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draft-agrawal-spring-srv6-mpls-interworking-05

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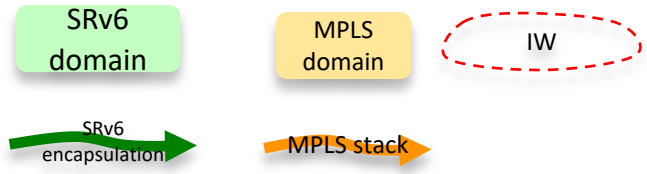
Summary

- The draft describes solution for the SRv6 and MPLS interworking.
- The initial version was posted in October 2018; the rev 5 provides the additional details.
- The draft describes the data plane and the associated control plane procedures.
- For data plane, End.DTM and decap variant End.BM behaviors are used.
- For control plane, both SR-PCE based and BGP based solutions are detailed.

Interworking (IW) scenarios



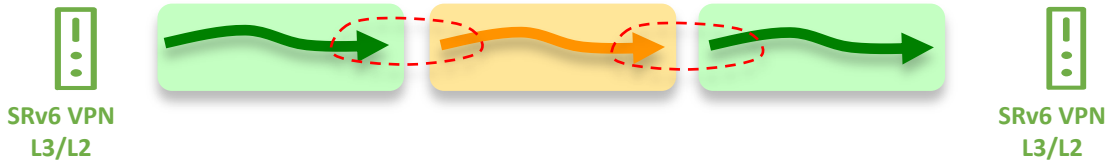
1. **Transport IW** - L3/L2 service continuity over a different intermediate transport

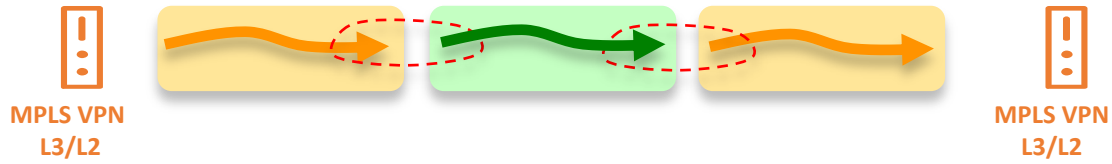
1.1 SRv6 over SR-MPLS-IPv4 (6oM)

Tunnel traffic destined to SRv6 Service SID bound to SRv6 locator of egress PE over SR-MPLS-IPv4 domain

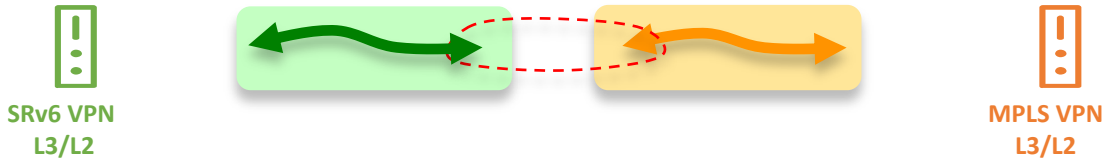
1.2 SR-MPLS-IPv4 over SRv6 (Mo6)

Tunnel MPLS LSP bound to IPv4 loopback address of egress PE over SRv6 C domain.





2. **Service IW** - Service discontinuity over a different intermediate transport i.e. BGP SRv6 VPN PE interworking with BGP MPLS VPN PE for L3/L2 service connectivity.



End.DTM SRv6 SID behavior

- The "Endpoint with decapsulation and MPLS table lookup" behavior.
- This behavior is executed on IW routers between the SRv6 and MPLS domain.

Pseudo Code

When N receives a packet destined to S and S is a local End.DTM SID, N does:

S01. When an SRH is processed {

S02. If (Segments Left != 0) {

S03. Send an ICMP Parameter Problem to the Source Address, Code 0 (Erroneous header field encountered), Pointer set to the Segments Left field, interrupt packet processing and discard the packet.

S04. }

S05. Proceed to process the next header in the packet

S06. } When processing the Upper-layer header of a packet matching a FIB entry locally instantiated as an End.DTM SID, N does:

S01. If (Upper-Layer Header type == 137(MPLS)) {

S02. Remove the outer IPv6 Header with all its extension headers

S03. Set the packet's associated FIB table to T

S04. Submit the packet to the MPLS FIB lookup for transmission according to the lookup result.

S05. } Else {

S06. Process as per [ietf-spring-srv6-network-programming] section 4.1.1

S07. }

SRv6 Headend Behaviors

- H.Encaps.M

H.Encaps applied to MPLS label stack. The H.Encaps.M behavior encapsulates a received MPLS Label stack [RFC3032] packet in an IPv6 header with an SRH. Together MPLS label stack and its payload becomes the payload of the new IPv6 packet. The Next Header field of the SRH MUST be set to 137 [RFC4023].

- H.Encaps.M.Red

H.Encaps.Red applied to MPLS label stack. The H.Encaps.M.Red behavior is an optimization of the H.Encaps.M behavior.

Transport IW

The draft enhances two well-known solutions to provide PE locator/IPv4 PE loopback LSP tunneling:

- SR-PCE (SDN Controller) procedure provides a path that satisfies the intent (e.g. low latency), across multiple domains. SR PCE detects the data plane discontinuity.
- BGP Inter-Domain routing procedure advertises PE locator/IPv4 Loopback address LSP for best effort end to end connectivity.

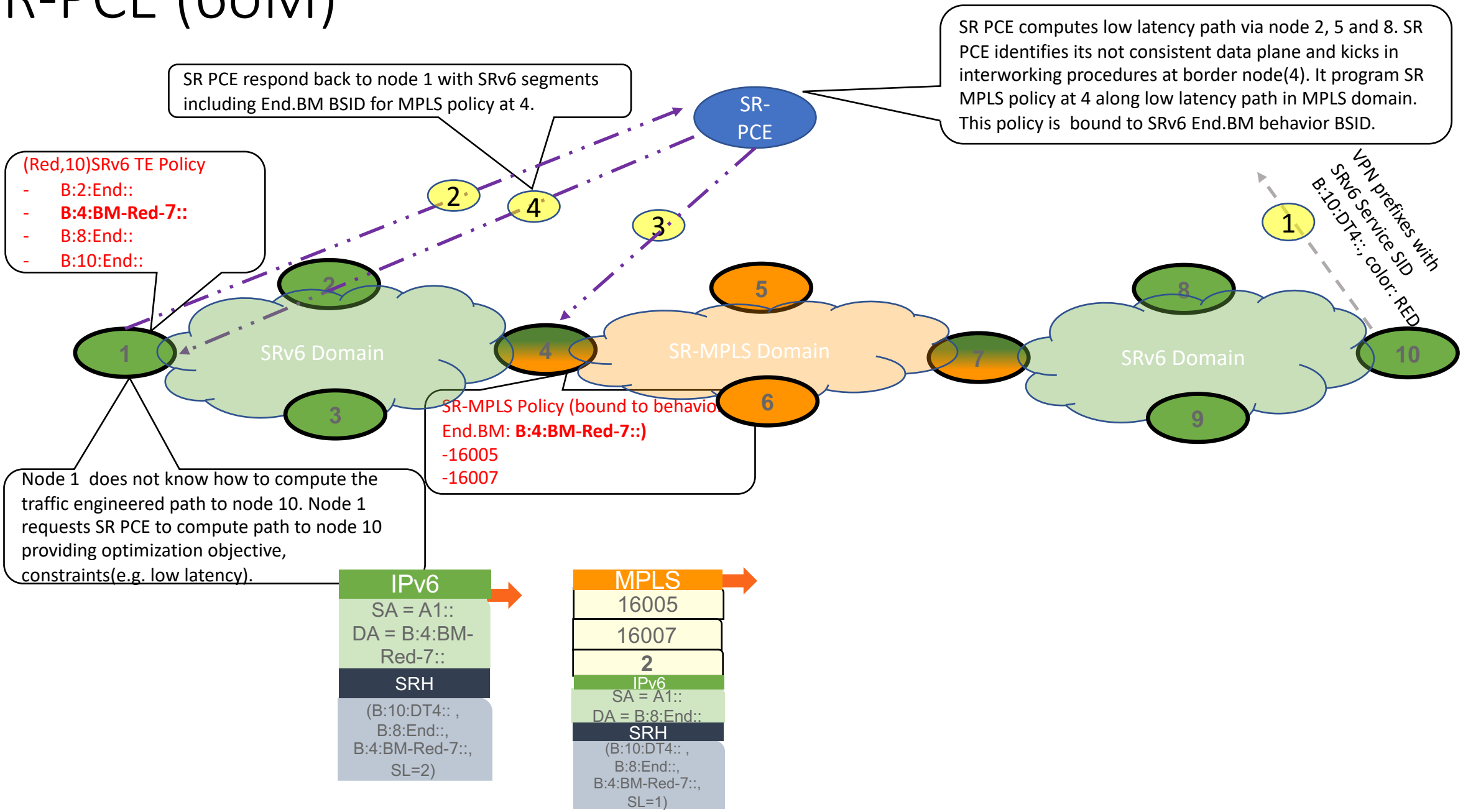
Legends

SRv6 Capable (F function on node B:k:F::, Router-id: Ak::)

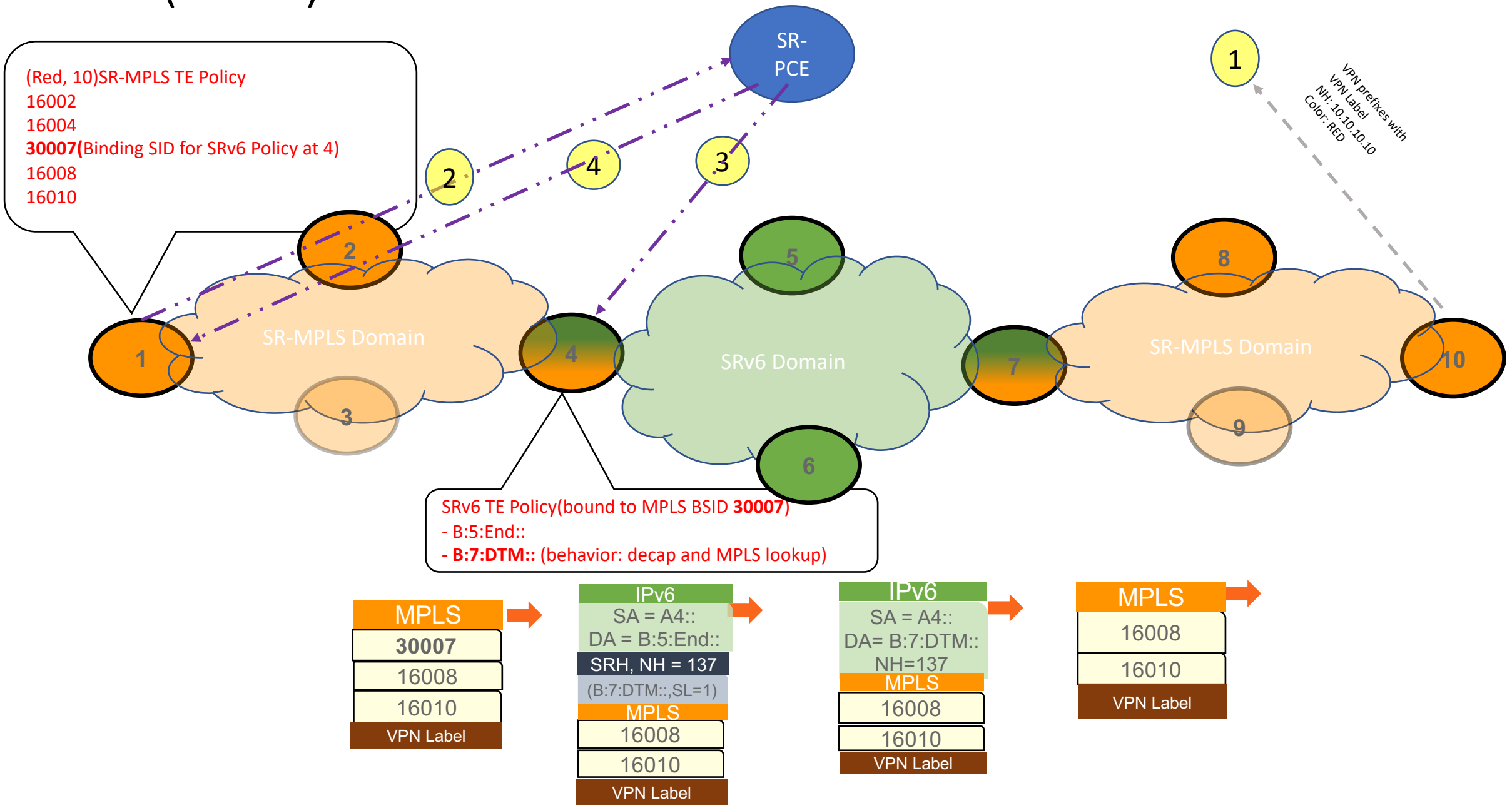
SR-MPLS IPv4 Node (Prefix SID label: 1600k, Router-id: 1.1.1.k)

SR-MPLS IPv4 and SRv6 Capable Node

SR-PCE (6oM)

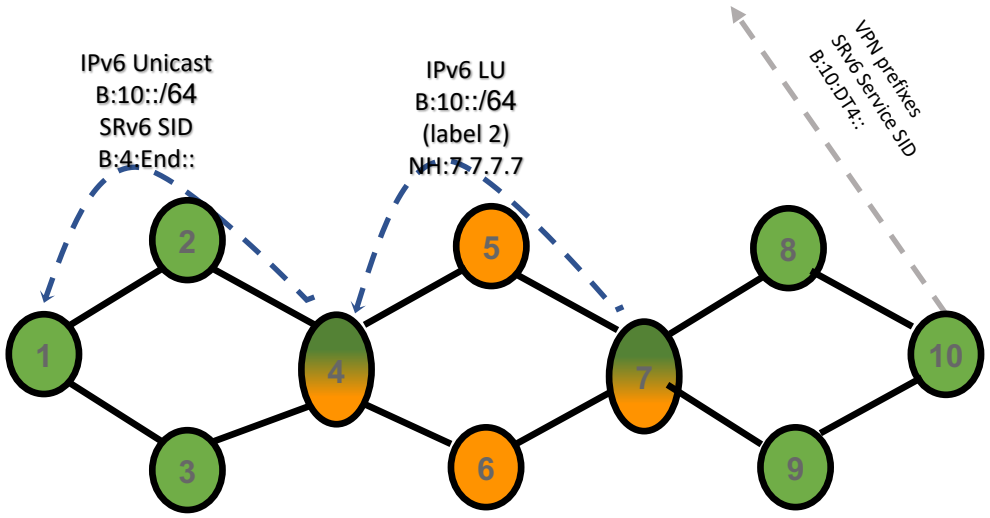

SR PCE respond back to node 1 with SRv6 segments including End.BM BSID for MPLS policy at 4.
SR PCE computes low latency path via node 2, 5 and 8. SR PCE identifies its not consistent data plane and kicks in interworking procedures at border node(4). It program SR MPLS policy at 4 along low latency path in MPLS domain. This policy is bound to SRv6 End.BM behavior BSID.
SR-PCE
(Red,10)SRv6 TE Policy
- B:2:End::
- B:4:BM-Red-7::
- B:8:End::
- B:10:End::
VPN prefixes with SRv6 Service SID B:10:DT4::, color: RED
SRv6 Domain
SR-MPLS Domain
SRv6 Domain
SR-MPLS Policy (bound to behavio
End.BM: B:4:BM-Red-7::)
-16005
-16007
Node 1 does not know how to compute the traffic engineered path to node 10. Node 1 requests SR PCE to compute path to node 10 providing optimization objective, constraints(e.g. low latency).
IPv6
SA = A1::
DA = B:4:BM-Red-7::
SRH
(B:10:DT4:: , B:8:End::, B:4:BM-Red-7::, SL=2)
MPLS
16005
16007
2
IPv6
SA = A1::
DA = B:8:End::
SRH
(B:10:DT4:: , B:8:End::, B:4:BM-Red-7::, SL=1)

SR-PCE (Mo6)


(Red, 10)SR-MPLS TE Policy
16002
16004
30007(Binding SID for SRv6 Policy at 4)
16008
16010
SR-PCE
1
2
3
4
5
6
7
8
9
10
SR-MPLS Domain
SRv6 Domain
SR-MPLS Domain
VPN prefixes with
VPN Label
NH: 10.10.10.10
Color: RED
SRv6 TE Policy(bound to MPLS BSID 30007)
- B:5:End::
- B:7:DTM:: (behavior: decap and MPLS lookup)
MPLS
30007
16008
16010
VPN Label
IPv6
SA = A4::
DA = B:5:End::
SRH, NH = 137
(B:7:DTM::,SL=1)
MPLS
16008
16010
VPN Label
IPv6
SA = A4::
DA= B:7:DTM::
NH=137
MPLS
16008
16010
VPN Label
MPLS
16008
16010
VPN Label

BGP (6oM)

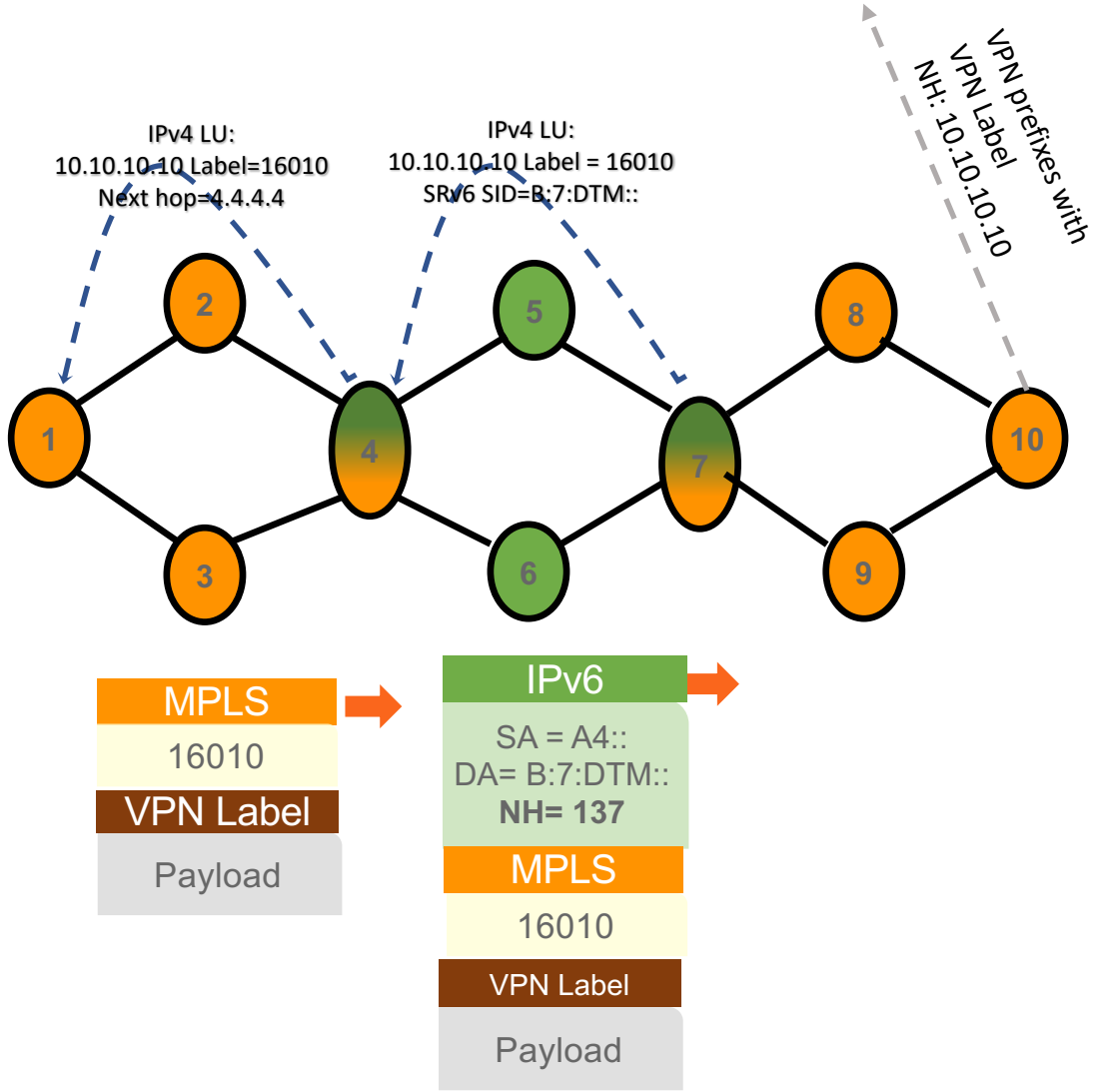
- Advertise PE locators i.e. node 10.
- Its classic 6PE on IW nodes (4 & 7) over SR-MPLS-IPv4 domain. (RFC 4798)
- Leak locator in left domain IGP or advertise locator to ingress PE (node 1) in IPv6 BGP with SRv6 SID of node 4 End behavior.



BGP (Mo6)

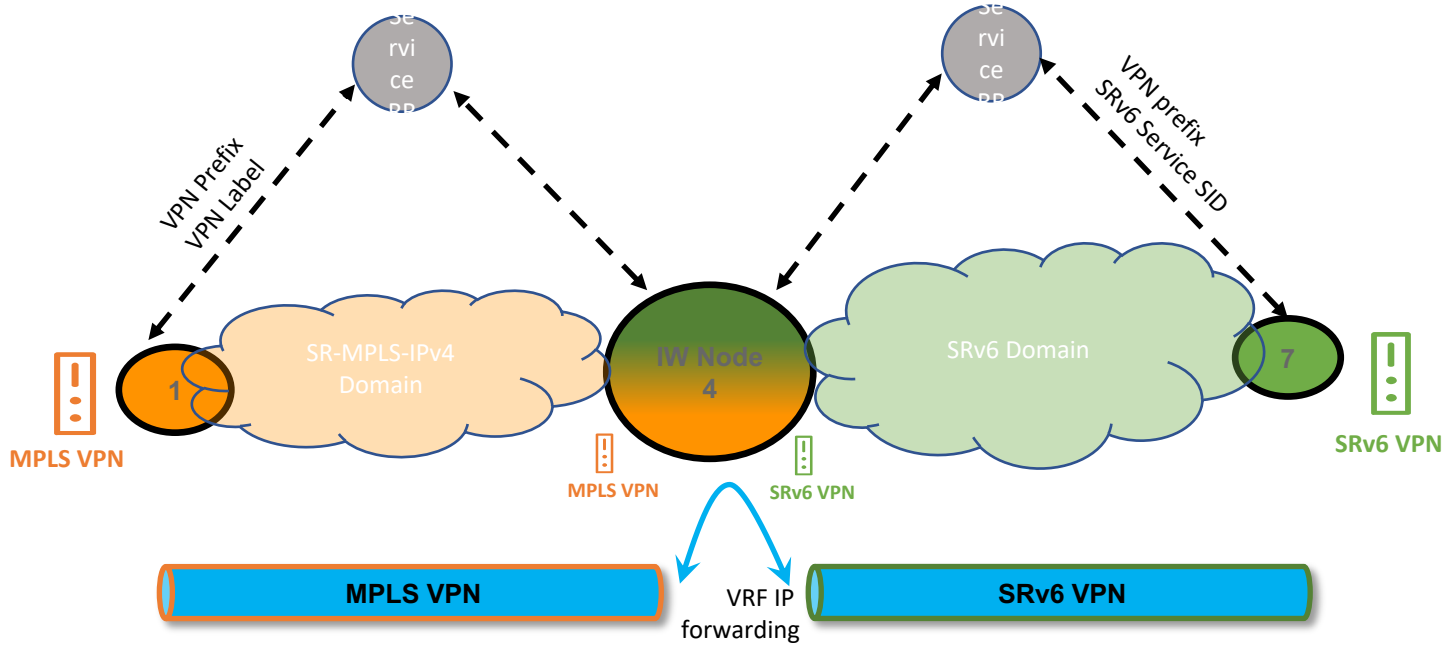
Intuitive solution for an MPLS-minded operator

- Existing BGP 3017 label cross-connect on border routers for each PE IPv4 loopback address
- The lookups at the ingress border router are based on BGP 3107 label as usual
- Just the SR-MPLS IPv4 LSP to next hop is replaced by an IPv6 tunnel with DA = SRv6 SID associated with End.DTM behavior of Egress IW node i.e. node 7.
- Ingress border router forwarding perform 3107 label swap and H.Encaps.M with DA = SRv6 SID associated with DTM behavior
- Draft introduces a new TLV called "SRv6 label route tunnel" TLV of the BGP Prefix-SID Attribute to signal SRv6 SID of behavior DTM that tunnel MPLS packet with label in NLRI at the top of its label stack through SRv6/IPv6 domain.



Service IW: Gateway solution

Gateway is router which supports both BGP SRv6 based L2/L3 services and BGP MPLS based L2/L3 services for a service instance (e.g. L3 VRF). It terminates service encapsulation and perform L2/ L3 destination lookup in service instance.



Next Steps

- The authors would like the WG to review and adopt the document.