

# I-AS MPLS VPN Solutions



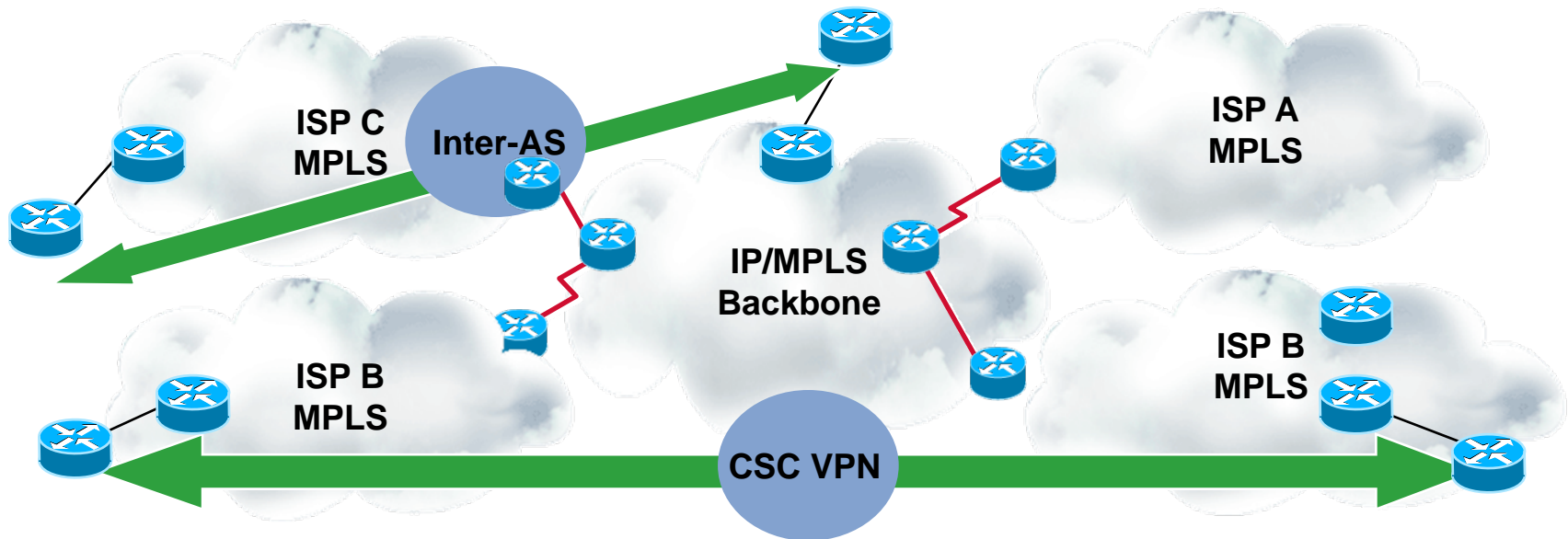
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# Agenda

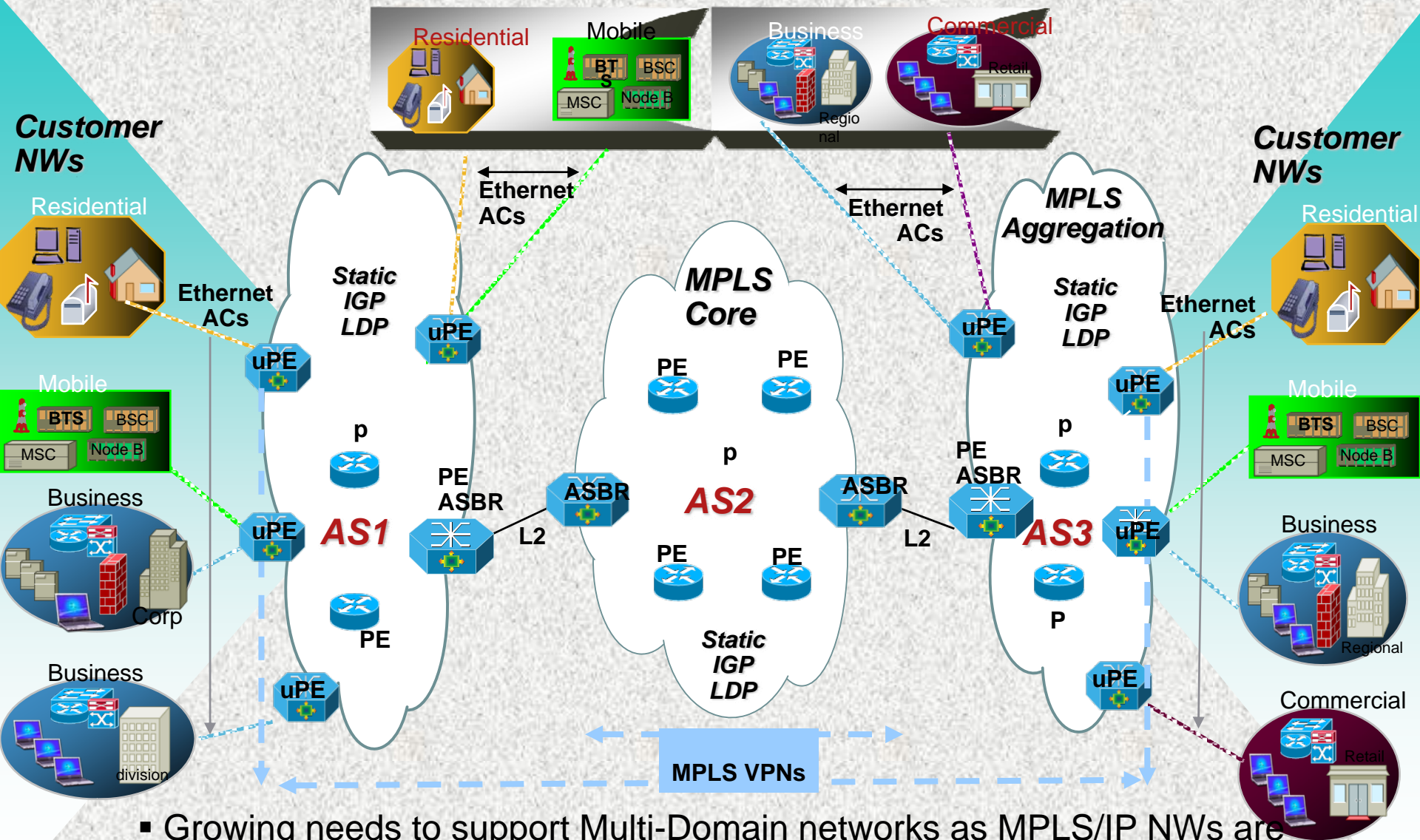
- I-AS MPLS L3VPN Deployment Models
- I-AS MPLS L2VPNs Deployment Models

# Global IP Inter-provider VPN Services



- **Inter-AS VPNs scale to large networks and span multi-domain networks**
- **Two methods of inter-connecting multi-domain networks**
  - **MPLS Inter-AS VPNs and Carrier Supporting Carrier VPNs**
- **Allows Time-to-Service, Global Reach, Reduced Cost**

# End-to-End Service Continuity via I-AS Networks

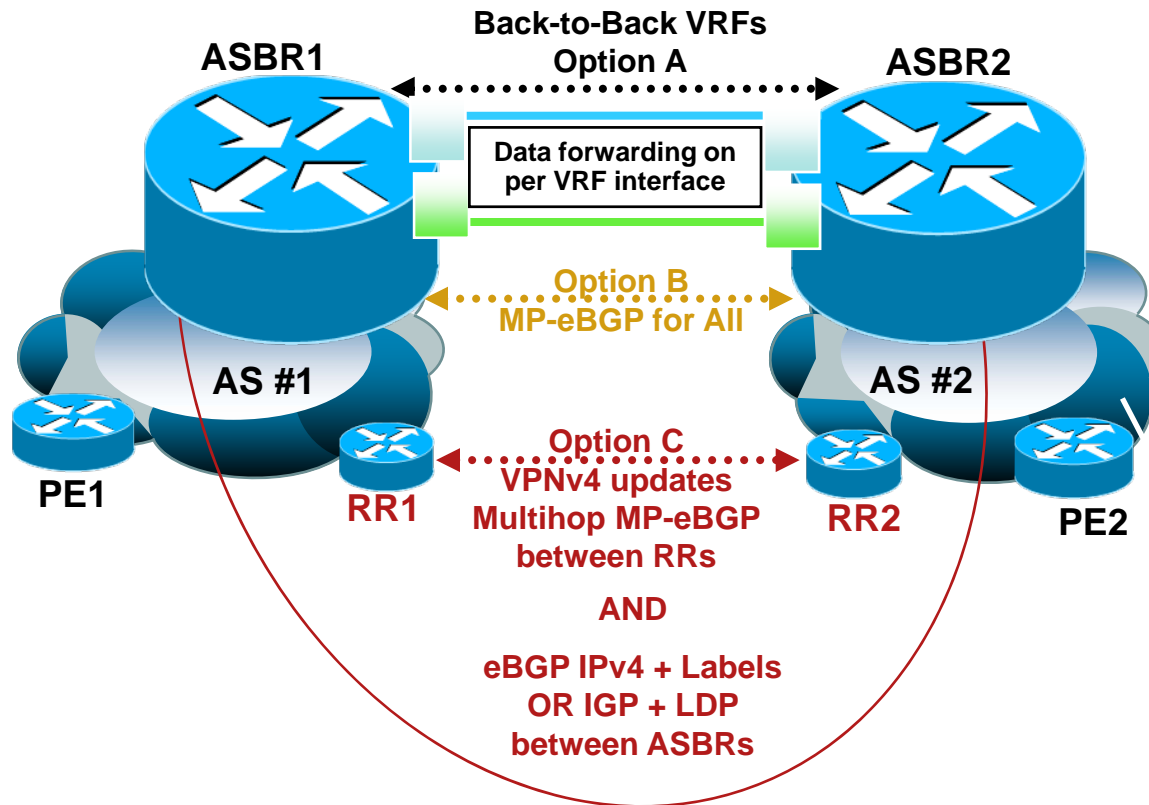


- Growing needs to support Multi-Domain networks as MPLS/IP NWs are becoming predominant
- VPN service transported over multiple MPLS segments

# Inter-AS L3VPN Deployment Models

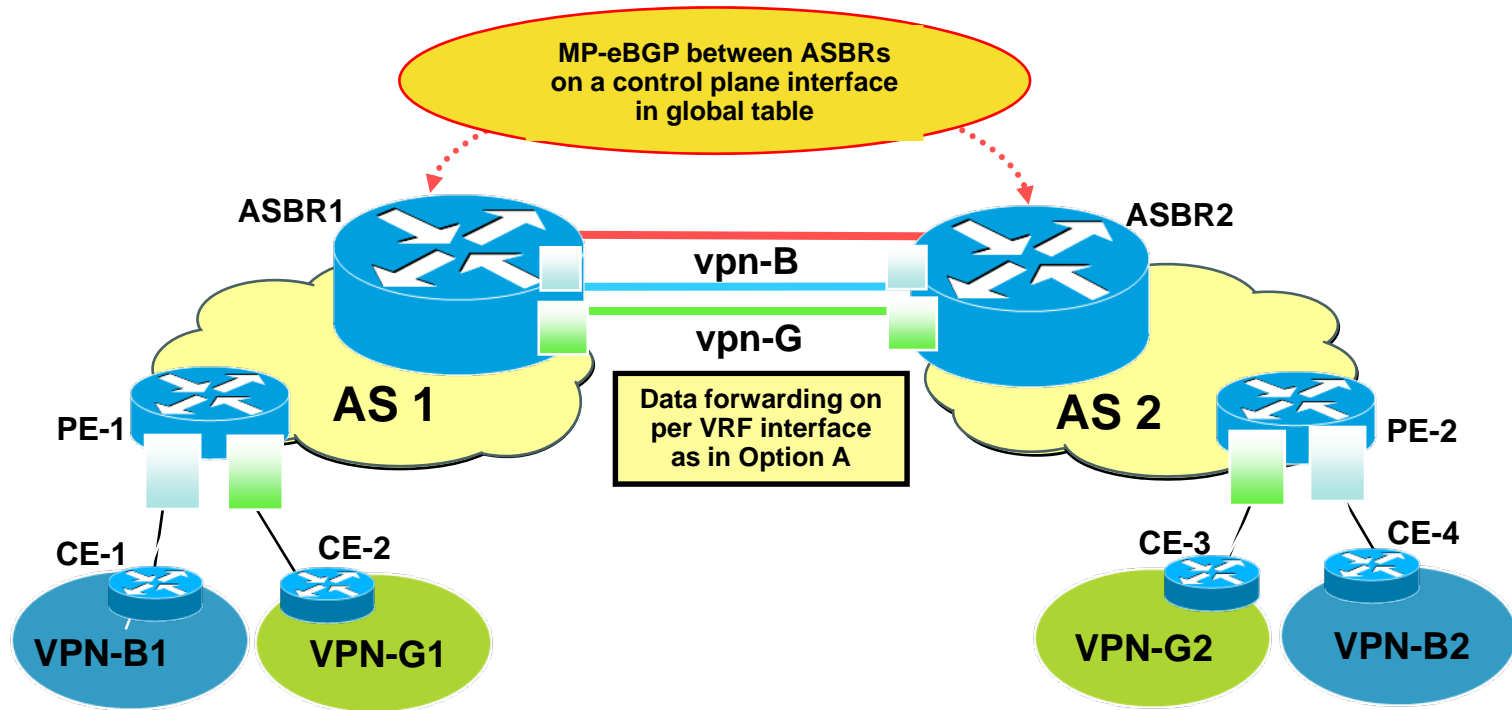


# Inter-AS VPNv4 Distribution Options



- Option A offers better security but not scalable for high #s of VPNs as it requires per VRF routing session
- Option B removes per VRF routing sessions but VPN traffic forwarded over the same interface(s)
- Option C offers a scalable way to extend VPN services

# MPLS VPN Inter-AS Option AB

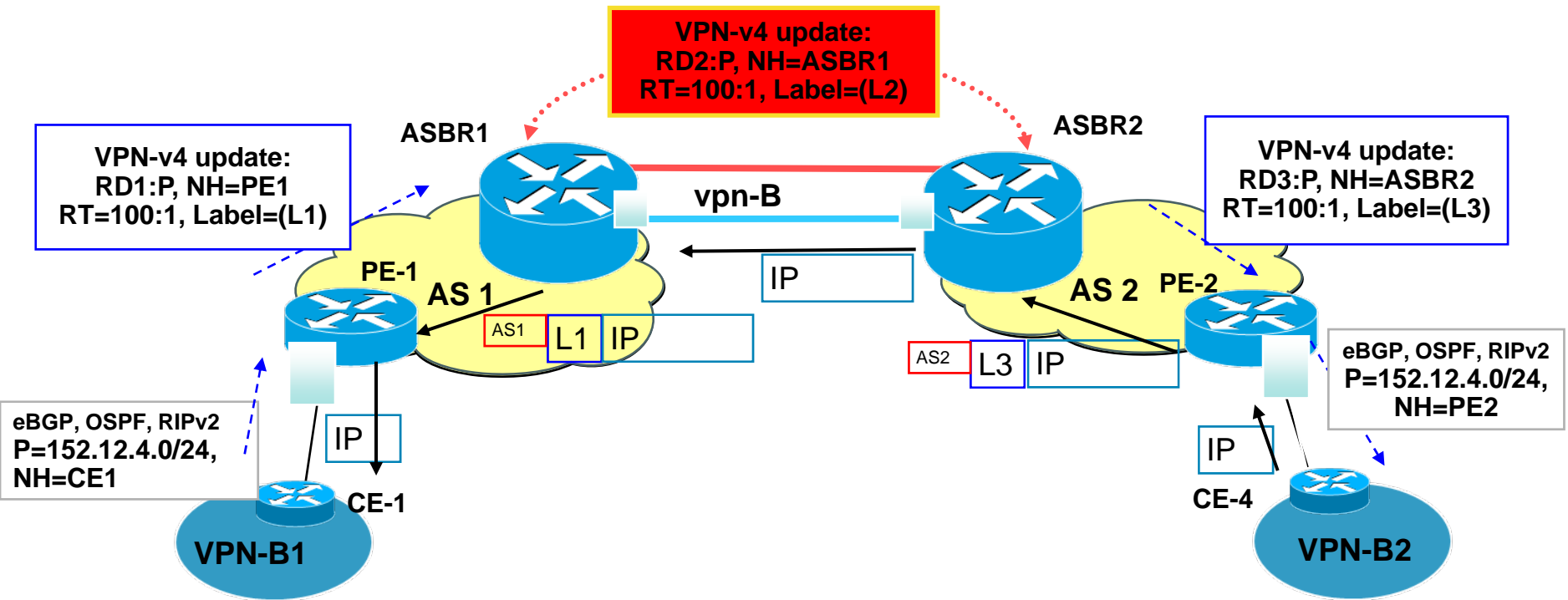


- Combines the benefits of Option A & Option B.
- Single MP-eBGP peer session between ASBRs leads to better scaling and reduced configurations.
- Separate per VRF interfaces between ASBRs forward data as in Option A. This provides security and QoS benefits of IP forwarding on the I-AS link.



# MPLS VPN Inter-AS Option AB

## Control & Forwarding Plane



- ASBR installs VPN-IPv4 routes into VRFs as described in RFC4364.
- VPN-IPv4 routes are converted back to IPv4 routes and imported into VRFs via Route Target (RT) based filtering policies.
- ASBRs can be configured to set itself as a Next Hop.
- After IPv4 routes are installed in a VRF, they are converted to VPNv4 routes by the Route Distinguisher (RD) values, along with VRF's associated RT(s) as set on the ASBR.

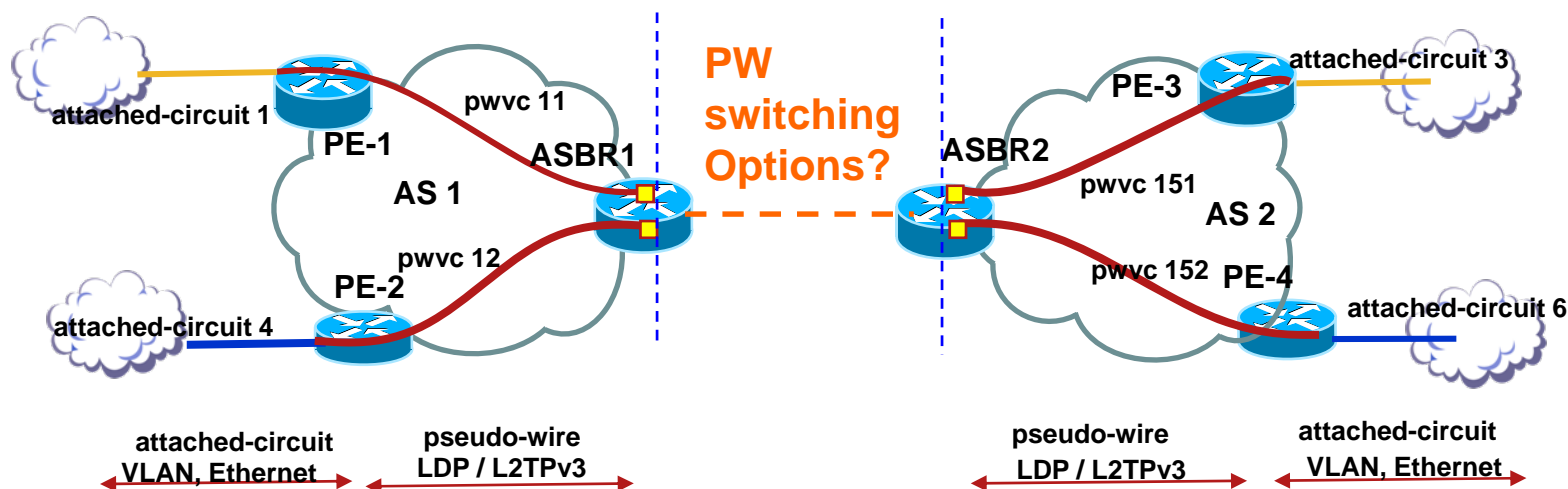


# Agenda

- I-AS MPLS L3VPN Deployment Models
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# Inter-AS Pseudowire switching options

- Allows a service provider to extend an existing PW with another PW in multi-AS environment



- Which options to choose from?
- Static vs. Dynamic Provisioning
  - BGP is used to auto discover VPLS VPN end-points in dynamic I-AS VPLS whereas VPN peers are defined statically through dLDP sessions
  - dLDP is used to setup PWs in either case
- Solution applicable to both Point-to-Point and Point-to-Multipoint PWs

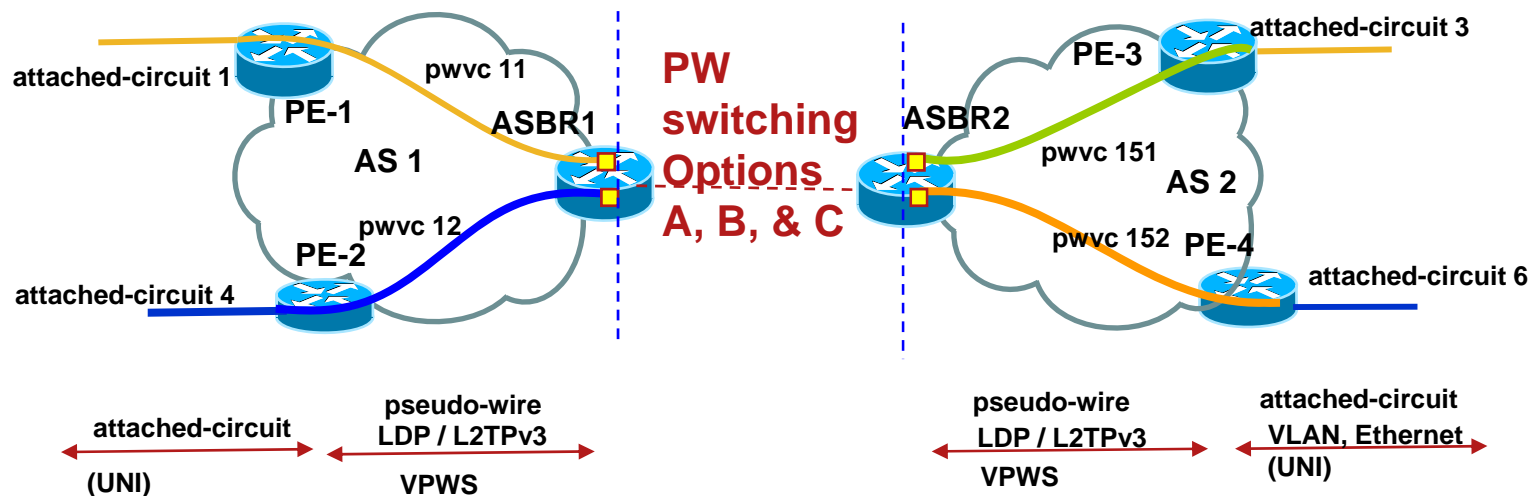
# Inter-AS ASBR-ASBR Switching Options

<p><b>Option A:</b> Layer-2 Peering between ASBRs</p>	<ul style="list-style-type: none"> <li>Clear demarcation between ASs facilitates management and troubleshooting</li> <li>Granular QoS control</li> <li>No reachability information shared between ASs</li> <li>May require a large number of ACs between ASBRs</li> </ul>	
<p><b>Option C:</b> Single-Hop PW</p>	<ul style="list-style-type: none"> <li>Simple provisioning on ASBRs</li> <li>No clear demarcation between ASs</li> <li>Significant sharing of reachability information (unless Inter-AS TE used)</li> <li>Limited QoS control between ASBRs (unless Inter-AS TE used)</li> </ul>	
<p><b>Option B:</b> Multi-Hop PW</p>	<ul style="list-style-type: none"> <li>Clear demarcation between ASs facilitates management and troubleshooting</li> <li>Minimal reachability info shared (single peering address)</li> <li>Granular QoS control possible with per-PW QoS</li> <li>Additional provisioning (on ASBRs)</li> </ul>	

# Dynamic Multi-segment Point to Point PWs

## Requirement:

- Today a multi-segmented point-to-point pseudowire requires manual configuration on the source and target terminating PEs as well as on the switching PEs in between. Need a scalable way to provision point to point PWs (AToM) in a single or multi-Segment environment

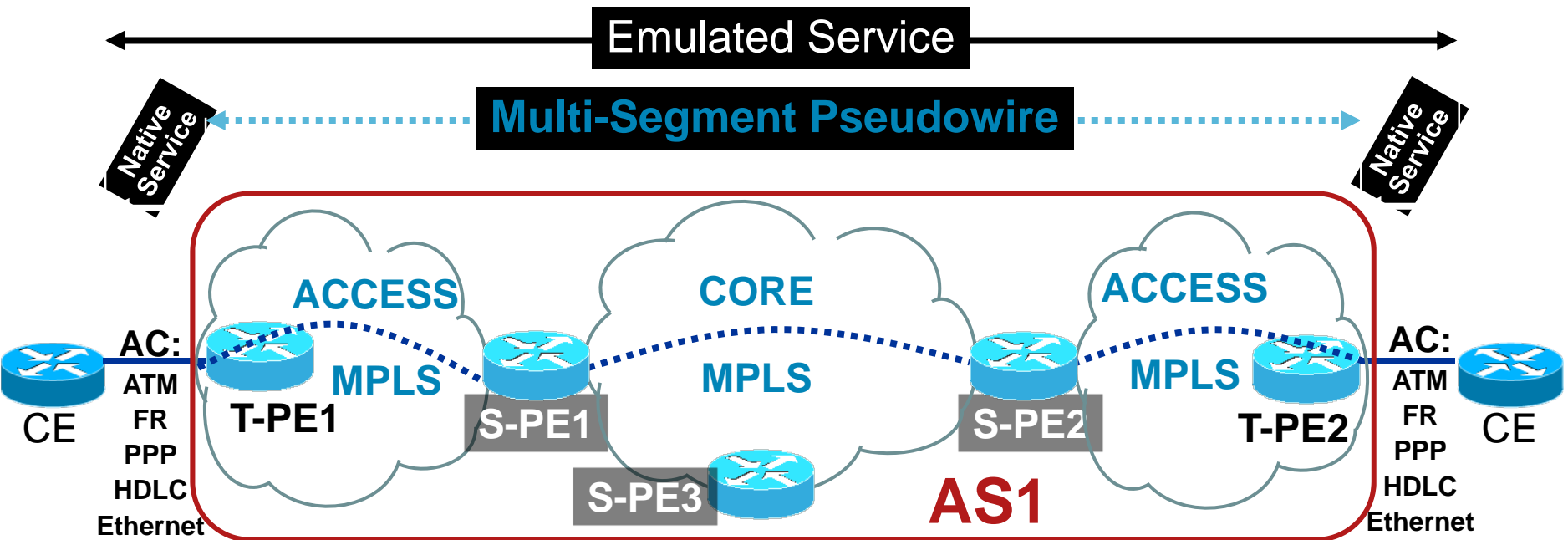


## Solution:

- Provide a dynamic provisioning of multi-segment PWs based on dynamic routing information

# Multi-Segment PW Definition

- **MS-PW:** Two or more contiguous VPWS PW segments that behave and function as a single point-to-point PW
- Described in draft-ietf-pwe3-segmented-pw-xx
- Extends the reach of PWs across multiple Packet Switched Networks

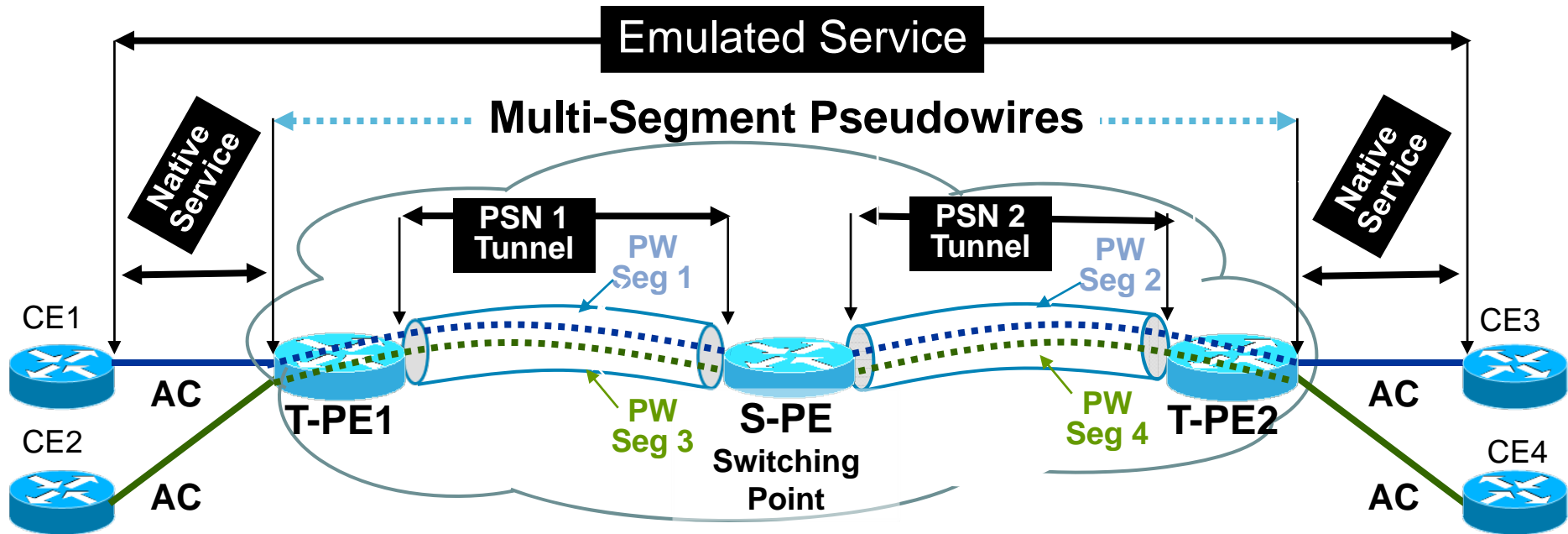


- **S-PE** – Switching Provider Edge – Can switch control and data planes of preceding and succeeding segments of a MS-PW. S-PE initiates the signaling for MS-PWs.
- **T-PE** – Terminating Provider Edge – Customer facing PE, hosting the first or last segment of a MS-PW

# Challenges for Multi-Segment PW

- Dynamic end-to-end signaling for MS-PW
- Scalable and inter-domain signaling and routing
- How to reduce the provisioning to a minimal number of provision touches ? (ideally provisioning only at the T-PEs)
- How to enforce and guarantee QoS Signaling, SLA...?
- Resiliency (S-PEs and PW “Protection”...)

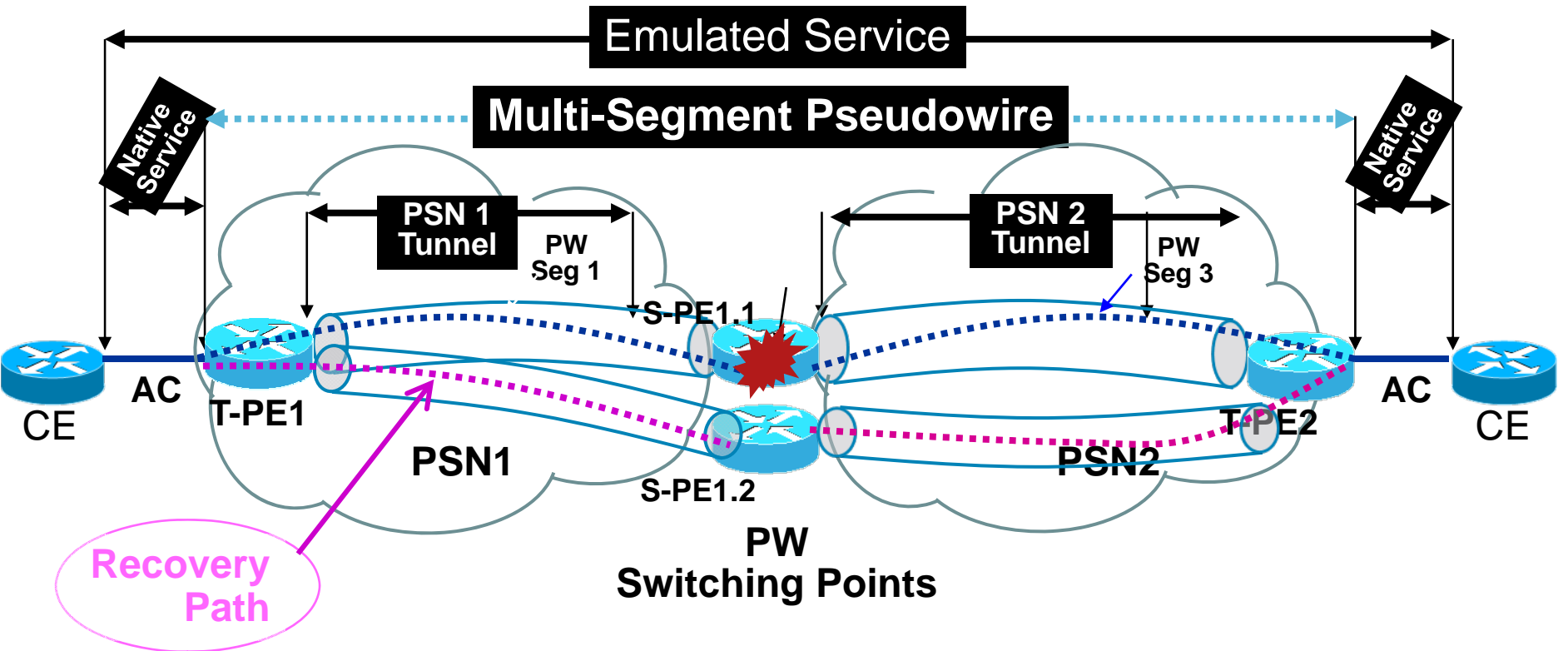
# Scenario 1: Single Switching Point



- Possible Solution:
  - Automatic selection of S-PE
  - Dynamic setup of MS-PW between two T-PEs
- Requires knowledge of the S-PEs (ASBR) within the AS (e.g. via IP next-hop or other techniques).
- S-PE creates a pseudowire to T-PE2.



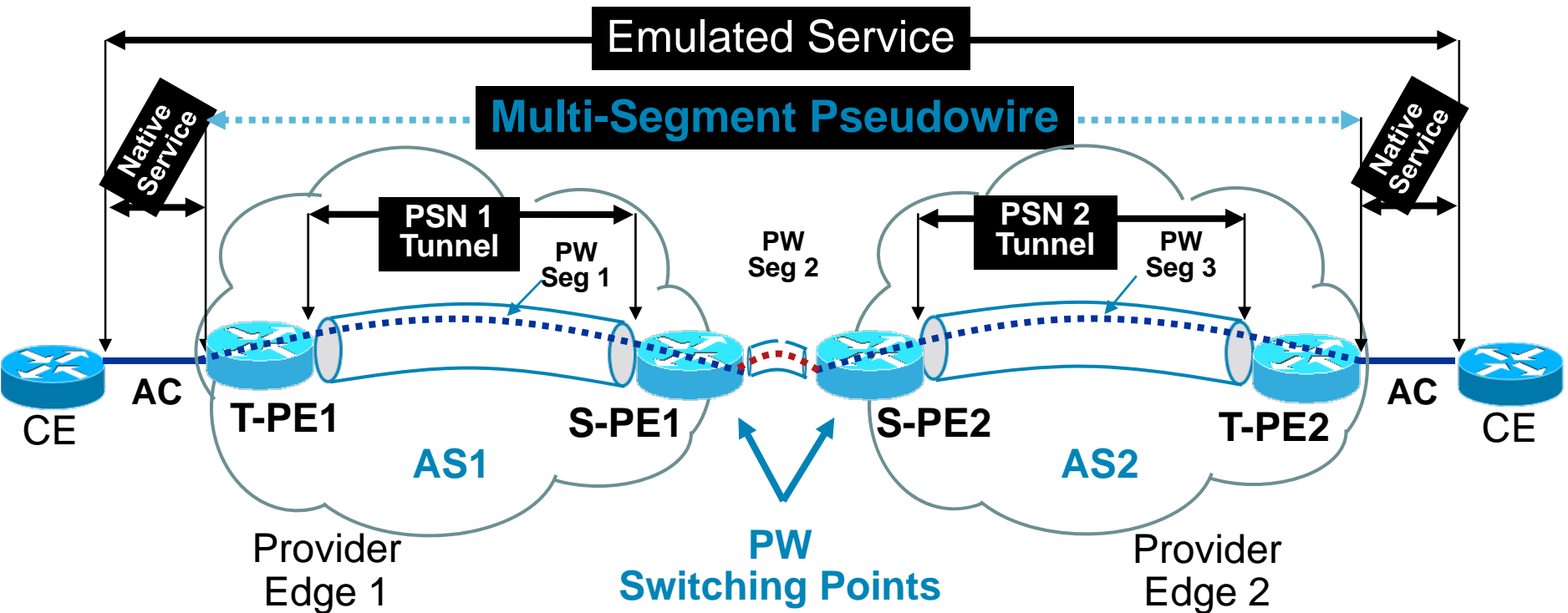
# Scenario 1a: Multi-Segment PW w ASBR Redundancy



## ■ In case of ASBR failure (e.g. S-PE1.1):

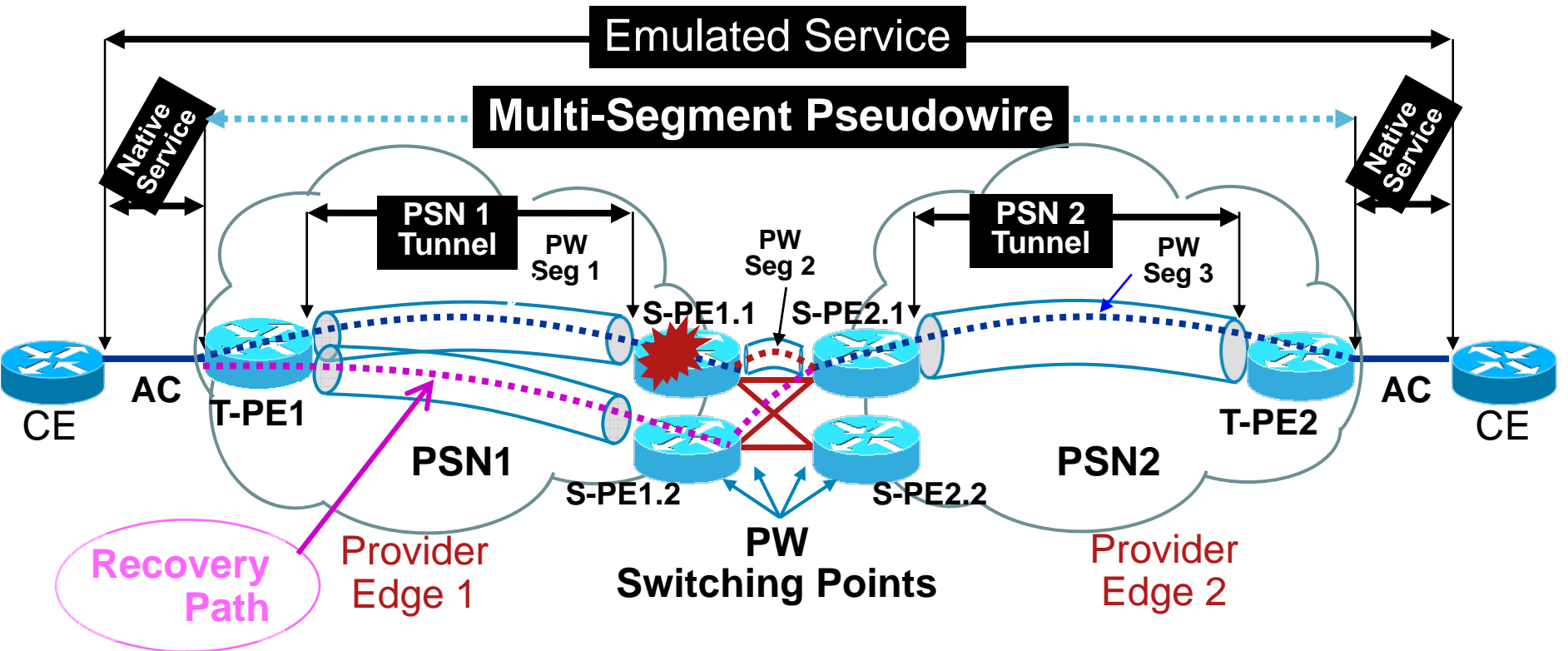
- PW backup pre-signaled to S-PE1.2
- When primary is down, traffic redirected to the “backup path”

## Scenario 2: Multiple Switching Points



- Possible Solution:
  - Automatic selection of S-PE1
  - S-PE1 needs to be aware of S-PE2
  - Automatic setup of MS-PW between T-PEs
- Requires pre-configuration or auto-discovery of the S-PEs

# Scenario 2a: Multi-Segment PW w ASBR Redundancy



## ■ In case of ASBR failure (e.g. S-PE1):

- Backup PW signaled between T-PE1 and S-PE1.2, S-PE1.2 to S-PE2.1
- When S-PE1.1 down, traffic redirected to the backup

..... = Recovery Path  
— = MPLS LSP Tunnel

# Key Takeaways

- Granular I-AS L3VPNs option for better scalability and security
- Several possible solution to achieve dynamic end-to-end signaling for Multi-segment, I-AS pseudowires
- Solution based on a combination of S-PE discovery and PW signaling



