



SRv6 in FRR

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SRv6 in FRR – Very Mature Support



<https://frrouting.org/>

- 5 years of support in mainline (since FRR 8.1 - 2021)
- ~420 Pull Requests
- ~1500 Commits
- Main contributors:
 - Cisco, Alibaba, LINE Corporation, 6WIND
 - Cisco is the number one contributor
 - > ~210 Pull Requests, ~910 Commits
- Thanks to the FRR community:
 - Donald Sharp, Donatas Abraitis, Russ White, Philippe Guibert, Dmytro Shytyi

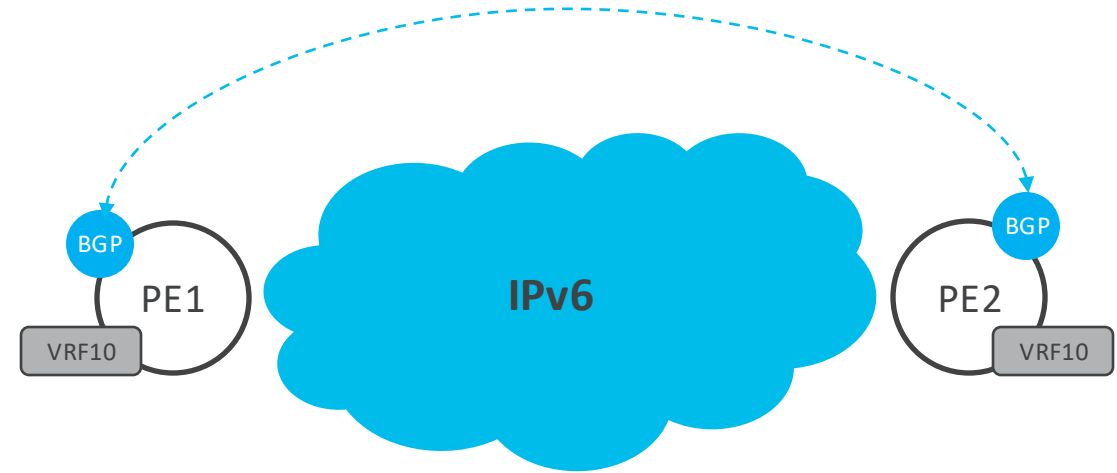
SRv6 in FRR – Very Mature Support

- BGP L3 Services - RFC 9252
 - L3VPN: IPv4/IPv6
 - GRT: IPv4/IPv6
- IS-IS Underlay - RFC 9352
- Static SIDs
- Static Traffic Steering into SRv6 SID List
- BGP-LS:
 - Both IS-IS and eBGP fabrics

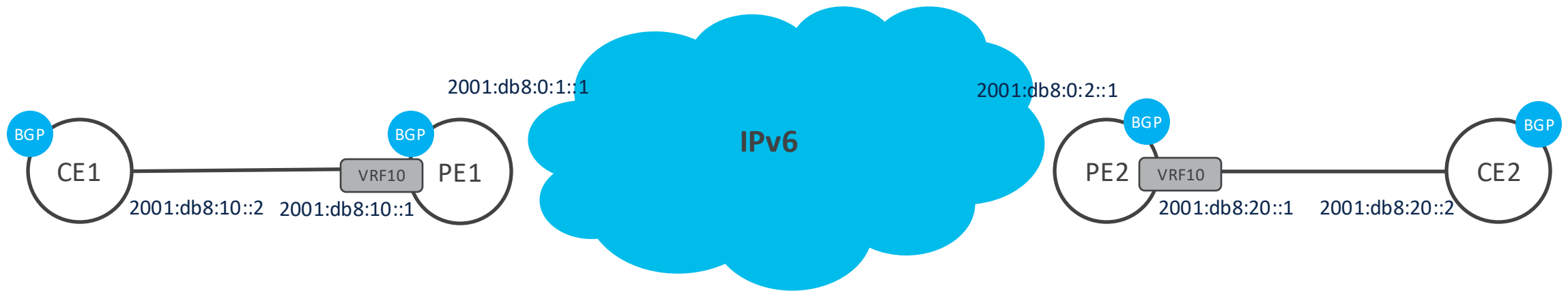
SRv6 BGP L3VPN

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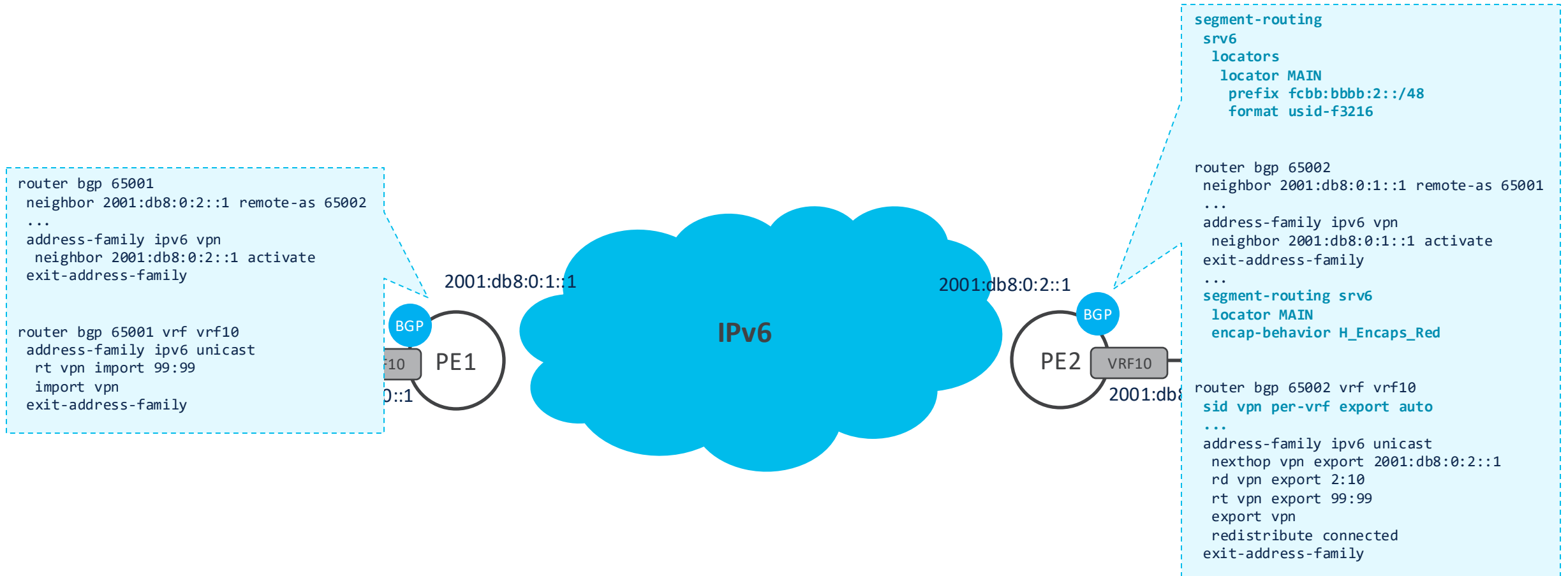
- IETF RFC 9252
- BGP exchanges VPN routes between PEs
- SRv6 carries VPN traffic across the IPv6 core
- Fully supported in FRR:
 - VPNv4 and VPNv6



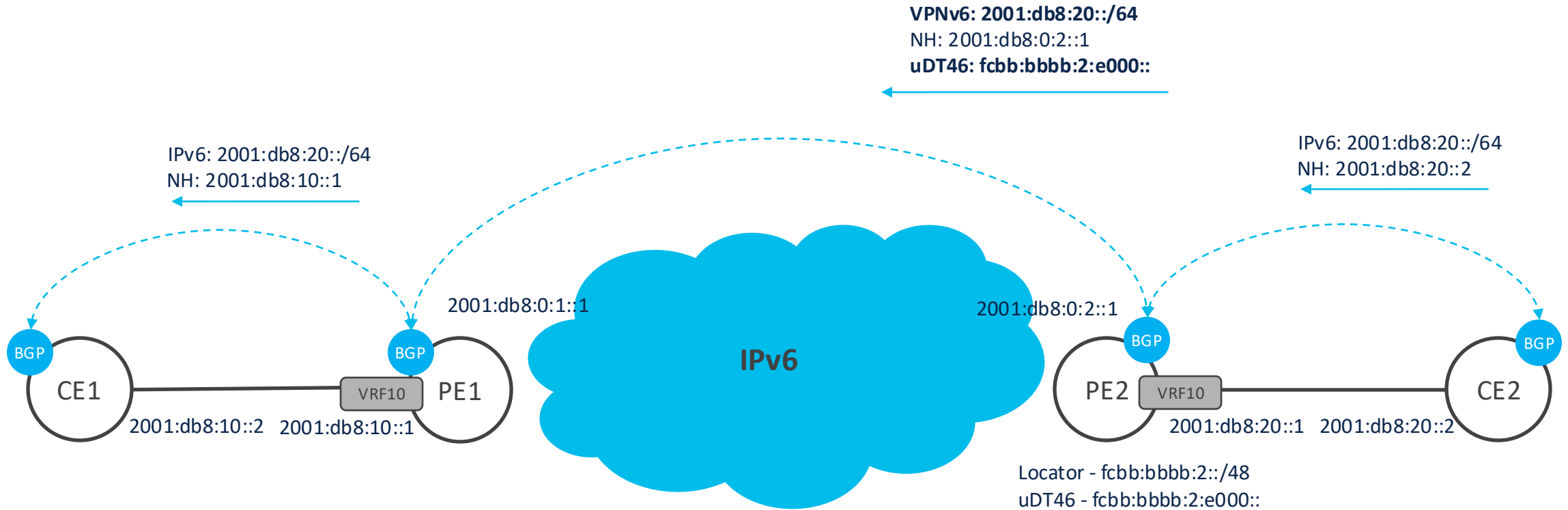
SRv6 BGP L3VPN – Configuration



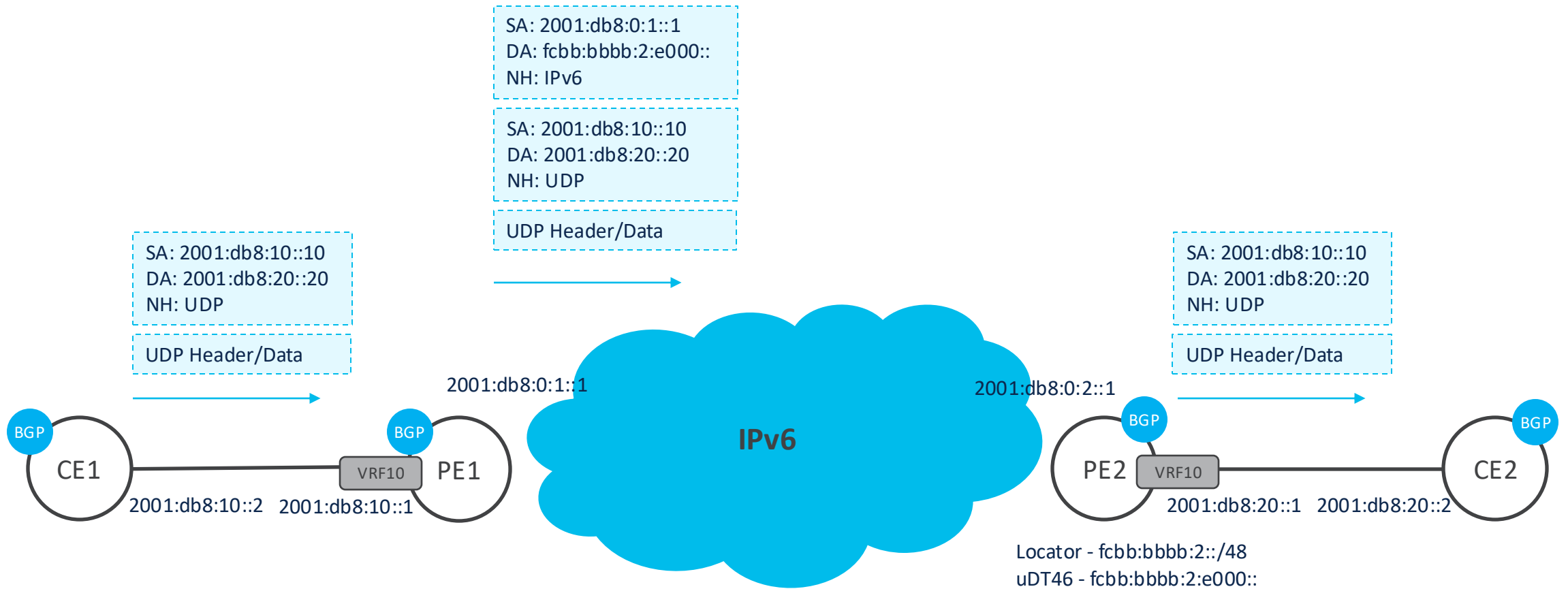
SRv6 BGP L3VPN – Configuration



SRv6 BGP L3VPN – Control Plane



SRv6 BGP L3VPN – Data Plane

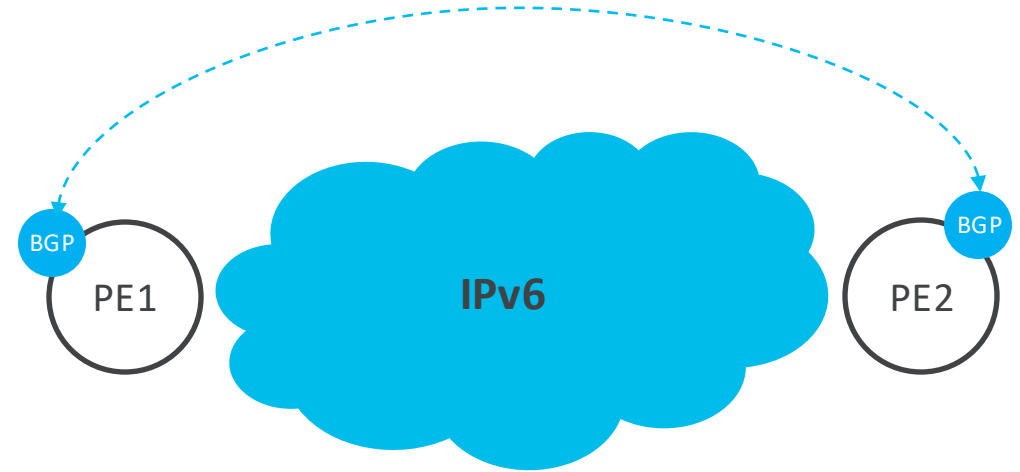


Decap + VRF Lookup

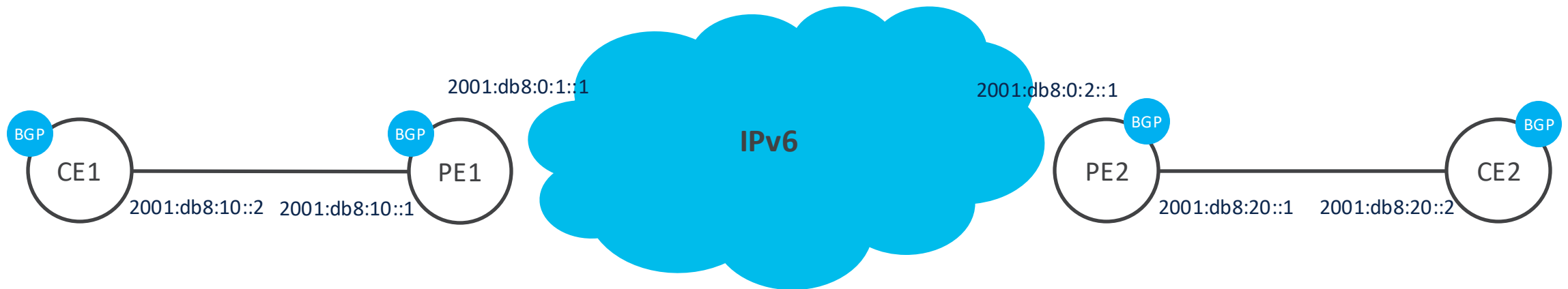
SRv6 BGP GRT

SRv6 BGP GRT “Global Routing Table”

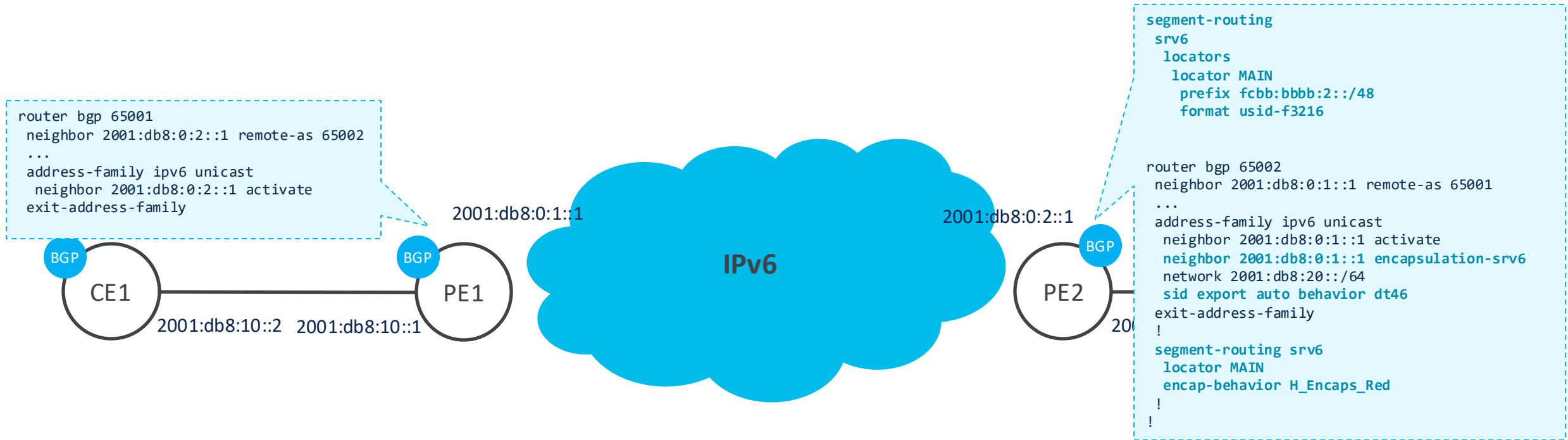
- Another BGP SRv6 service from RFC 9252
- Same model as L3VPN:
 - BGP advertises route + SRv6 SID
 - SRv6 transports traffic across the IPv6 core
- Difference:
 - No customer VRF
 - No VPN routes
 - Routes are IPv4/IPv6 unicast routes from the global routing table
- Fully supported in FRR



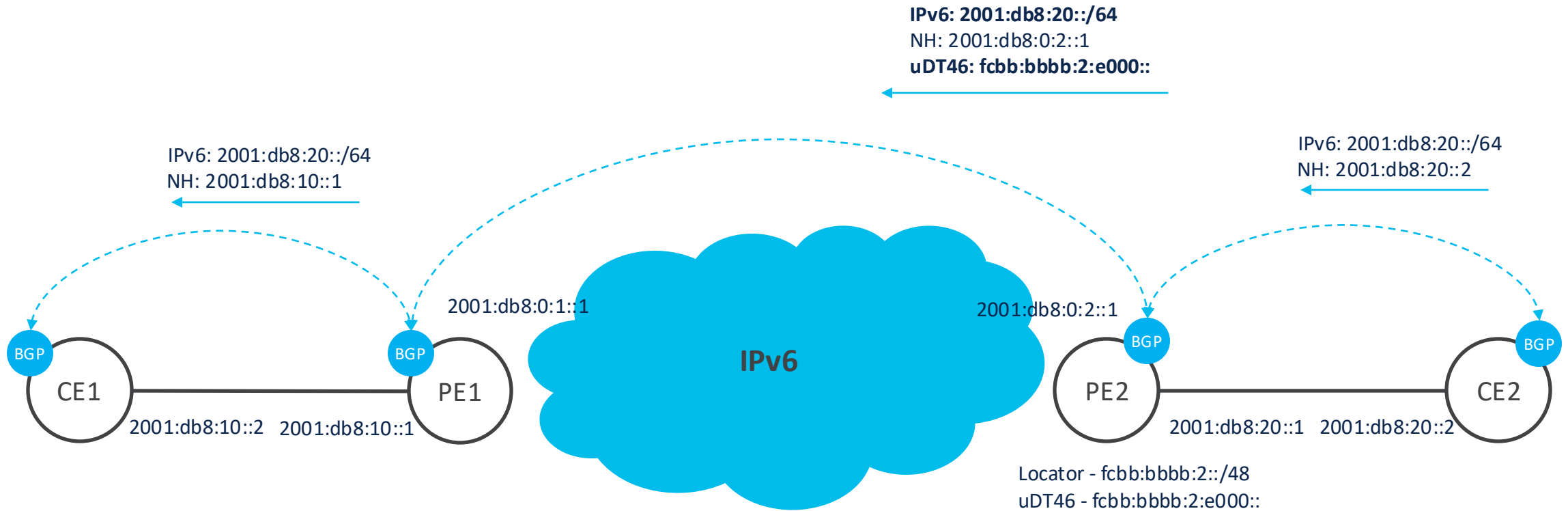
SRv6 BGP GRT – Configuration



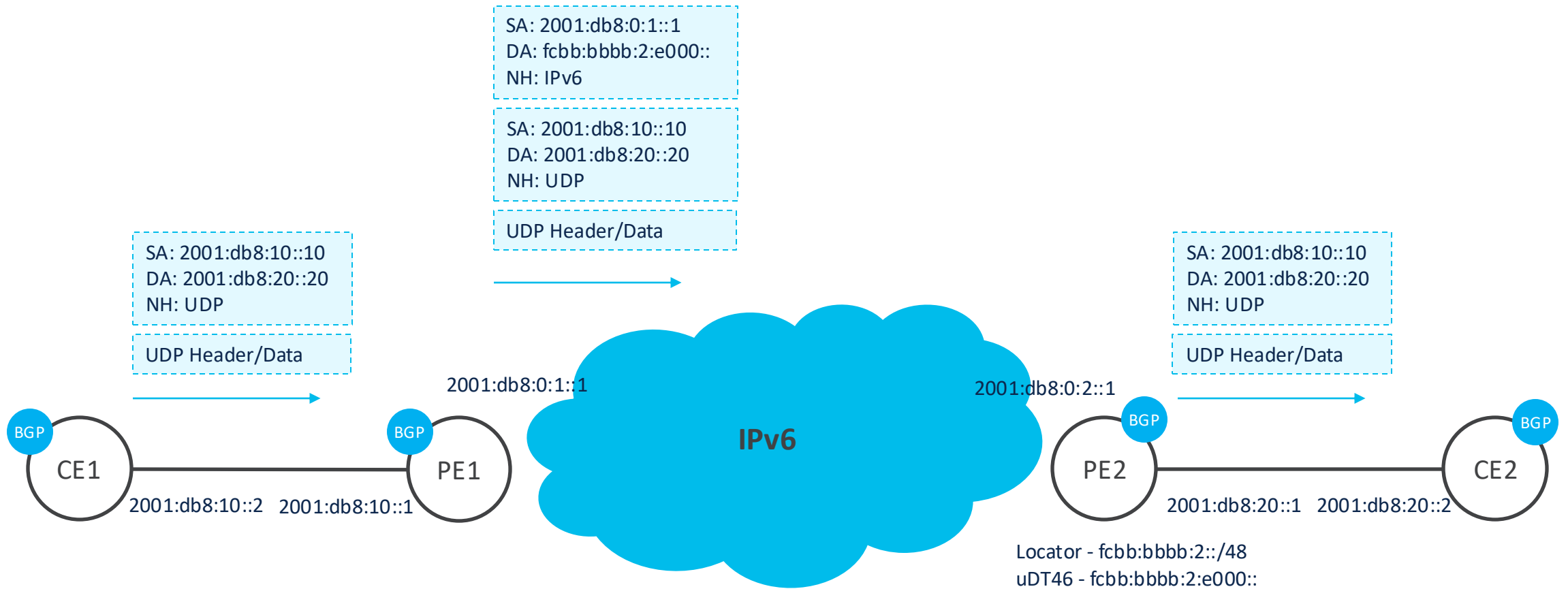
SRv6 BGP GRT – Configuration



SRv6 BGP GRT – Control Plane



SRv6 BGP GRT – Data Plane

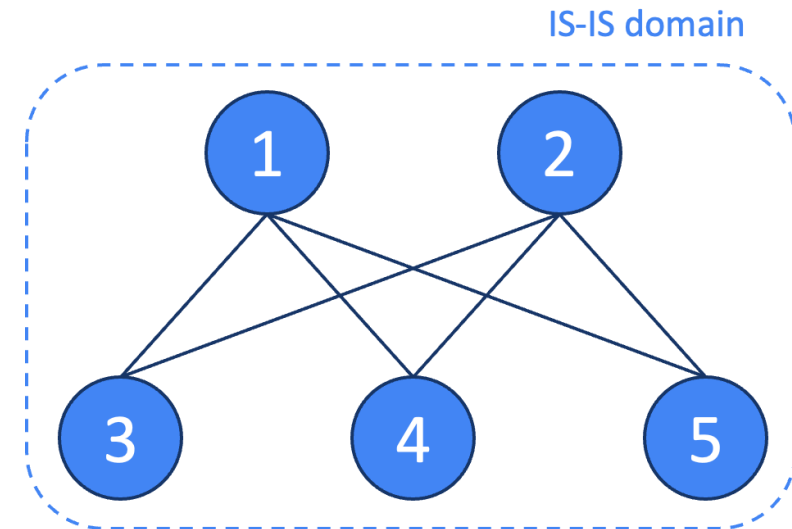


Decap + GRT Lookup

SRv6 IS-IS Underlay

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- IS-IS builds the underlay topology
 - Reachability, prefixes, link metrics
- IETF RFC 9352 – An IS-IS extension to advertise:
 - SRv6 locator
 - uN SID: node SID
 - uA SID: adjacency SID
 - SRv6 capabilities
- Fully supported in FRR



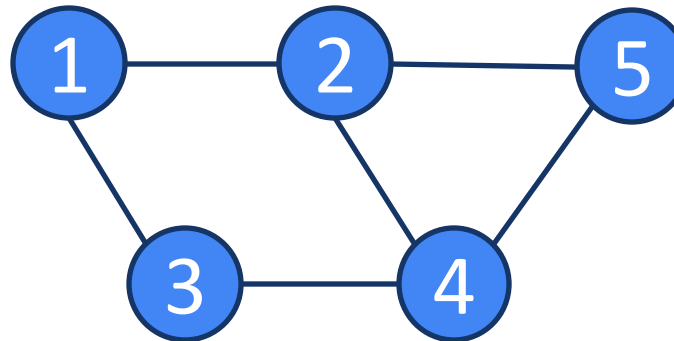
SRv6 Static SIDs

SRv6 Static SIDs

- Main use case: SRv6 SDN deployment
- Static SRv6 SIDs programmed by the SDN controller
 - uN: Node SID
 - uA: Adjacency SID
 - uDT4 / uDT6 / uDT46: VPN SID “decapsulation + table lookup”
- Fully supported in FRR
- Microsoft SRv6 SDN use case in SONiC:
 - https://github.com/sonic-net/SONiC/blob/master/doc/srv6/srv6_static_config_hld.md
 - Collaboration between Cisco, Alibaba, Microsoft, and Nvidia

SRv6 Static SIDs – Configuration

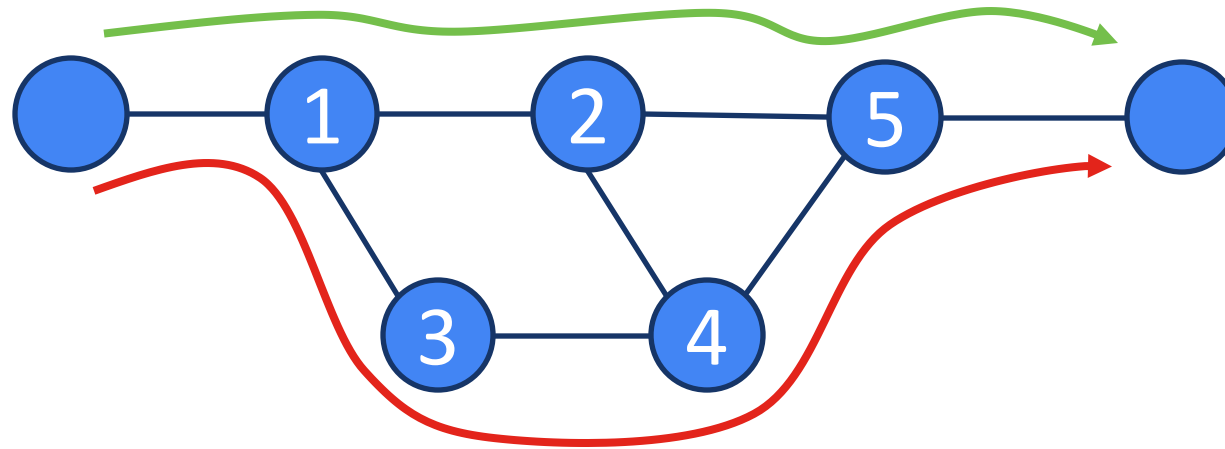
```
segment-routing
srv6
  locators
    locator MAIN
      prefix fcbb:bbbb:1::/48
      format usid-f3216
  !
  static-sids
    sid fcbb:bbbb:1::/48 locator MAIN behavior uN
    sid fcbb:bbbb:1:fe10::/64 locator MAIN behavior uDT4 vrf Vrf10
    sid fcbb:bbbb:1:fe20::/64 locator MAIN behavior uDT6 vrf Vrf20
    sid fcbb:bbbb:1:fe30::/64 locator MAIN behavior uDT46 vrf Vrf30
    sid fcbb:bbbb:1:fe40::/64 locator MAIN behavior uA interface eth0
```



Static Traffic Steering into SRv6

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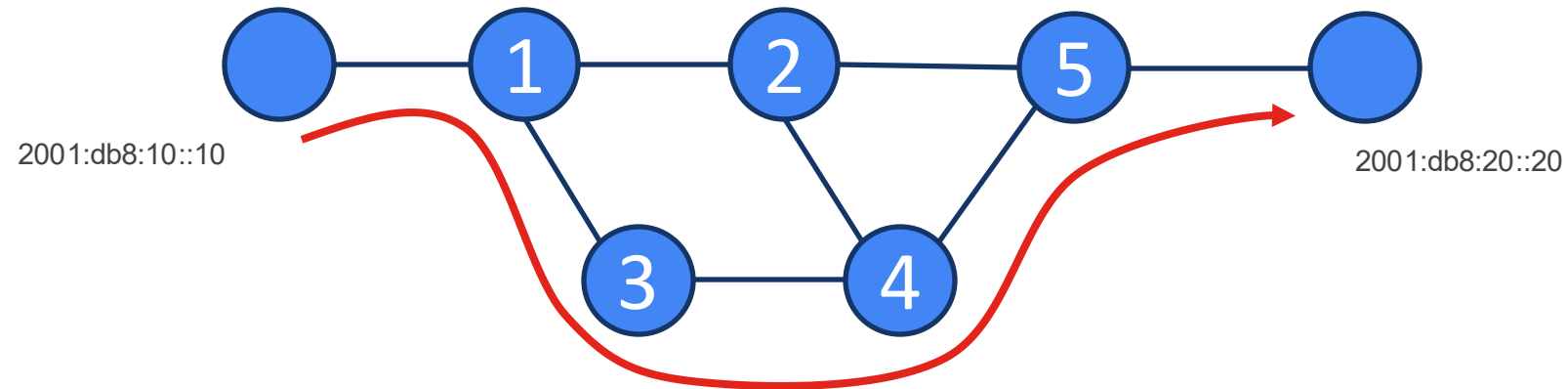
- Steers IPv4/IPv6 traffic over an explicit SRv6 path
 - The path is encoded as an SRv6 SID list
- Example:
 - Default routing follows the **best path**
 - Static steering overrides it with an **explicit path**



Fully supported in FRR

Static Traffic Steering into SRv6 – Configuration

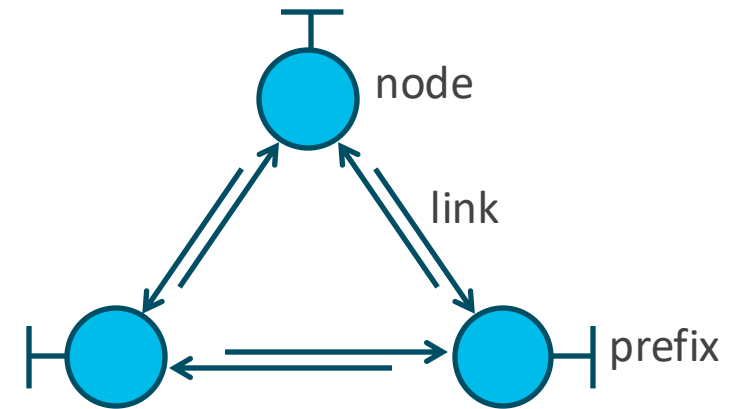
```
ip route 2001:db8:20::/64 eth0 segments fcbb:bbbb:3:4:5:fe00:: encap-behavior H_Encaps_Red
```



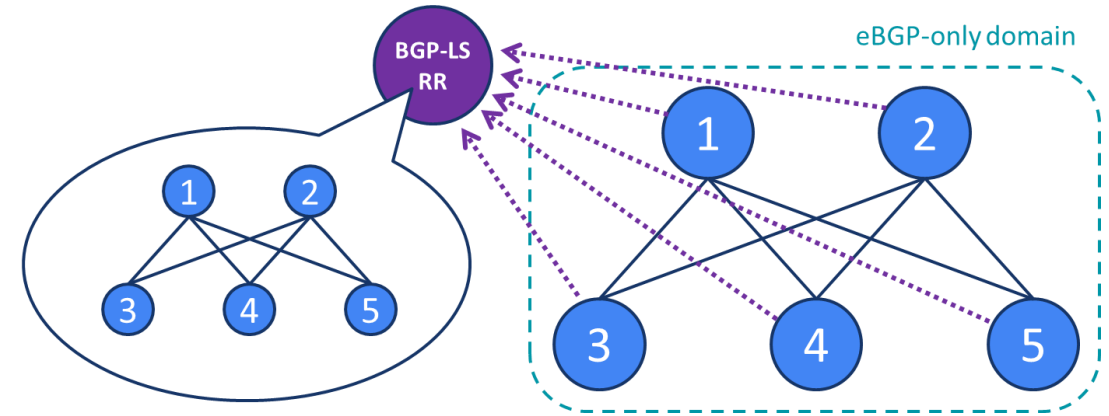
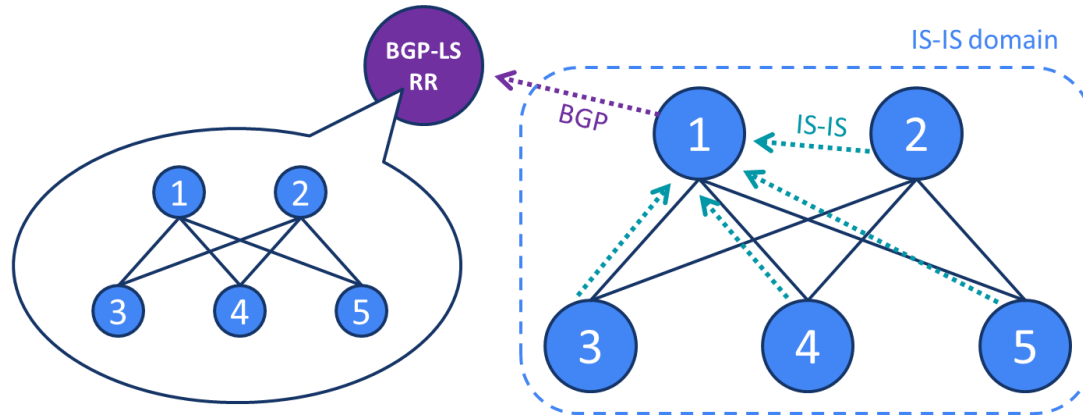
BGP Link-State

BGP Link-State

- IETF RFC 9552 – a BGP extension to:
 - **Collect** topology info from the network protocol (IGP, BGP)
 - **Normalize** protocol information into a single topology model
 - **Distribute** it to any app or process that requires the topology
- BGP-LS topology model, three base object types:
 - **Node** – router, switch, protocol instance
 - **Link** – directed link anchored to two nodes
 - **Prefix** – anchored to a node
- Different BGP NLRI type per object-type
- More object/NLRI types exist (SRv6 SID, ...)



BGP-LS – Two deployment models



RR

```
router bgp 65000
  neighbor 10.0.1.1 remote-as 65000
  !
  address-family link-state link-state
    neighbor 10.0.1.1 activate
  exit-address-family
```

R1

```
router bgp 65000
  neighbor 10.0.0.1 remote-as 65000
  !
  address-family link-state link-state
    neighbor 10.0.0.1 activate
  exit-address-family

router isis FRR
  net 49.0001.0000.0000.0001.00
  distribute link-state
  !
```

RR

```
router bgp 65000
  neighbor 10.0.1.1 remote-as 65000
  neighbor 10.0.2.1 remote-as 65000
  neighbor 10.0.3.1 remote-as 65000
  neighbor 10.0.4.1 remote-as 65000
  neighbor 10.0.5.1 remote-as 65000
  !
  address-family link-state link-state
    neighbor 10.0.1.1 activate
    neighbor 10.0.2.1 activate
    neighbor 10.0.3.1 activate
    neighbor 10.0.4.1 activate
    neighbor 10.0.5.1 activate
  exit-address-family
```

R1 – R5

```
router bgp 65000
  neighbor 10.0.0.1 remote-as 65000
  !
  address-family link-state link-state
    distribute bgp-fabric-link-state
    neighbor 10.0.0.1 activate
  exit-address-family
```

Conclusion

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- SRv6 in FRR – Very Mature Support
 - BGP L3VPN & GRT Services
 - IS-IS Underlay
 - Static SID allocation
 - Static Traffic Steering into SRv6 SID List
 - BGP-LS: IS-IS and eBGP fabrics
- Very rich ecosystem
 - Cisco, Alibaba, 6WIND, LINE Corporation
- We are committed to supporting SRv6 in FRR:
 - New features, bugfixes, testing, ...

