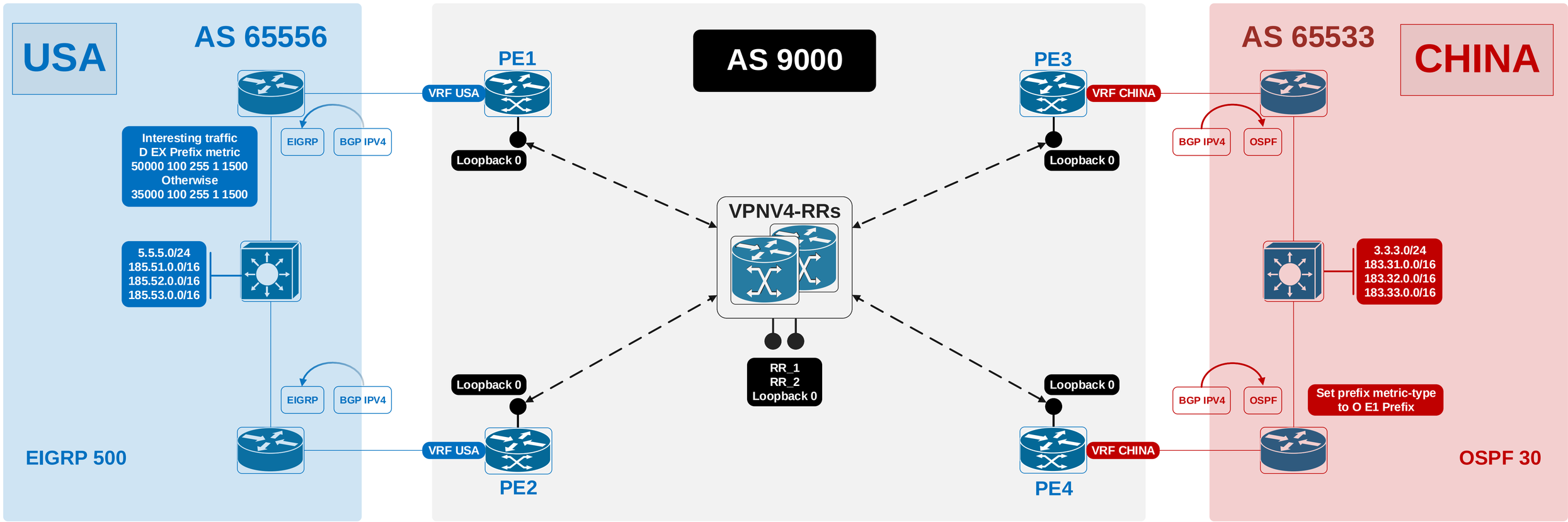
MP-BGP Route-Reflector



Route Reflector Limitation

When multiple iBGP paths installed in a routing table, a route reflector will advertise only one paths (next-hop). If a router is behind a route reflector, all routers that are connected to multi-homed sites will not beadvertised unless a different route distinguisher is configured for each VRF.

IGP Traffic Engineering IPv4



USA

```
Route-map SET_CHINA_PREFIX_EIGRP_BANDWIDTH_HIGHER
permit 10
 match ip address prefix-list
SET_CHINA_PREFIX_EIGRP_BANDWIDTH_HIGHER
 set metric 50000 100 255 1 1500
route-map SET_CHINA_PREFIX_EIGRP_BANDWIDTH_HIGHER permit
20
 set metric 35000 100 255 1 1500
Router eigrp 500
 redistribute bgp 65556 route-map
SET_CHINA_PREFIX_EIGRP_BANDWIDTH_HIGHER
ip prefix-list SET_CHINA_PREFIX_EIGRP_BANDWIDTH_HIGHER seq
5 permit X.X.X.X/X
```

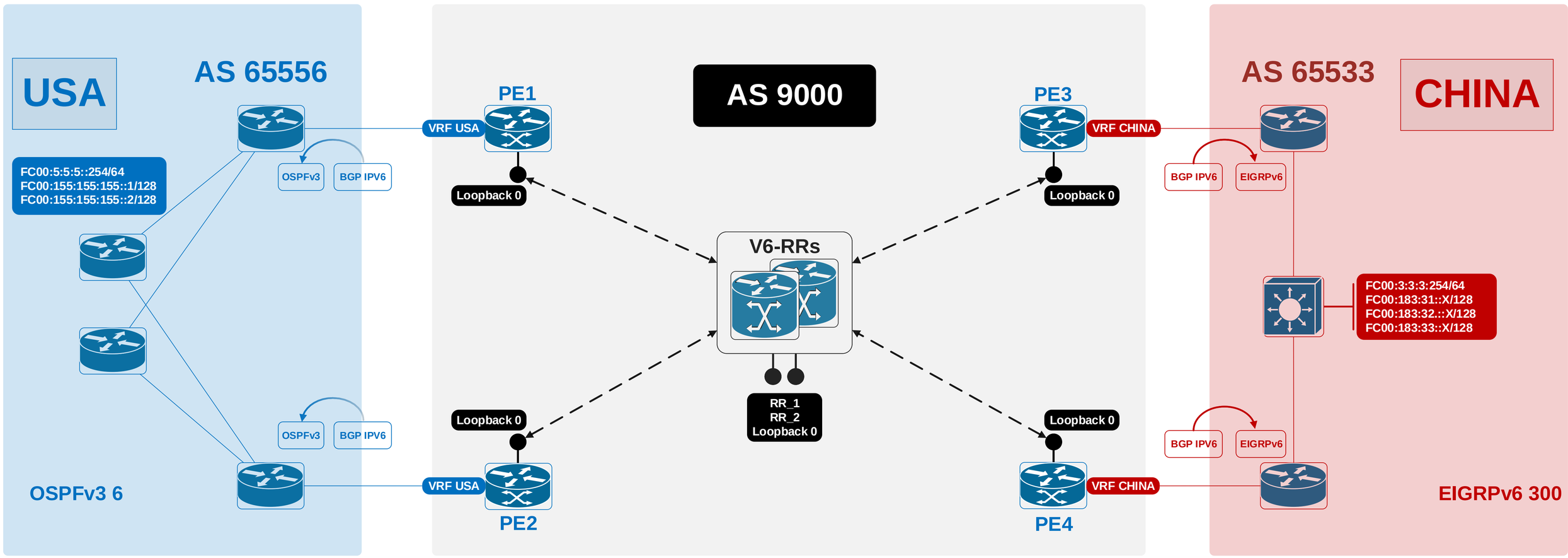
3.3.3.0/24 > CHINA-1 > USA-1> 5.5.5.0/24
183.31.0.0/16 > CHINA-2 > USA-2> 185.51.0.0/16
183.32.0.0/16 > CHINA-2 > USA-2> 185.52.0.0/16
183.33.0.0/16 > CHINA-2 > USA-2> 185.53.0.0/16

5.5.5.0/24 > USA-1 > CHINA-1> 3.3.3.0/24
185.51.0.0/16 > USA-2 > CHINA-2> 183.31.0.0/16
185.52.0.0/16 > USA-2 > CHINA-2> 183.32.0.0/16
185.53.0.0/16 > USA-2 > CHINA-2> 183.33.0.0/16

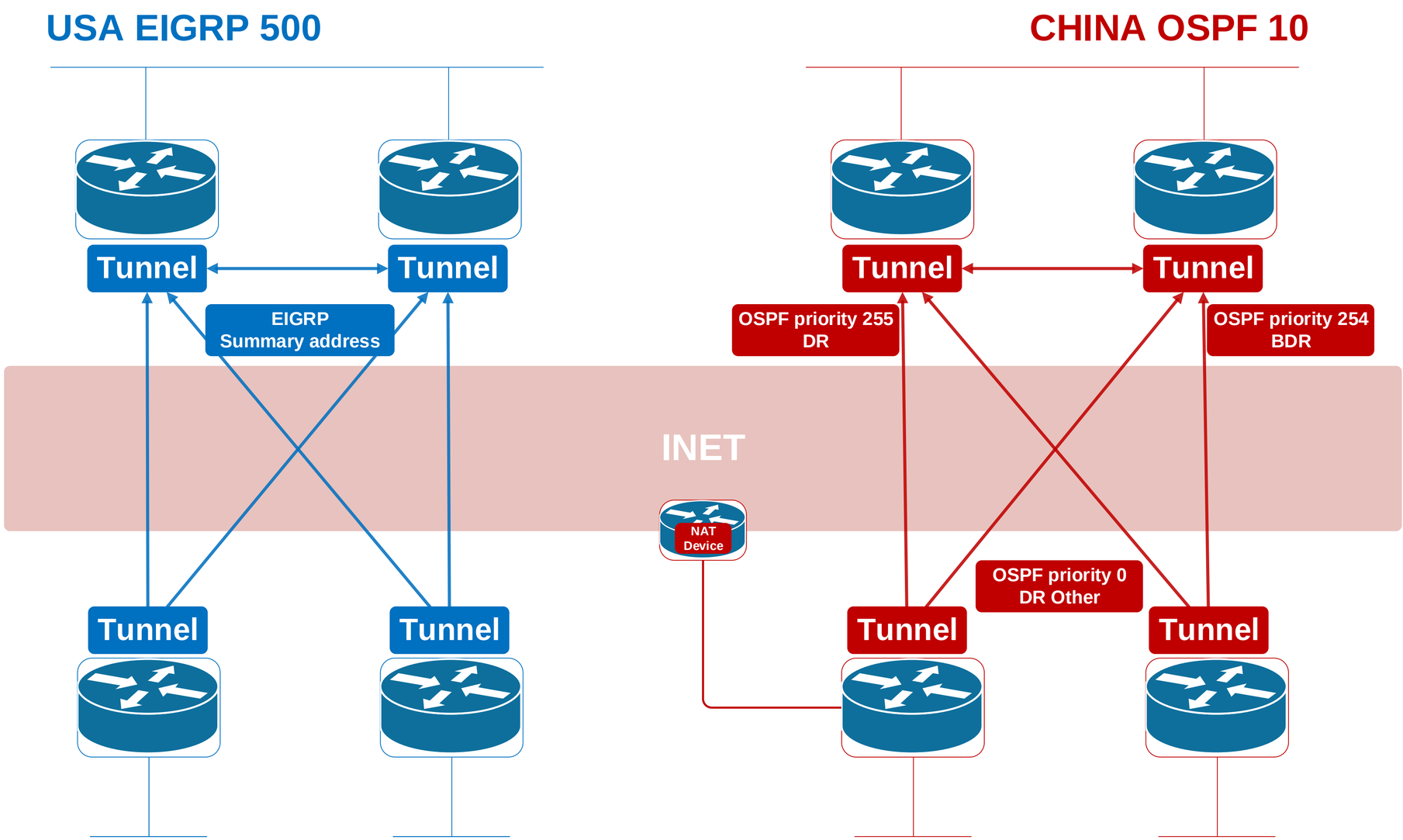
CHINA

```
Router ospf 30
 no redistribute bgp 65533 subnets
 no redistribute bgp 65533
 redistribute bgp 65533 subnets route-map
SET_USA_PREFIX_OSPF_OE1
!
ip prefix-list SET_USA_PREFIX_OSPF_OE1 seq 5 permit X.X.X.X/X
!
route-map SET_USA_PREFIX_OSPF_OE1 permit 10
 match ip address prefix-list SET_USA_PREFIX_OSPF_OE1
 set metric-type type-1
route-map SET_USA_PREFIX_OSPF_OE1 permit 20
```

IGP Traffic Engineering IPv6
Load Balancing

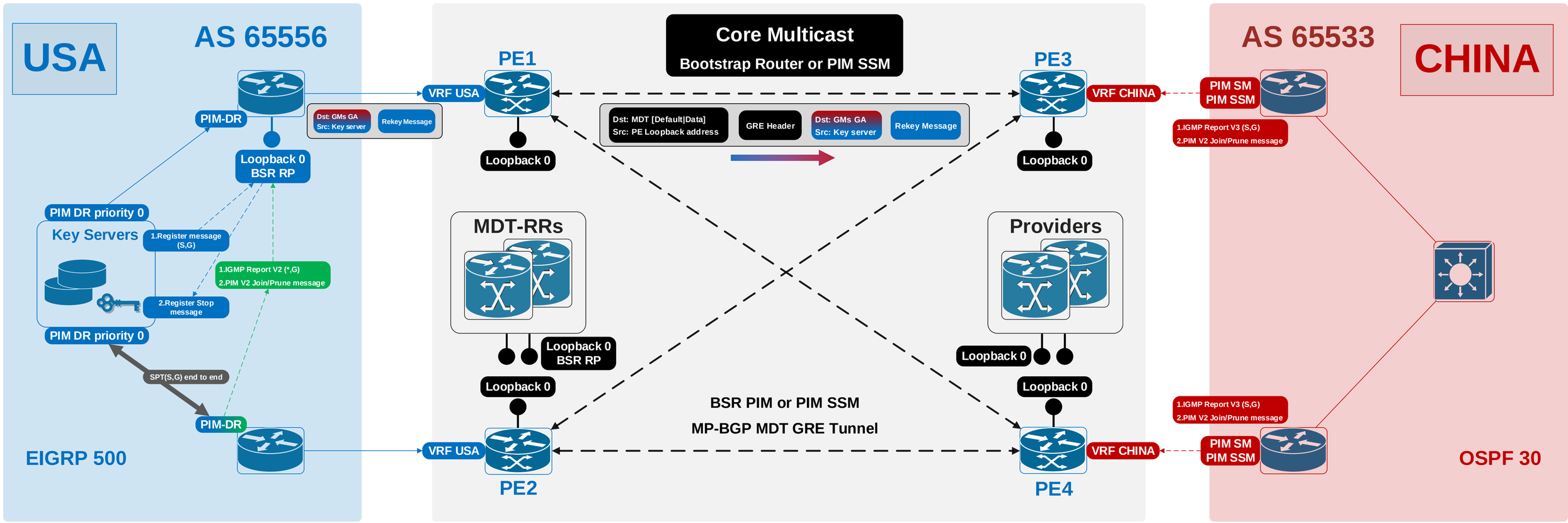


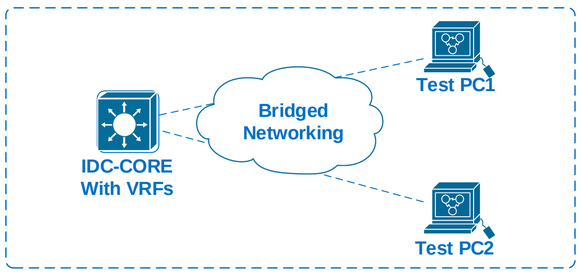
DMVPN Tunnels



- **Source tree (Shortest-Path Tree)**
- **Shared tree**
- **US_KS_1: 155.155.155.1/32**
- **US_KS_2: 155.155.155.2/32**
- **GMs IGMP: 232.155.155.1/2**

Multicast VPN Intra-AS LAB Topology

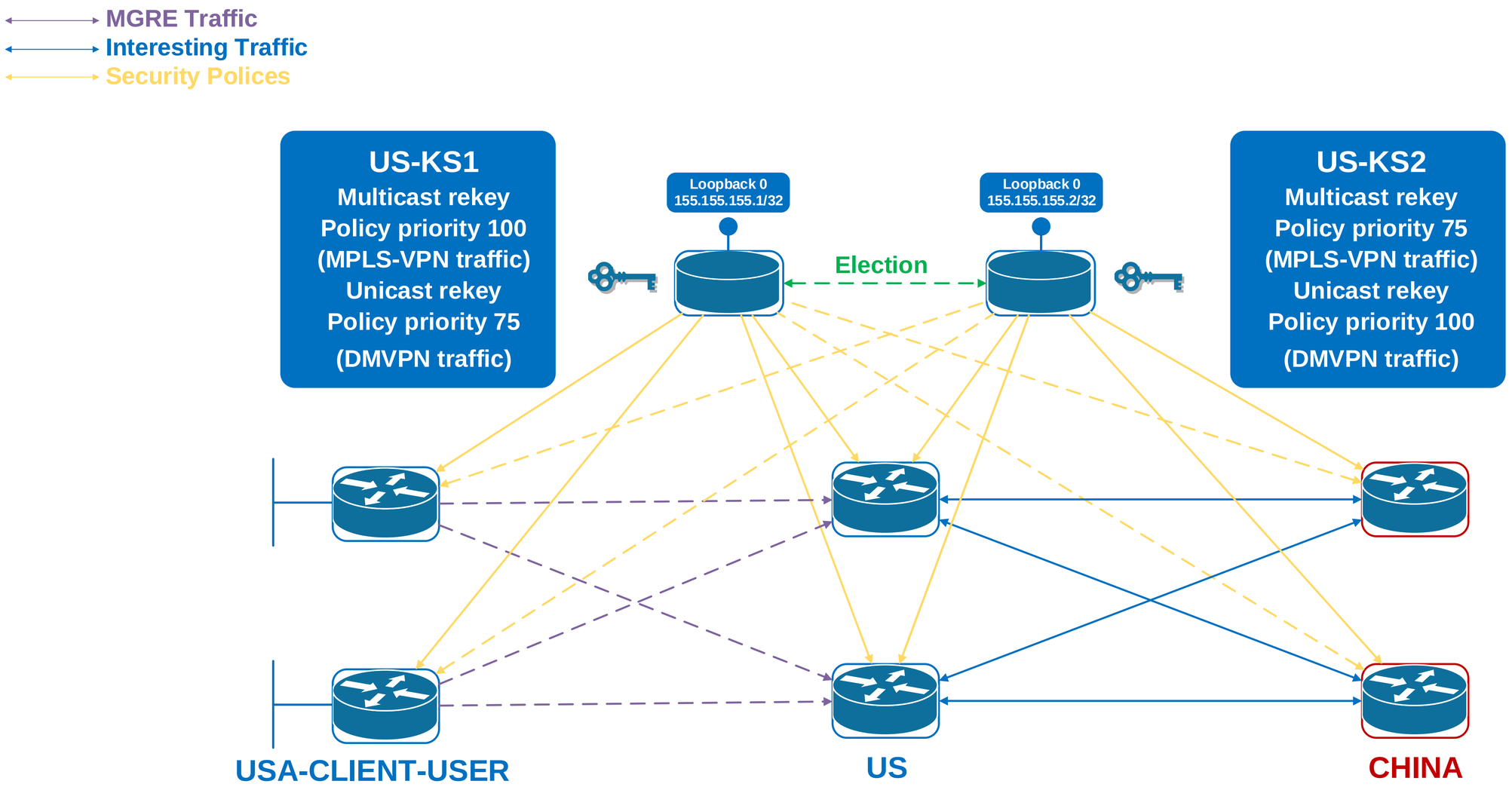




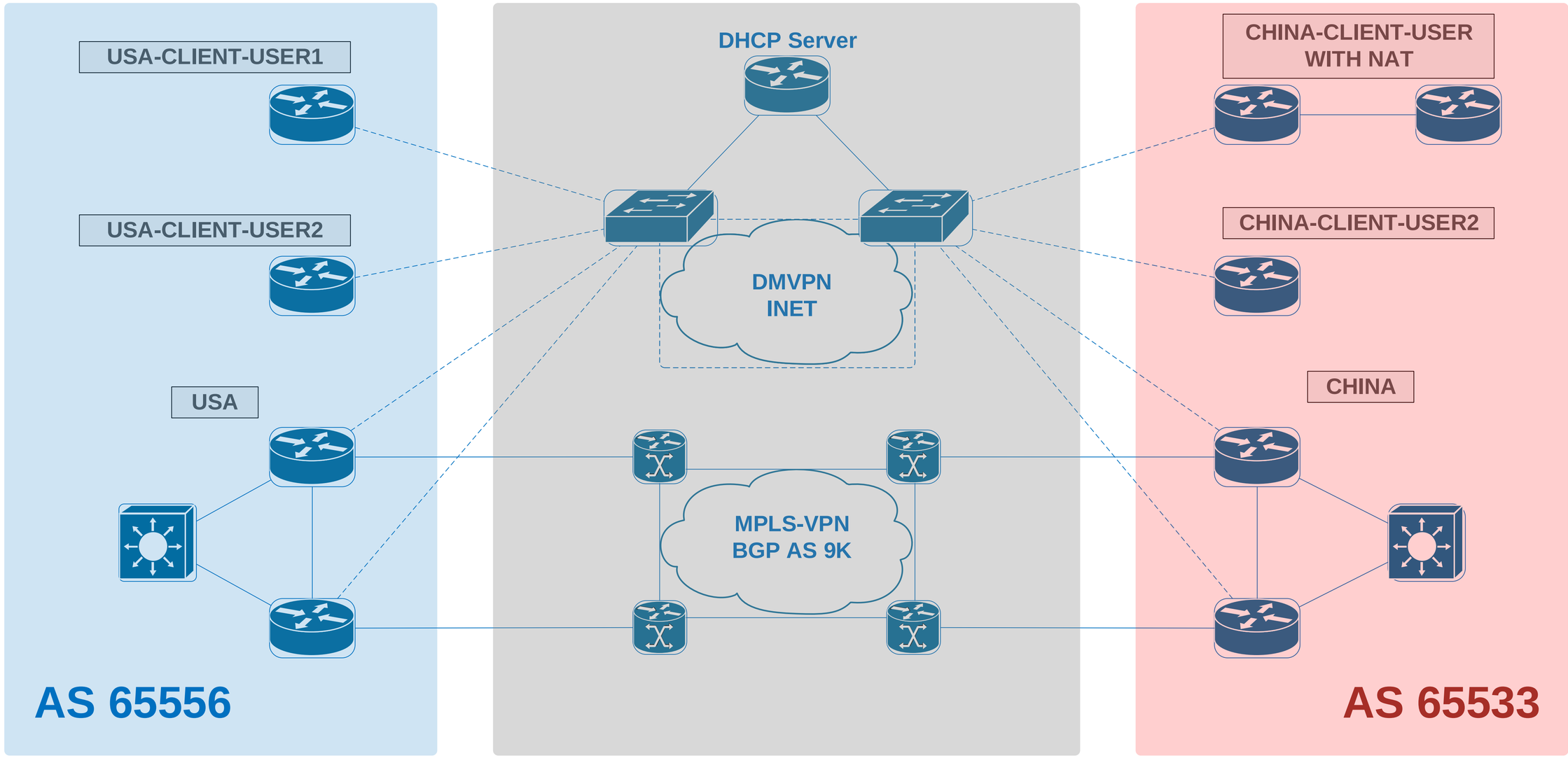
- **BSR:Bootstrap router**
- **RP:Rendezvous point**
- **PIM SM: Protocol Independent Multicast Sparse-mode**
- **PIM SSM:Source Specific Multicast**
- **IGMP:Internet Group Management Protocol**
- **MDT:Multicast Distribution Trees**
- **(S,G) = (Unicast source for the multicast group G, multicast group G)**
- **(*,G) = (Any source for the multicast group G, multicast group G)**

- **SSM:232.0.0.0/8**
- **BSR:224.0.0.0/4**
- **PIM SM Mode**
  MDT Default:239.0.0.1/32
- **PIM SSM Mode**
  MDT Default:232.232.232.232/32
  MDT Data:232.253.[PE Number].0/24

GET-VPN LAB Topology



DMVPN LAB Topology



MPLS-VPN Layer 3 Inter-AS Option A LAB Topology

Control plane
Data plane

BGP AS 9K

Providers

ABSR-1
91.91.91.1/30
VRF UK
Gig 1/0.1
OPTION A

PE1

VPNV4-RRs

19.19.1.1/30
VRF UK
Gig 1/0.1
OPTION A

ASBR-2

UK

Back to back VRF

Back to back VRF

BGP AS 1K

JAPAN
ABSR-1
91.91.91.2/30
VRF TOKYO
Gig 1/0.1
OPTION A

JAPAN-P
VPNV4-RR

19.19.1.2/30
VRF TOKYO
Gig 1/0.1
OPTION A

JAPAN
ASBR-2

JAPAN-PE1

Tokyo

MPLS-VPN Layer 3 Inter-AS Option B LAB Topology

Control plane
Data plane

BGP AS 9K

Providers

ABSR-1

91.91.91.5/30

Gig 1/0.2
OPTION B

PE1

VPNV4-RRs

UK

19.19.1.5/30

Gig 1/0.2
OPTION B

ASBR-2

BGP VPNV4 Peering

BGP VPNV4 Peering

BGP AS 1K

JAPAN
ABSR-1

91.91.91.6/30

Gig 1/0.2
OPTION B

JAPAN-P
VPNV4-RR

19.19.1.6/30

Gig 1/0.1
OPTION B

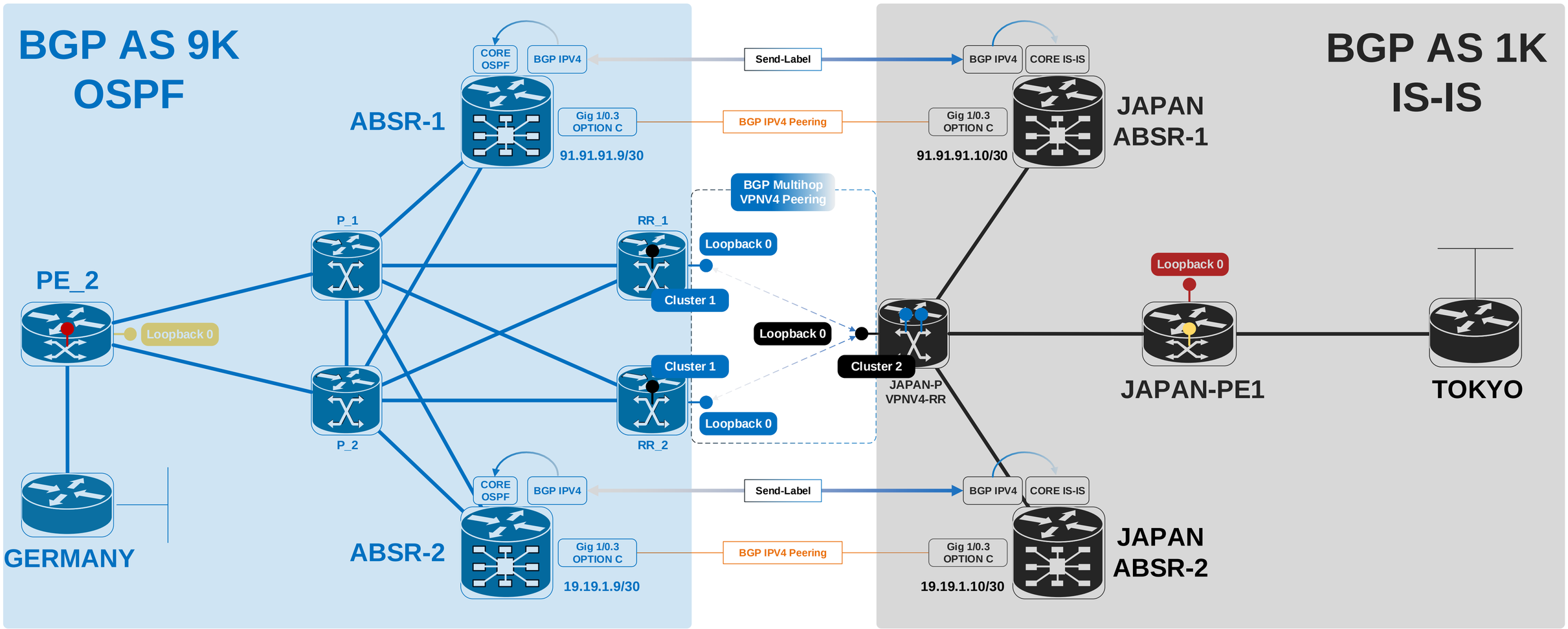
JAPAN
ASBR-2

JAPAN-PE1

Tokyo

MPLS-VPN Layer 3 Inter-AS Option C LAB Topology

Loopback 0 169.169.253.253/32
Loopback 0 169.169.254.254/32
Loopback 0 192.168.253.253/32
Loopback 0 169.169.253.2/32
Loopback 0 192.168.251.251/32

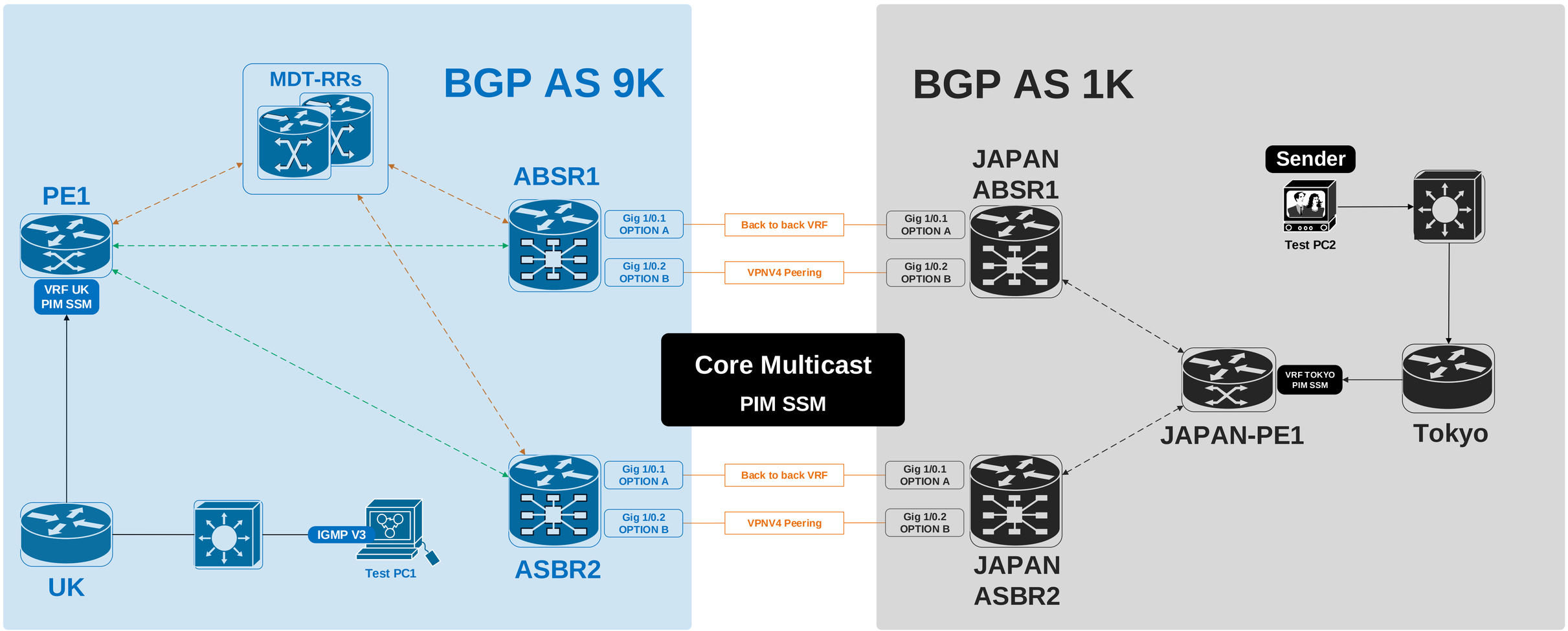


Multicast VPN Inter-AS LAB Topology

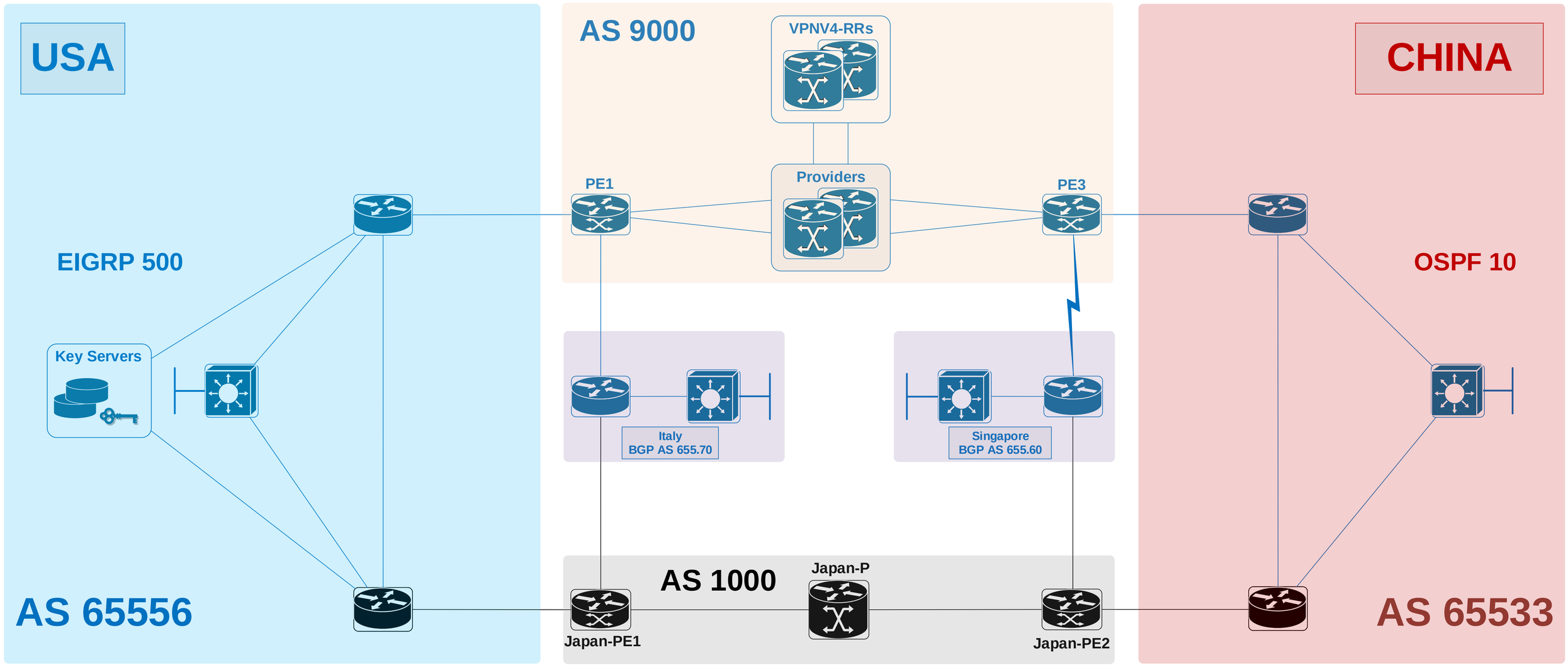
MP-BGP MDT session

MDT Tunnel

- Tokyo Test PC2: 111.111.111.111/24
- UK Test PC1 IGMP V3: 232.7.7.7



Dual Carrier LAB Topology



MULTI-HOMED SOURCE NAT IPv4