LISP Control-Plane for SRv6 Endpoint Mobility

Alberto Rodriguez-Natal
Vina Ermagan
Fabio Maino

Darren Dukes
Pablo Camarillo
Clarence Filsfils

LISP WG – IETF 102 (Montreal)

LISP for Loc/ID split in SRv6

- LISP for “where to go"
  - Control plane to support Loc/ID split aspects in SRv6
  - Maps **Endpoint + VNI** to **SRv6 egress + VPN segment** (End.DT, End.DX function)

- SRv6 for “how to go”
  - Flexible data-plane with support for Traffic Engineering, Network Slicing, FRR and Service Programming.
  - Path computation (if necessary) provided by SR-PCE

Use-Cases

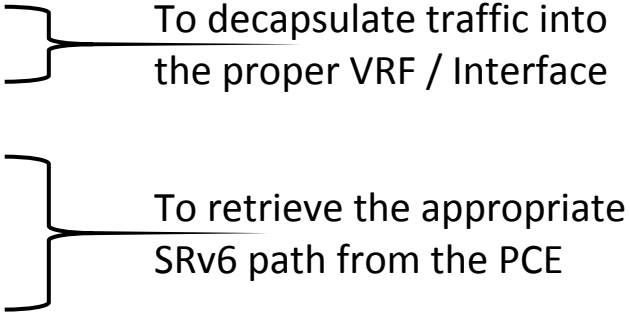
- SRv6 for Overlay, Mobility and Traffic Engineering
  - Covered in -00

- SRv6 for Overlay and Mobility
  - To be covered in -01

Endpoint registration

- Egress SRv6 nodes register endpoints into the MSMR

- New SR LCAF to register:
  - Egress VPN-SID at egress SRv6 node
  - Egress SRv6 node
  - Endpoint’s Traffic Steering Tag



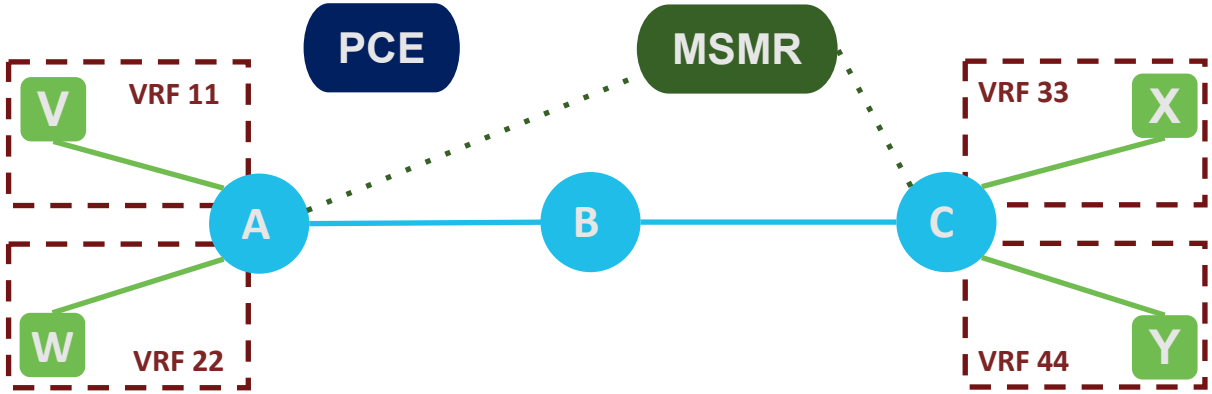
Endpoint resolution

- Disjoint resolution
  - Ingress SRv6 node request endpoint info to the LISP MSMR
  - MSMR returns egress VPN-SID for the endpoint to the ingress SRv6 node (along with egress SRv6 node and endpoint tag)
  - Ingress SRv6 node uses egress node and endpoint tag to retrieve SRv6 policy from PCE
- Joint resolution
  - Ingress SRv6 node request endpoint info to the LISP MSMR
  - LISP MSMR uses egress node and endpoint tag to retrieve SRv6 policy from PCE
  - MSMR returns complete SRv6 path to the ingress SRv6 node

Disjoint resolution

MSMR

IID	EID	RLOC



A

LISP Local EID DB

VRF	IID	EID	Color
11	1	V	Red
22	2	W	Blue

LISP Map Cache

IID	EID	RLOC

SRv6 My Local SID table

SID	Action
A::D11	Decap – VRF 11
A::D22	Decap - VRF 22

SRv6 policies

NextHop	Color	SID list

Local EID database has been configured

My Local SID table has been configured

MSMR

IID	EID	RLOC
1	V	A::D11, Red
1	X	C::D33, Red
2	W	A::D22, Blue
2	Y	C::D44, Blue

A

LISP Local EID DB

VRF	IID	EID	Color
11	1	V	Red
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LISP Map Cache

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SRv6 My Local SID table

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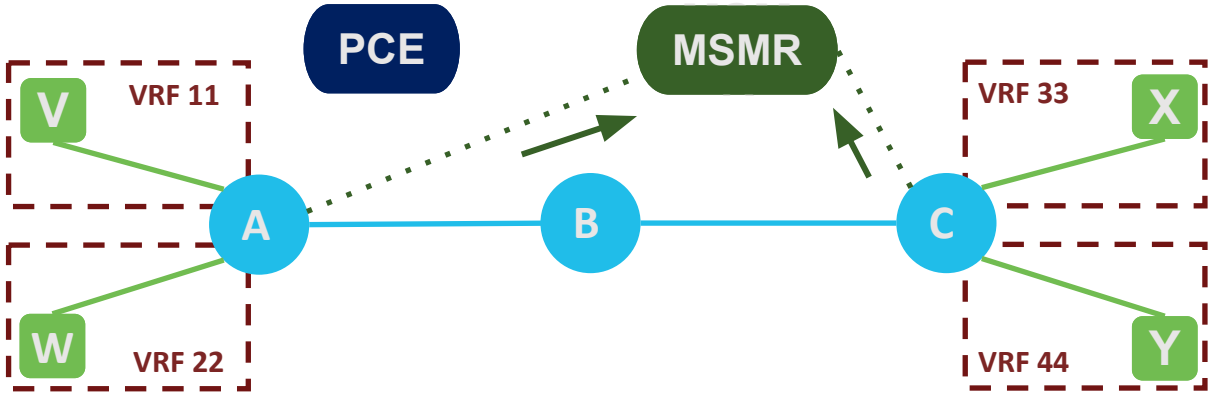
SRv6 policies

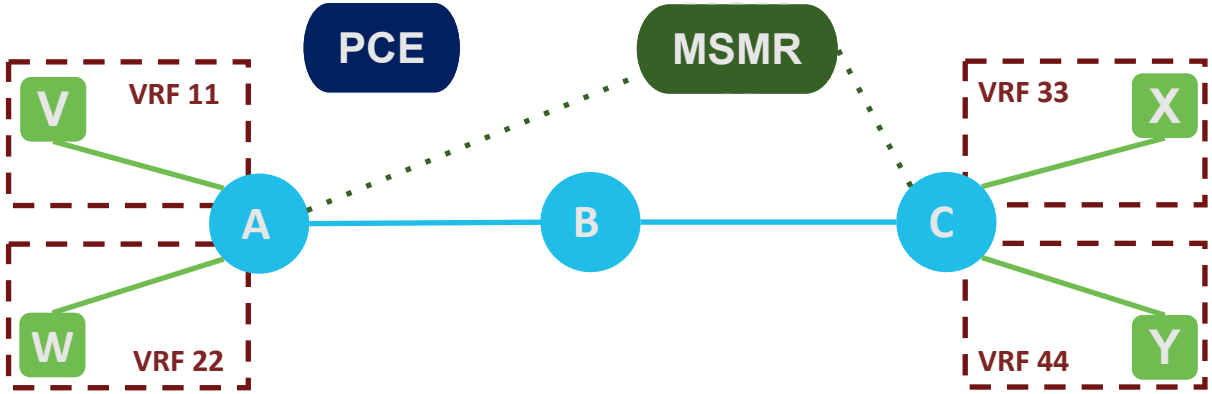
NextHop	Color	SID list



Map-Register messages from A and C populate the MSMR

MSMR

IID	EID	RLOC
1	V	A::D11, Red
1	X	C::D33, Red
2	W	A::D22, Blue
2	Y	C::D44, Blue



A

LISP Local EID DB

VRF	IID	EID	Color
11	1	V	Red
22	2	W	Blue

LISP Map Cache

IID	EID	RLOC

SRv6 My Local SID table

SID	Action
A::D11	Decap – VRF 11
A::D22	Decap - VRF 22

SRv6 policies

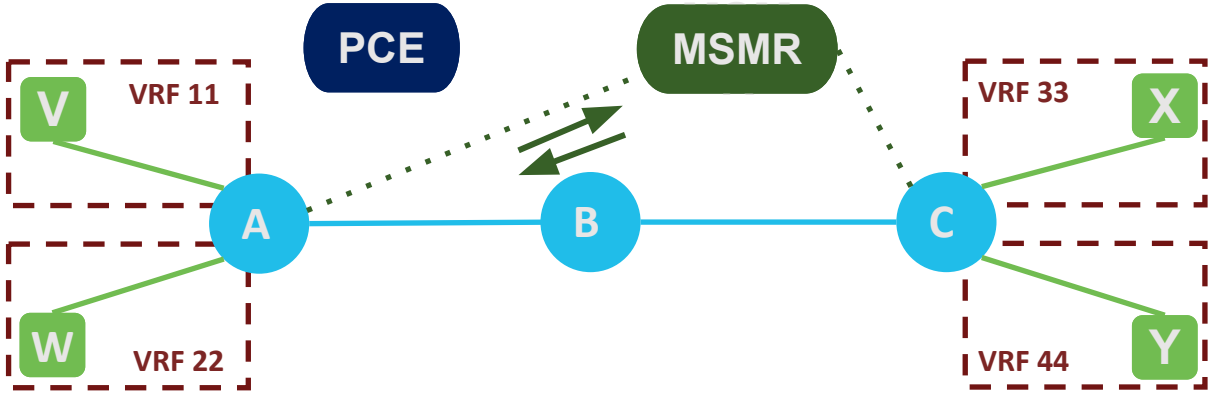
NextHop	Color	SID list

IPv6 Hdr	SA = V::, DA = **X::**
Payload	

Traffic at A going to X triggers Map Cache resolution

MSMR

IID	EID	RLOC
1	V	A::D11, Red
1	X	C::D33, Red
2	W	A::D22, Blue
2	Y	C::D44, Blue



A

LISP Local EID DB

VRF	IID	EID	Color
11	1	V	Red
22	2	W	Blue

LISP Map Cache

IID	EID	RLOC
1	X	C::D33, Red

SRv6 My Local SID table

SID	Action
A::D11	Decap – VRF 11
A::D22	Decap - VRF 22

SRv6 policies

NextHop	Color	SID list

IPv6 Hdr	SA = V::, DA = **X::**
Payload	

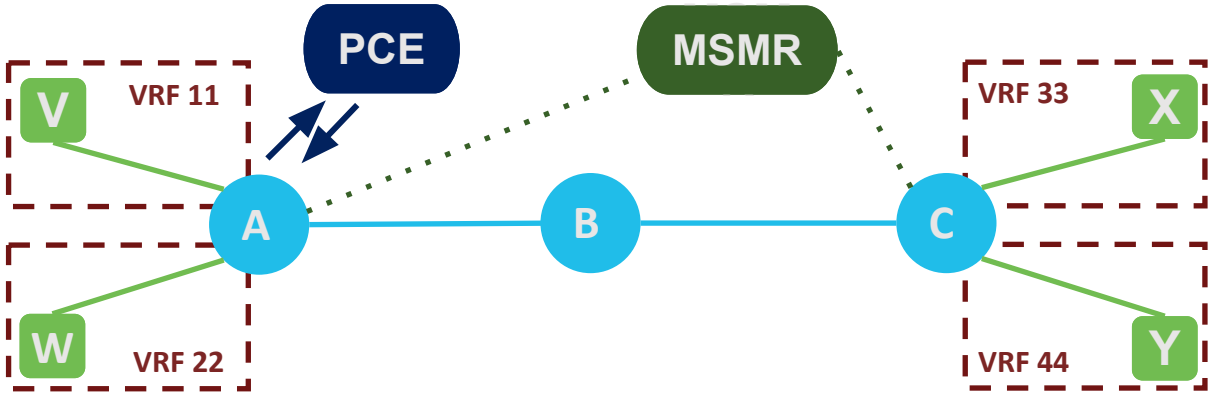
Traffic at A going to X triggers Map Cache resolution

Map-Request from A to the MSMR: “Where’s X?”

Map-Reply from the MSMR to A: “X is at C::D33 with color Red”

MSMR

IID	EID	RLOC
1	V	A::D11, Red
1	X	C::D33, Red
2	W	A::D22, Blue
2	Y	C::D44, Blue



A

LISP Local EID DB

VRF	IID	EID	Color
11	1	V	Red
22	2	W	Blue

LISP Map Cache

IID	EID	RLOC
1	X	C::D33, Red

SRv6 My Local SID table

SID	Action
A::D11	Decap – VRF 11
A::D22	Decap - VRF 22

SRv6 policies

NextHop	Color	SID list
C::	Red	<B::1>

IPv6 Hdr	SA = V::, DA = **X::**
Payload	

Traffic at A going to X triggers Map Cache resolution

Map-Request from A to the MSMR: “Where’s X?”

Map-Reply from the MSMR to A: “X is at C::D33 with color Red”

A retrieves SRv6 Policies via PCE for {C::, Red}
Note: *The ”Color” gives a hint to the PCE on which SLA it should apply for the path computation. i.e. uRLLC network slice.*

MSMR

IID	EID	RLOC
1	V	A::D11, Red
1	X	C::D33, Red
2	W	A::D22, Blue
2	Y	C::D44, Blue

A

LISP Local EID DB

VRF	IID	EID	Color
11	1	V	Red
22	2	W	Blue

LISP Map Cache

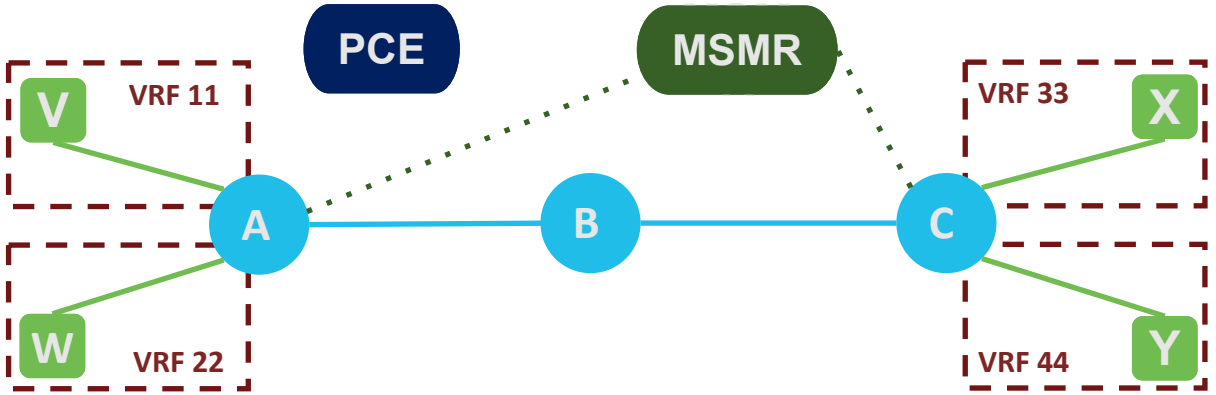
IID	EID	RLOC
1	X	C::D33, Red

SRv6 My Local SID table

SID	Action
A::D11	Decap – VRF 11
A::D22	Decap - VRF 22

SRv6 policies

NextHop	Color	SID list
C::	Red	<B::1>



IPv6 Hdr	SA = V::, DA = **X::**
Payload	

IPv6 Hdr	SA = **A::**, DA = **B::1**
SR Hdr	(C:D33::, **B::1**) SL=1
IPv6 Hdr	SA = **V::**, DA = **X::**
Payload	

IPv6 Hdr	SA = **A::**, DA = **C::D33**
IPv6 Hdr	SA = **V::**, DA = **X::**
Payload	

IPv6 Hdr	SA = V::, DA = **X::**
Payload	

Traffic flows from V to X via the SRv6 path <A::, B::1, C::D33>

MSMR

IID	EID	RLOC
1	V	A::D11, Red
1	X	C::D33, Red
2	W	A::D22, Blue
2	Y	C::D44, Blue

A

LISP Local EID DB

VRF	IID	EID	Color
11	1	V	Red
22	2	W	Blue

LISP Map Cache

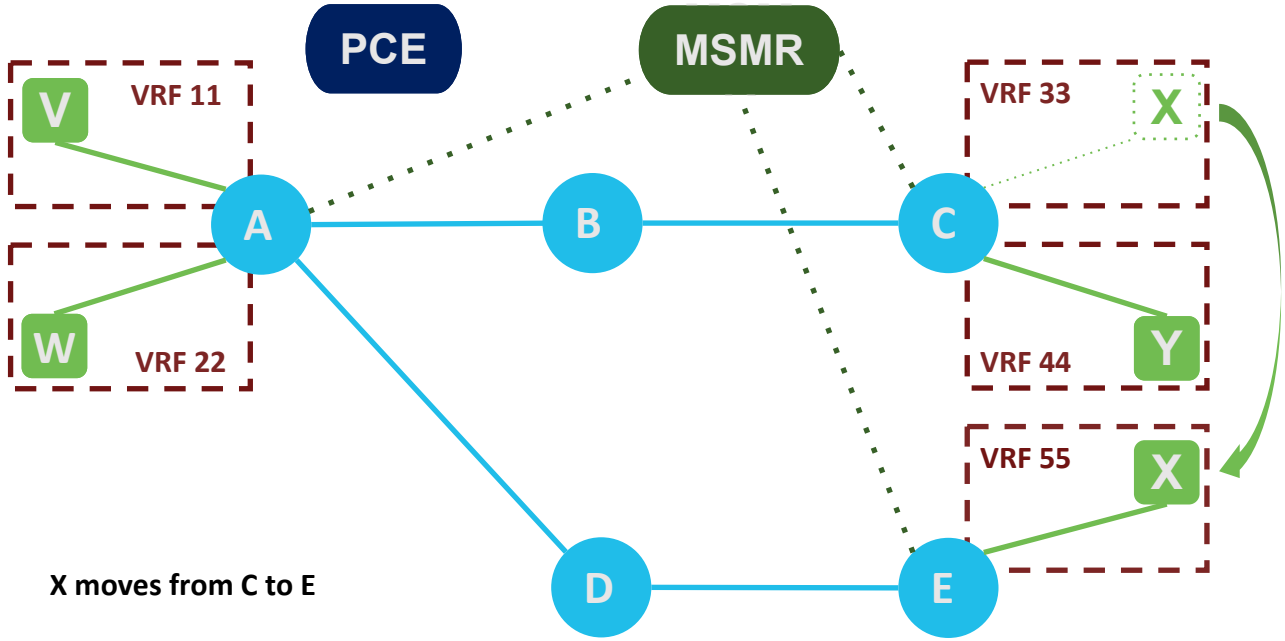
IID	EID	RLOC
1	X	C::D33, Red

SRv6 My Local SID table

SID	Action
A::D11	Decap – VRF 11
A::D22	Decap - VRF 22

SRv6 policies

NextHop	Color	SID list
C::	Red	<B::1>



MSMR

IID	EID	RLOC
1	V	A::D11, Red
1	X	E::D55, Red
2	W	A::D22, Blue
2	Y	C::D44, Blue

A

LISP Local EID DB

VRF	IID	EID	Color
11	1	V	Red
22	2	W	Blue

LISP Map Cache

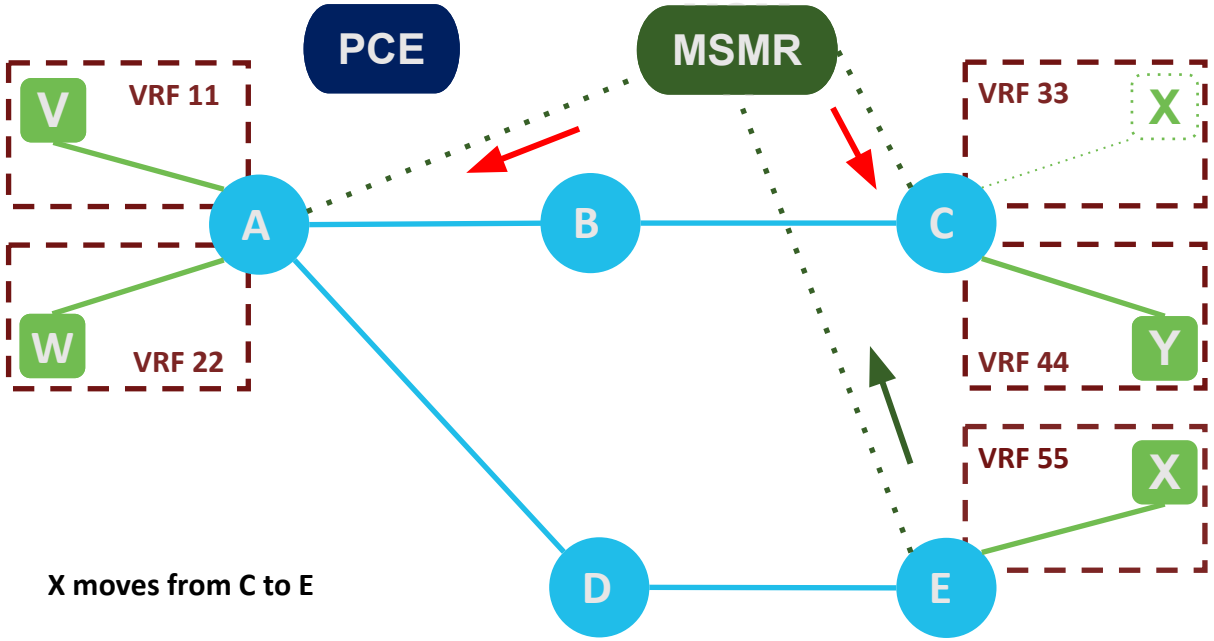
IID	EID	RLOC
1	X	E::D55, Red

SRv6 My Local SID table

SID	Action
A::D11	Decap – VRF 11
A::D22	Decap - VRF 22

SRv6 policies

NextHop	Color	SID list
C::	Red	<B::1>



X moves from C to E

E sends a Map-Register with X's new location to the MSMR, this triggers:

(1) Notification of new location to old location (to enable redirects) [draft-ietf-eid-mobility]

(2) Notification of new location to previous requesters [draft-ietf-lisp-pubsub]

MSMR

IID	EID	RLOC
1	V	A::D11, Red
1	X	**E::D55, Red**
2	W	A::D22, Blue
2	Y	C::D44, Blue

A

LISP Local EID DB

VRF	IID	EID	Color
11	1	V	Red
22	2	W	Blue

LISP Map Cache

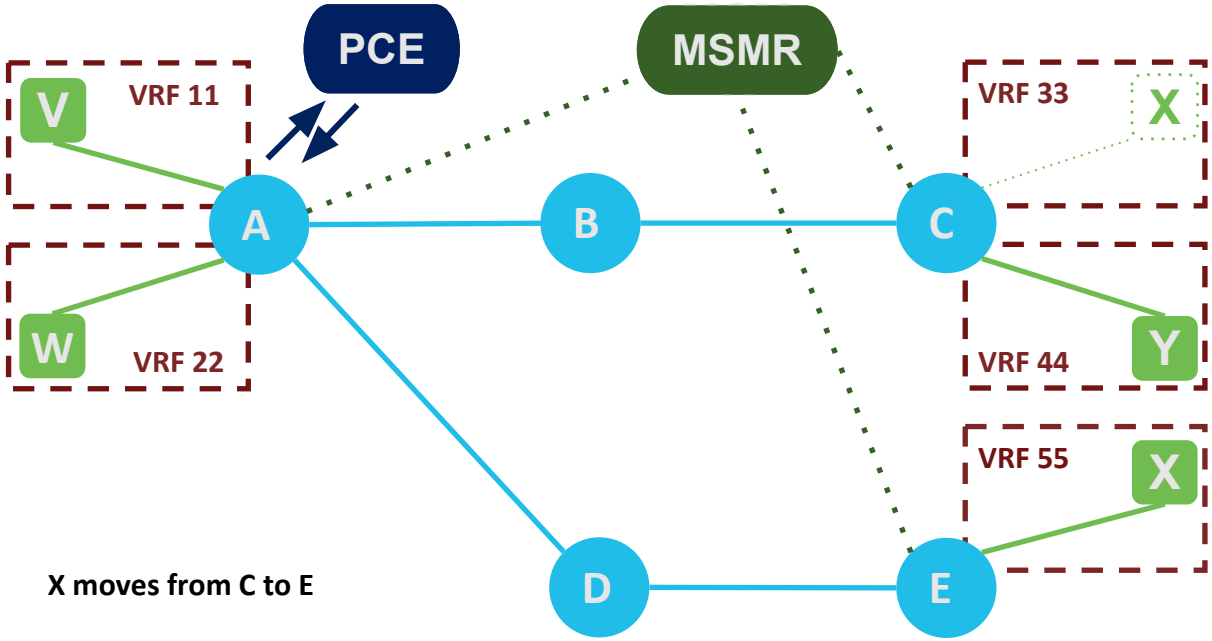
IID	EID	RLOC
1	X	**E::D55, Red**

SRv6 My Local SID table

SID	Action
A::D11	Decap – VRF 11
A::D22	Decap - VRF 22

SRv6 policies

NextHop	Color	SID list
C::	Red	<B::1>
E::	**Red**	***None***



X moves from C to E

E sends a Map-Register with X's new location to the MSMR, this triggers:

(1) Notification of new location to old location (to enable redirects) [draft-ietf-eid-mobility]

(2) Notification of new location to previous requesters [draft-ietf-lisp-pubsub]

A retrieves SRv6 Policies via PCE for {E::, Red}

MSMR

IID	EID	RLOC
1	V	A::D11, Red
1	X	**E::D55, Red**
2	W	A::D22, Blue
2	Y	C::D44, Blue

A

LISP Local EID DB

VRF	IID	EID	Color
11	1	V	Red
22	2	W	Blue

LISP Map Cache

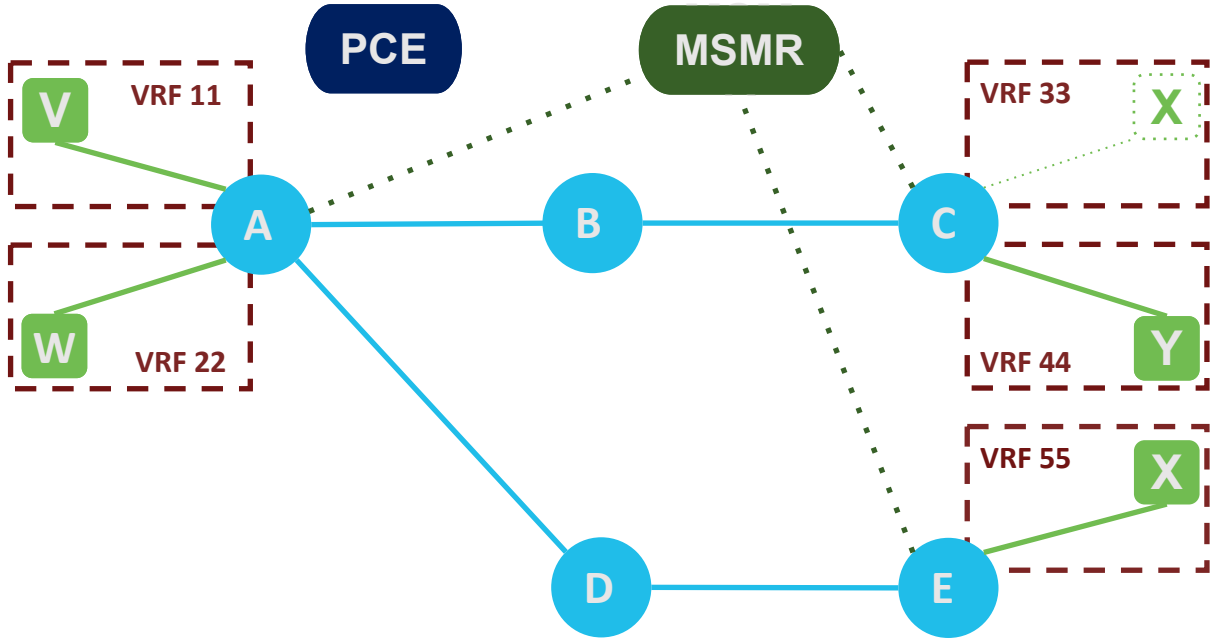
IID	EID	RLOC
1	X	**E::D55, Red**

SRv6 My Local SID table

SID	Action
A::D11	Decap – VRF 11
A::D22	Decap - VRF 22

SRv6 policies

NextHop	Color	SID list
C::	Red	<B::1>
E::	**Red**	***None***



IPv6 Hdr	SA = V::, DA = **X::**
Payload	

IPv6 Hdr	SA = **A::**, DA = **E::D55**
IPv6 Hdr	SA = **V::**, DA = **X::**
Payload	

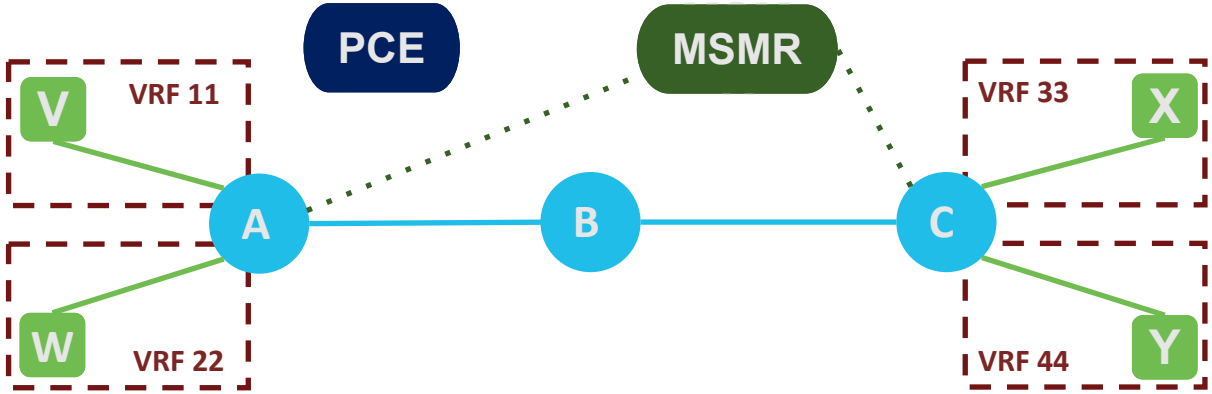
IPv6 Hdr	SA = V::, DA = **X::**
Payload	

Traffic flows from V to X via the SRv6 path <A::, E::D55>

Joint resolution

MSMR

IID	EID	RLOC
1	V	A::D11, Red
1	X	C::D33, Red
2	W	A::D22, Blue
2	Y	C::D44, Blue



A

LISP Local EID DB

VRF	IID	EID	Color
11	1	V	Red
22	2	W	Blue

LISP Map Cache

IID	EID	RLOC

SRv6 My Local SID table

SID	Action
A::D11	Decap – VRF 11
A::D22	Decap - VRF 22

SRv6 policies

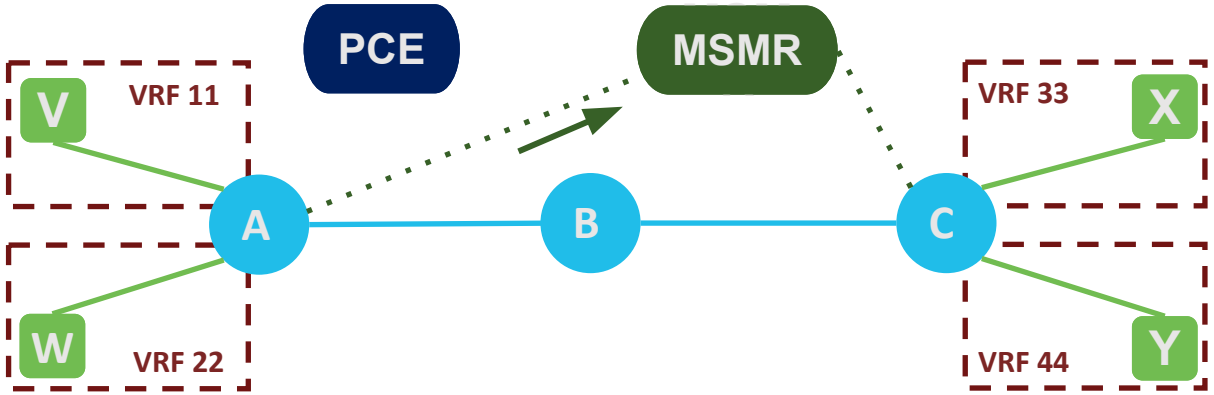
NextHop	Color	SID list

IPv6 Hdr	SA = V::, DA = **X::**
Payload	

Traffic at A going to X triggers Map Cache resolution

MSMR

IID	EID	RLOC
1	V	A::D11, Red
1	X	C::D33, Red
2	W	A::D22, Blue
2	Y	C::D44, Blue



A

LISP Local EID DB

VRF	IID	EID	Color
11	1	V	Red
22	2	W	Blue

IPv6 Hdr	SA = V::, DA = **X::**
Payload	

LISP Map Cache

IID	EID	RLOC

SRv6 My Local SID table

SID	Action
A::D11	Decap – VRF 11
A::D22	Decap - VRF 22

SRv6 policies

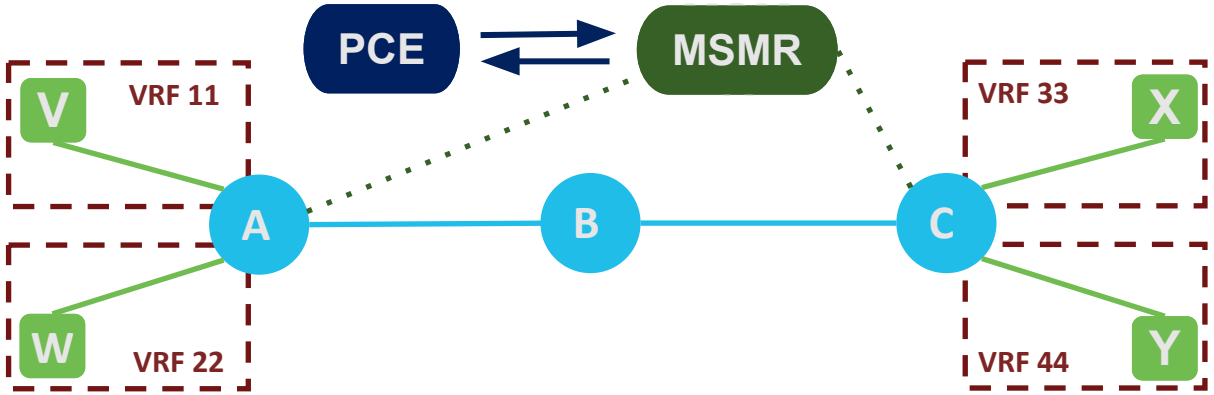
NextHop	Color	SID list

Traffic at A going to X triggers Map Cache resolution

Map-Request from A to the MSMR: “Where’s X?”

MSMR

IID	EID	RLOC
1	V	A::D11, Red
1	X	C::D33, Red
2	W	A::D22, Blue
2	Y	C::D44, Blue



A

LISP Local EID DB

VRF	IID	EID	Color
11	1	V	Red
22	2	W	Blue

IPv6 Hdr	SA = V::, DA = **X::**
Payload	

LISP Map Cache

IID	EID	RLOC

SRv6 My Local SID table

SID	Action
A::D11	Decap – VRF 11
A::D22	Decap - VRF 22

SRv6 policies

NextHop	Color	SID list

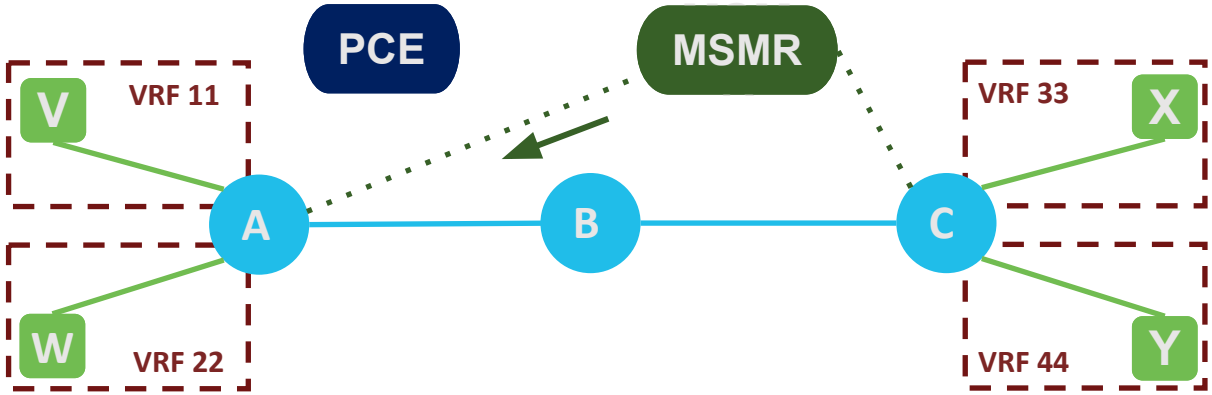
Traffic at A going to X triggers Map Cache resolution

Map-Request from A to the MSMR: “Where’s X?”

MSMR retrieves SRv6 Policies via PCE for {C::, Red}

MSMR

IID	EID	RLOC
1	V	A::D11, Red
1	X	C::D33, Red
2	W	A::D22, Blue
2	Y	C::D44, Blue



A

LISP Local EID DB

VRF	IID	EID	Color
11	1	V	Red
22	2	W	Blue

LISP Map Cache

IID	EID	RLOC
1	X	<B::1, C::D33>

SRv6 My Local SID table

SID	Action
A::D11	Decap – VRF 11
A::D22	Decap - VRF 22

SRv6 policies

NextHop	Color	SID list

IPv6 Hdr	SA = V::, DA = **X::**
Payload	

Traffic at A going to X triggers Map Cache resolution

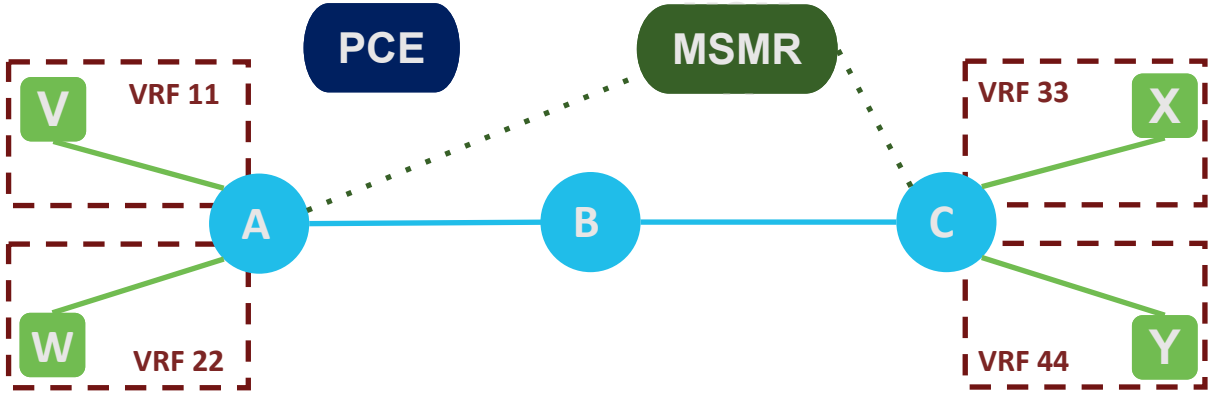
Map-Request from A to the MSMR: “Where’s X?”

MSMR retrieves SRv6 Policies via PCE for {C::, Red}

Map-Reply from the MSMR to A: “Path to X is <B::1, C::D33>”

MSMR

IID	EID	RLOC
1	V	A::D11, Red
1	X	C::D33, Red
2	W	A::D22, Blue
2	Y	C::D44, Blue



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LISP Local EID DB

VRF	IID	EID	Color
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LISP Map Cache

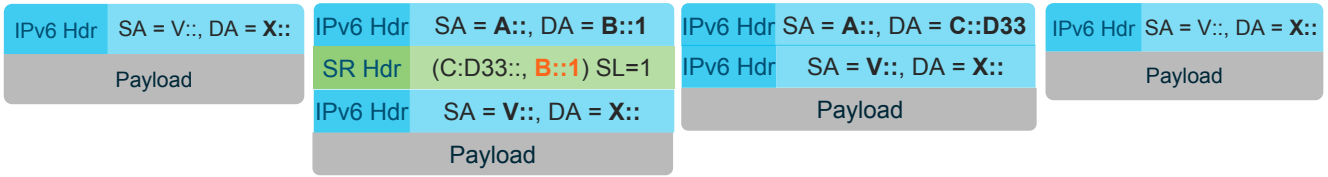
IID	EID	RLOC
1	X	<B::1, C::D33>

SRv6 My Local SID table

SID	Action
A::D11	Decap – VRF 11
A::D22	Decap - VRF 22

SRv6 policies

NextHop	Color	SID list



Traffic flows from V to X via the SRv6 path <A::, B::A, C::D33>

MSMR

IID	EID	RLOC
1	V	A::D11, Red
1	X	C::D33, Red
2	W	A::D22, Blue
2	Y	C::D44, Blue

A

LISP Local EID DB

VRF	IID	EID	Color
11	1	V	Red
22	2	W	Blue

LISP Map Cache

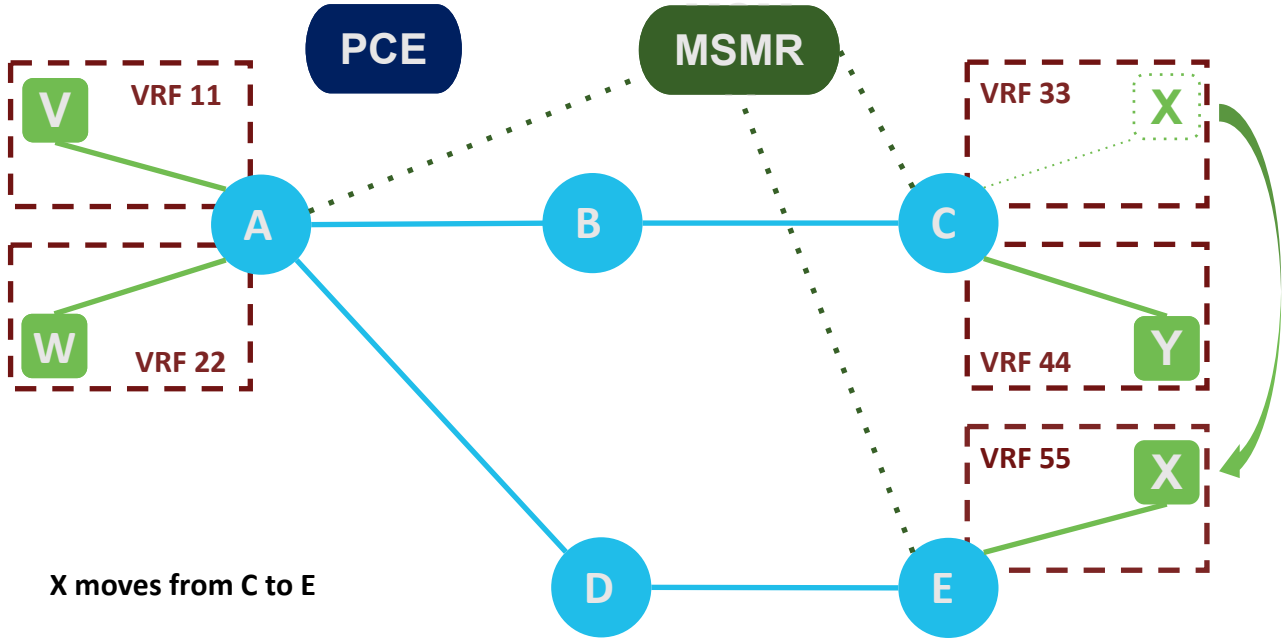
IID	EID	RLOC
1	X	<B::1, C::D33>

SRv6 My Local SID table

SID	Action
A::D11	Decap – VRF 11
A::D22	Decap - VRF 22

SRv6 policies

NextHop	Color	SID list



MSMR

IID	EID	RLOC
1	V	A::D11, Red
1	X	E::D55, Red
2	W	A::D22, Blue
2	Y	C::D44, Blue

A

LISP Local EID DB

VRF	IID	EID	Color
11	1	V	Red
22	2	W	Blue

LISP Map Cache

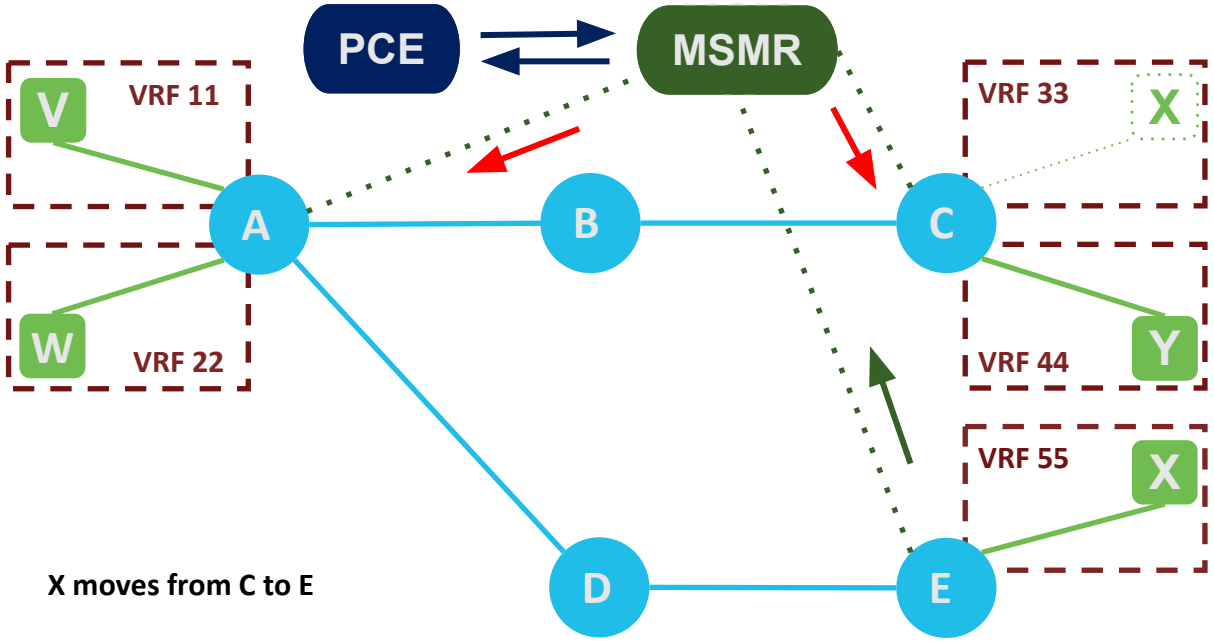
IID	EID	RLOC
1	X	E::D55

SRv6 My Local SID table

SID	Action
A::D11	Decap – VRF 11
A::D22	Decap - VRF 22

SRv6 policies

NextHop	Color	SID list



X moves from C to E

E sends a Map-Register with X's new location to the MSMR, this triggers:

(0) Retrieval of SRv6 Policies via PCE for {E::, Red}

(1) Notification of new path to old location (to enable redirects) [draft-ietf-eid-mobility]

(2) Notification of new path to previous requesters [draft-ietf-lisp-pubsub]

MSMR

IID	EID	RLOC
1	V	A::D11, Red
1	X	**E::D55, Red**
2	W	A::D22, Blue
2	Y	C::D44, Blue

A

LISP Local EID DB

VRF	IID	EID	Color
11	1	V	Red
22	2	W	Blue

LISP Map Cache

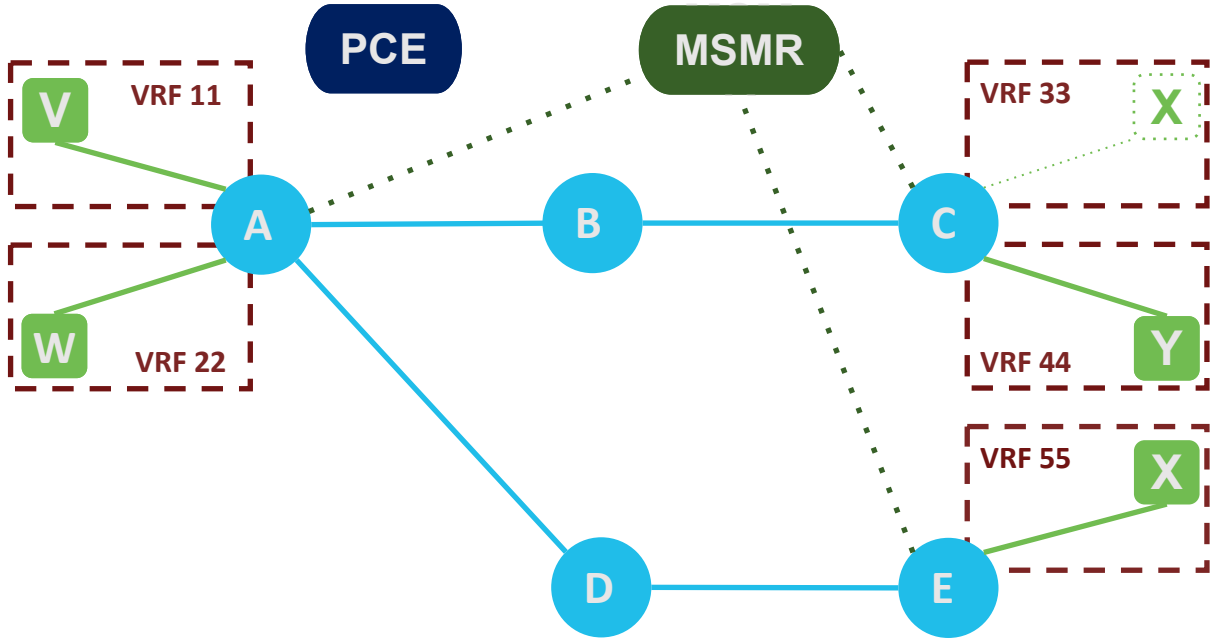
IID	EID	RLOC
1	X	**E::D55**

SRv6 My Local SID table

SID	Action
A::D11	Decap – VRF 11
A::D22	Decap - VRF 22

SRv6 policies

NextHop	Color	SID list



IPv6 Hdr	SA = V::, DA = **X::**
Payload	

IPv6 Hdr	SA = **A::**, DA = **E::D55**
IPv6 Hdr	SA = **V::**, DA = **X::**
Payload	

IPv6 Hdr	SA = V::, DA = **X::**
Payload	

Traffic flows from V to X via the SRv6 path <A::, E::D55>

Open questions

- Encoding for SRv6 path in LISP control-plane messages
  - Reuse ELP or define new subtype within the new SR LCAF?

Next steps

- Extend and refine for version -01
- Present draft to SPRING WG and gather feedback
- Experimental implementation in FD.io (VPP)