Service Interworking between SRv6

draft-cheng-spring-service-interworking-srv6-05

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Introduction & Motivation

Problem Statement

Operators deploy SRv6 for L3VPN/L2VPN services.
Networks are not always a single domain, often split into multiple Ass or administrative domains.
Locator routes (for service SIDs) are not advertised across domains.
This breaks the end-to-end service path.

Basis for Solution

Need interworking across domains.
Inspired by BGP/MPLS VPN models (Options A, B, C).
Adapt models to SRv6 BE and TE forwarding.

Goal

Describe how to achieve end-to-end SRv6 VPN service interworking across domains.

Reference Topology

We use a standard multi-AS topology for our examples:

CE (Customer Edge)

CE1 and CE2 represent the customer endpoints.

PE (Provider Edge)

PE1, PE6 are the ingress and egress PEs connected to CEs.

ASBR (AS Border Router)

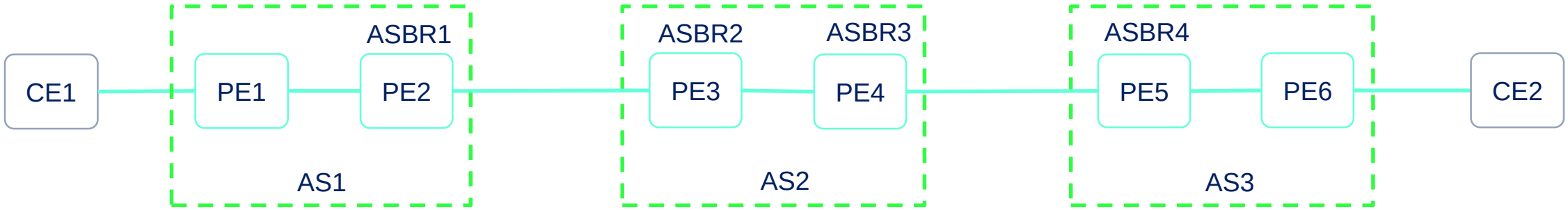
PE2-PE5 are the routers at the boundaries between ASs.

SRv6 Domains

Each AS is a separate SRv6 domain with its own locator space.

Traffic Flow

Focus on traffic from CE1 to CE2, illustrating how the service is maintained across the three ASs.



Option A: VRF-to-VRF

Core Idea

ASBRs treat each other as if they were CE routers.
Direct links configured with sub-interfaces bound to specific VRFs.

Control Plane

Within AS : iBGP advertises VPNv4/v6 routes + VPN SIDs.
Between ASBRs : eBGP advertises IPv4/IPv6 unicast routes.

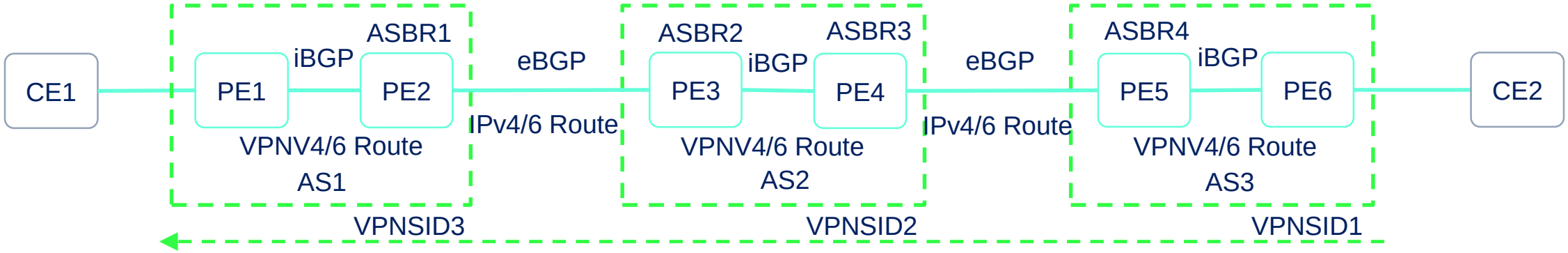
Forwarding

SRv6 BE : SRv6 inside AS, standard IP over VRF-lite links.
SRv6 TE : SR Policy inside AS, terminated at egress PE.

Characteristics

Simplicity : No new SRv6 functions required on ASBRs.
Scalability : Poor, requires dedicated link/sub-interface per VPN.

Summary: Simple implementation but limited scalability due to per-VPN link requirements.



Option B: VPN Route Redistribution

Core Concept

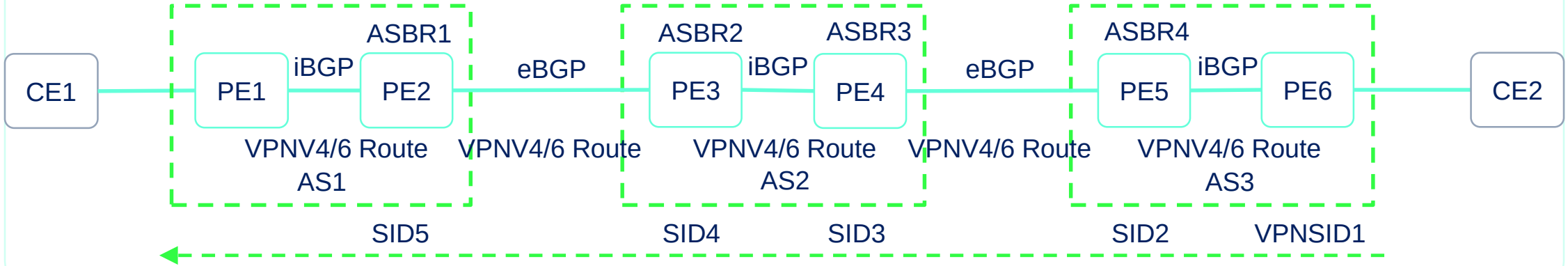
- ASBRs do **not** bind VPNs to physical interfaces.
- VPNv4/v6 routes are redistributed via eBGP.
- Traffic carried over multi-segment SRv6 tunnels.

Key Characteristics

- **Scalability :** Better than Option A (no per-VPN links).
- **Complexity :** Medium (requires new SID behaviors).

SRv6 BE Operation

- Allocates a **new local SID** mapped to the original VPN SID (or SID).
- Advertises the new SID internally within the AS or between ASs.
- Forwarding : Simple Destination Address (DA) replacement.



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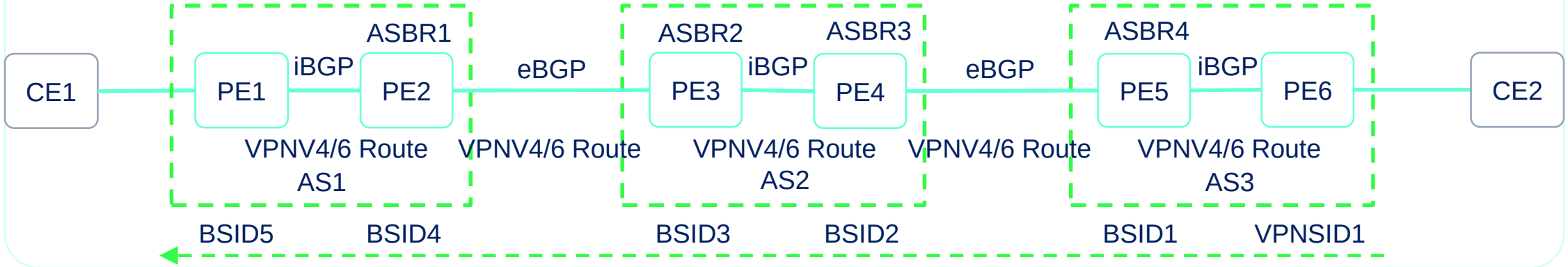
SRv6 TE Operation

- Uses **Binding SIDs (BSIDs)** for segment lists.
- New **End.B6R** type enables stitching TE paths across domains.



Summary: Option B avoids per-VPN interface overhead by redistributing routes via eBGP and using SRv6 SID/BSID translation, offering better scalability than Option A.

Option C: Multi-hop eBGP (PE-to-PE)

Core Idea

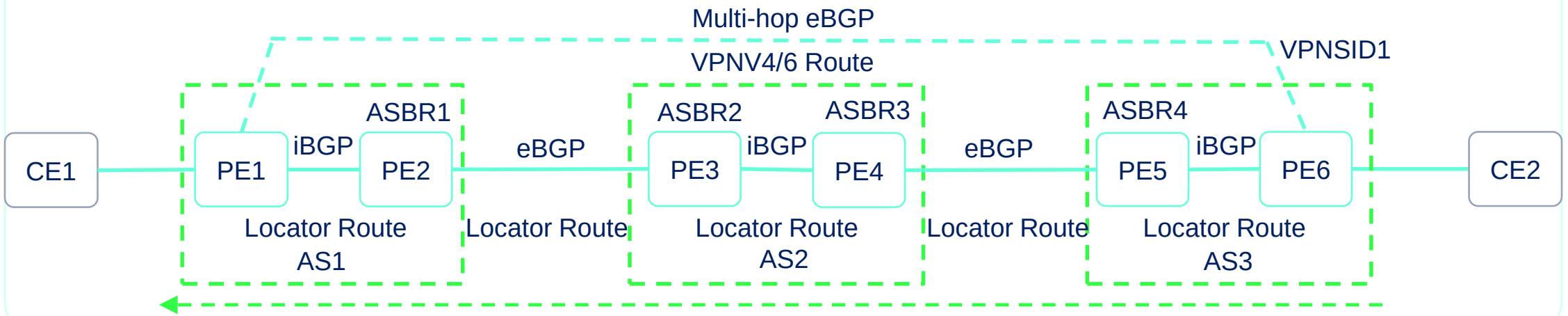
Egress PE (PE6) directly advertises VPN routes & SIDs to Ingress PE (PE1) in a different AS.
Uses **multi-hop eBGP** between PEs.

Characteristics

Scalability : **High** (PE-to-PE model).
Complexity : **High** (Requires multi-hop eBGP & locator propagation).

SRv6 BE

Requires **Locator Routes** to be advertised across intermediate ASs.
Forwarding : Single SRv6 encapsulation (IPv6 header) to VPN SID.



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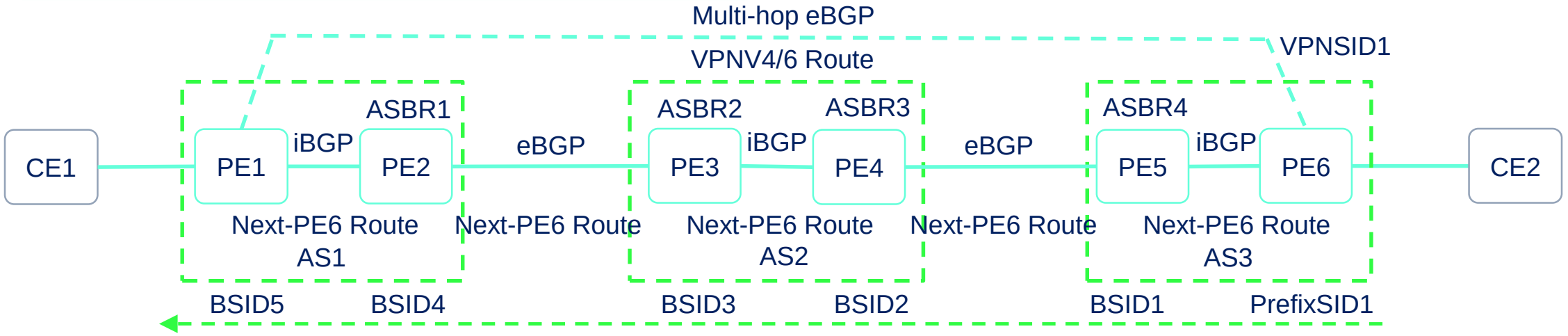
SRv6 TE

With Controller : Directly programs end-to-end SRv6 Policy.
Without Controller : Resolve next hop to segment list (uses End.B6R).

Summary : Option C offers the best scalability as it removes ASBRs from the data plane path, but it requires the most complex control plane setup, including multi-hop eBGP between PEs and careful management of locator route advertisements across domains.



Intra-domain Interworking: HVPN

Scenario

- Splits PE function into **UPE** (access) and **SPE** (core).
- UPE handles customer traffic.
- SPE manages VPN routes.

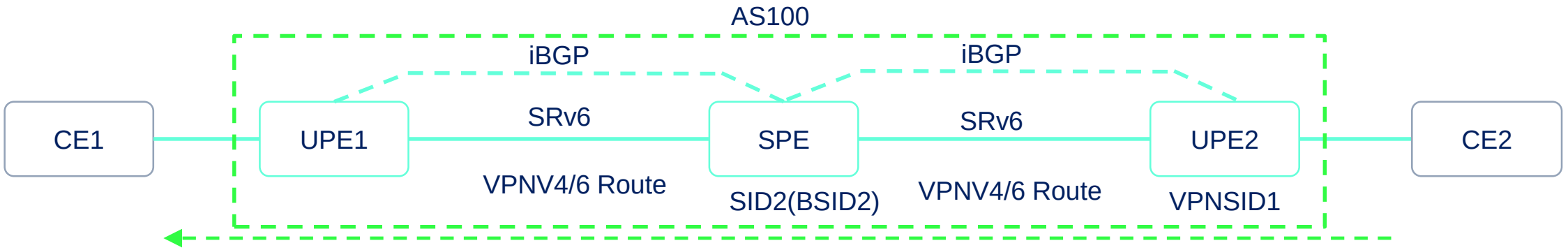
SRv6 Adaptation

- Analogous to **Option B** inter-domain.
- UPE advertises VPN SID via iBGP.
- SPE allocates new SID (ASBR role).

Forwarding

- SPE performs **SID replacement**.
- Swaps its SID for destination UPE's VPN SID.
- Similar to DA replacement in Option B.

Conclusion: The same mechanisms developed for inter-domain Option B can be directly applied to solve the intra-domain HVPN scenario with SRv6.



Solution Comparison & Deployment Considerations

Feature	Option A (VRF-to-VRF)	Option B (Route Redir.)	Option C (Multi-hop eBGP)
Model	VRF Lite (ASBR as CE)	ASBR as Route Reflector	PE-to-PE (ASBR as Transit)
ASBR VPN Binding	Per VPN (sub-interface)	None	None
Route Type	IPv4/IPv6 Unicast	VPNv4/v6	VPNv4/v6
VPN SID Handling	Terminated per AS	Replaced at each ASBR	End-to-End (unchanged)
Complexity	**Low**	**Medium**	**High**
Scalability	Low (Per-VPN links)	Medium	High

Option A : Small Scale

Suitable for small deployments or strict isolation. Easy to implement but lacks scalability.

Option B : Balanced

Good balance for operators. Better scalability than A without C's complexity. Uses End.B6R.

Option C : Large Scale

Best for unified networks. Highly scalable but complex. Requires locator route advertisement.

Key Decision Factors : The choice depends on network size, administrative boundaries, trust model between ASs, and existing operational models (e.g., preference for PE-to-PE vs. ASBR-based models).

Next Steps

- **WG Feedback : Seek comments on proposed solutions**

- **Call to Action :**

  We believe these solutions fill a critical gap in SRv6 deployment. Please review the draft and provide your valuable feedback to help us advance this work towards standardization.

Thank You for Your Attention