SRv6 Lab

the new frontier of backbone

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itnog7 – bologna – may 10th, 2023

SRv6 Lab - Agenda

- Why this Lab SRv6

- SRv6 Deep Dive

- Our Lab

- SRv6 Case study

- SRv6 Conclusion

Why this Lab SRv6

The question was:

SRv6 || ! SRv6 Today ?

SRv6 Deep Dive

Our future network will be Intent Driven/Based Network (IDN/IBN)

- ✓ Elastic architecture (Fabric)

- ✓ Dedicated network experience (Slicing)

- ✓ **Any2any connection (SRv6)**

- ✓ Intent driven (SDN)

- ✓ Highly Intelligent (AI)

SRv6 Deep Dive

Gradually Maturing SRv6 Standards

Service	Description	Status
Base	SRv6 Arch-Network Programming	RFC 8986
	IPv6 Segment Routing Header	RFC 8754
VPN	SRv6 VPN	RFC Ed
IGP	ISIS & OSPFv3 for SRv6	RFC Ed & WG

SRv6 Deep Dive

IPv6 Header

SA	DA

IPv6 extension header 1
⋮
SR extension header
(Routing Header)

Segment[0]
Segment[1]
…
Segment[n]

Optional TLV
Payload

Flexible IPv6 extension headers

Hop-by-hop	Routing Header	…	Authentication header	Destination

Programmable segment lists, enabling flexible path programmability

128 bits	128 bits	128 bits	…	128 bits

Programmable segments, enabling service programmability

Locator	Function	Argument
Location information Reachability	Service function definition	Enhancement

Programmable Optional TLVs, enabling application programmability   Service chain TLV

APP ID		Type
User ID		Length
Net Req.		Service Meta

Programmable Paths

Flexible segment list orchestration provides definable service paths

Programmable Services

VPN, VAS, and SFC service information can be flexibly defined

Programmable Applications

Extension header + Optional TLV enables networks to be aware of applications.

SRv6 Deep Dive

Control Protocols

5+	>>	2

IGP, LDP, BGP   IGP, BGP
RSVP-TE, LDP

Encapsulation Protocols

4+	>>	1

MPLS, VXLAN   IP
GRE, L2TP, IP

Service Configuration

6+	>>	2

Segment-by-segment,   Service end nodes only
device-by-device
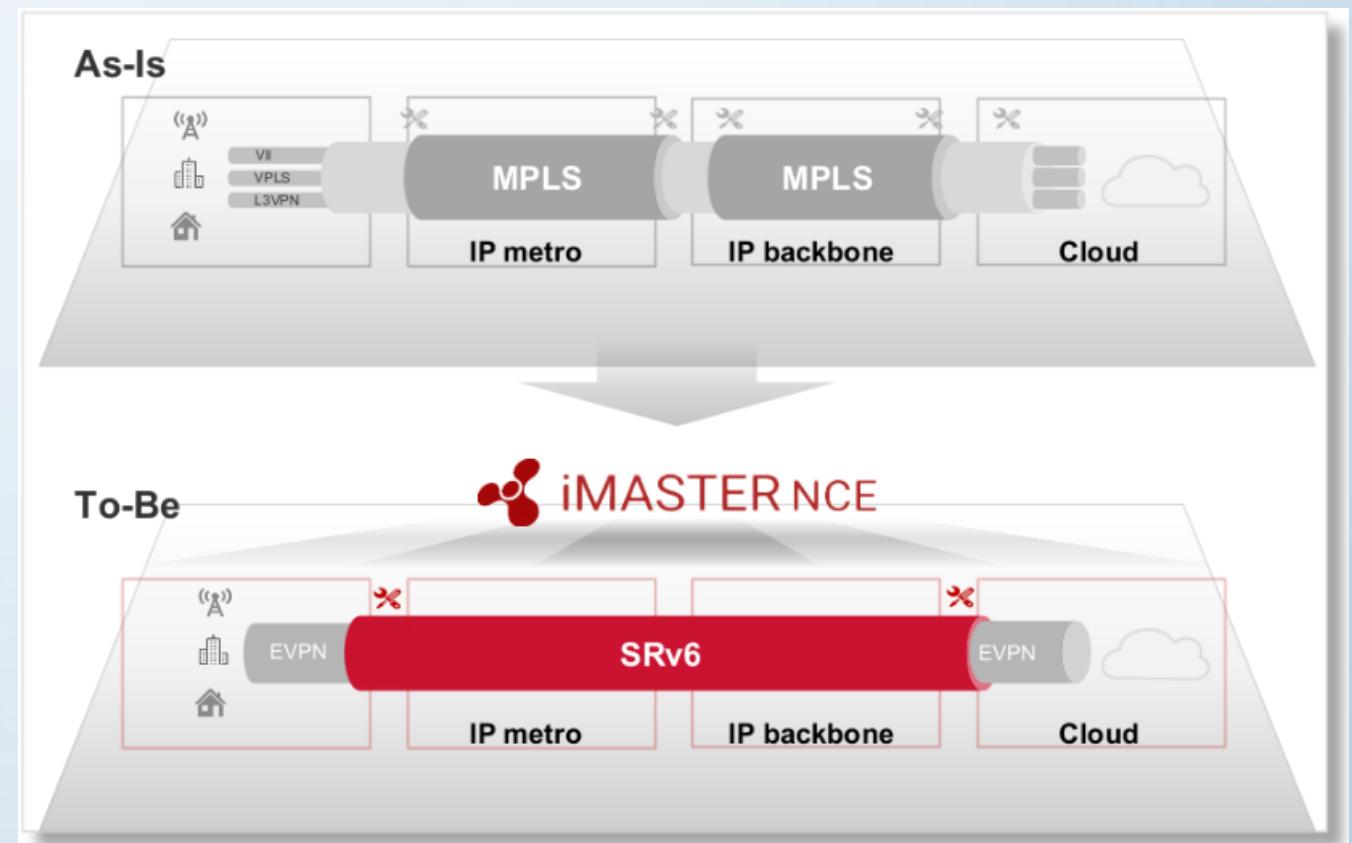
SRv6 Deep Dive
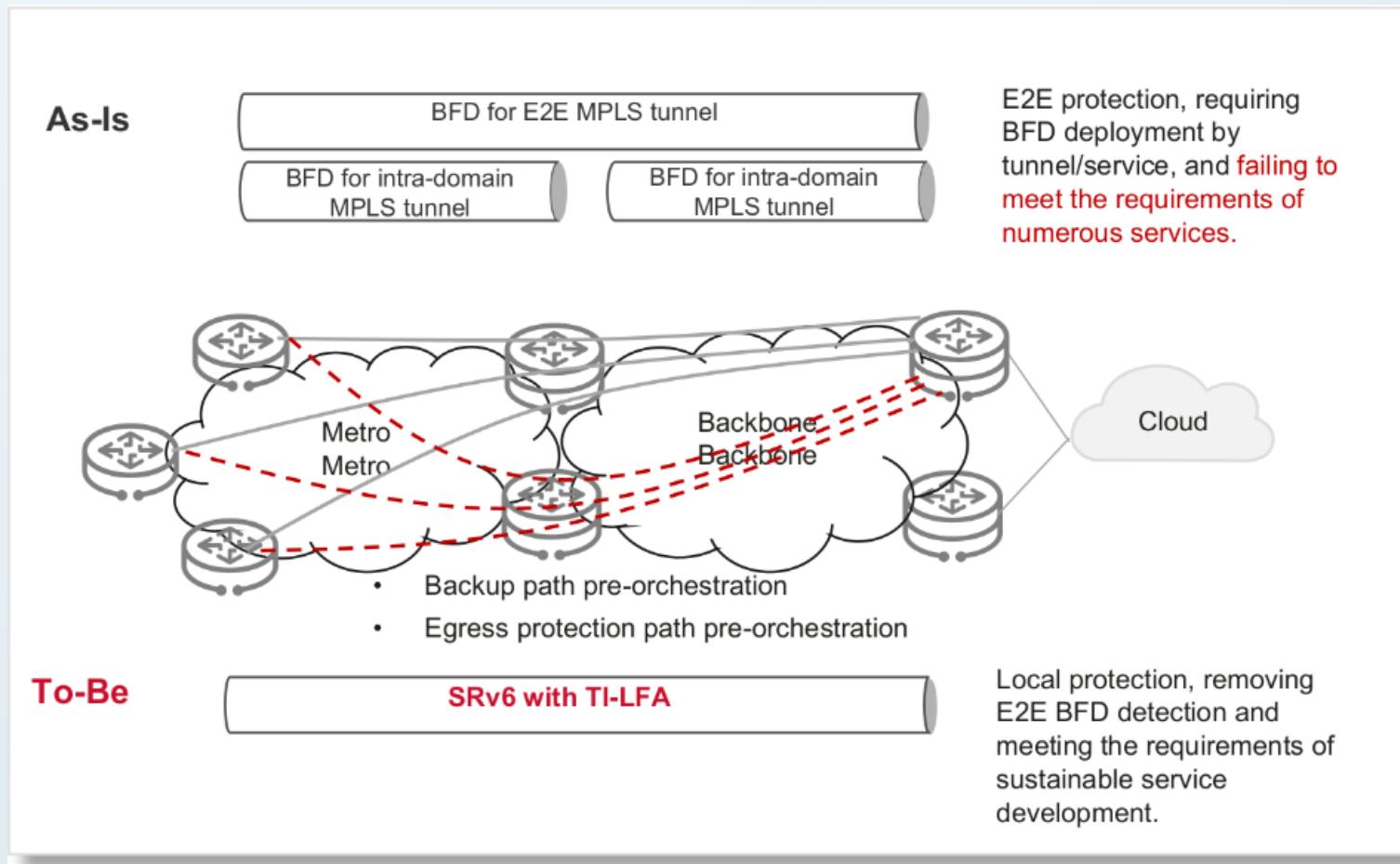
Recovery Within 50 ms

Local protection, fast detection, and fast recovery

Any Topology

Unified protection for any topology

Numerous Services

One-time simple deployment, irrelevant to the number of tunnels or services

SRv6 Deep Dive

Day 0 | Day 1 | Day 2

Evolution path 1: **overlay mode**

Evolution path 2: **interworking mode**

Non-SRv6 node | SRv6 node
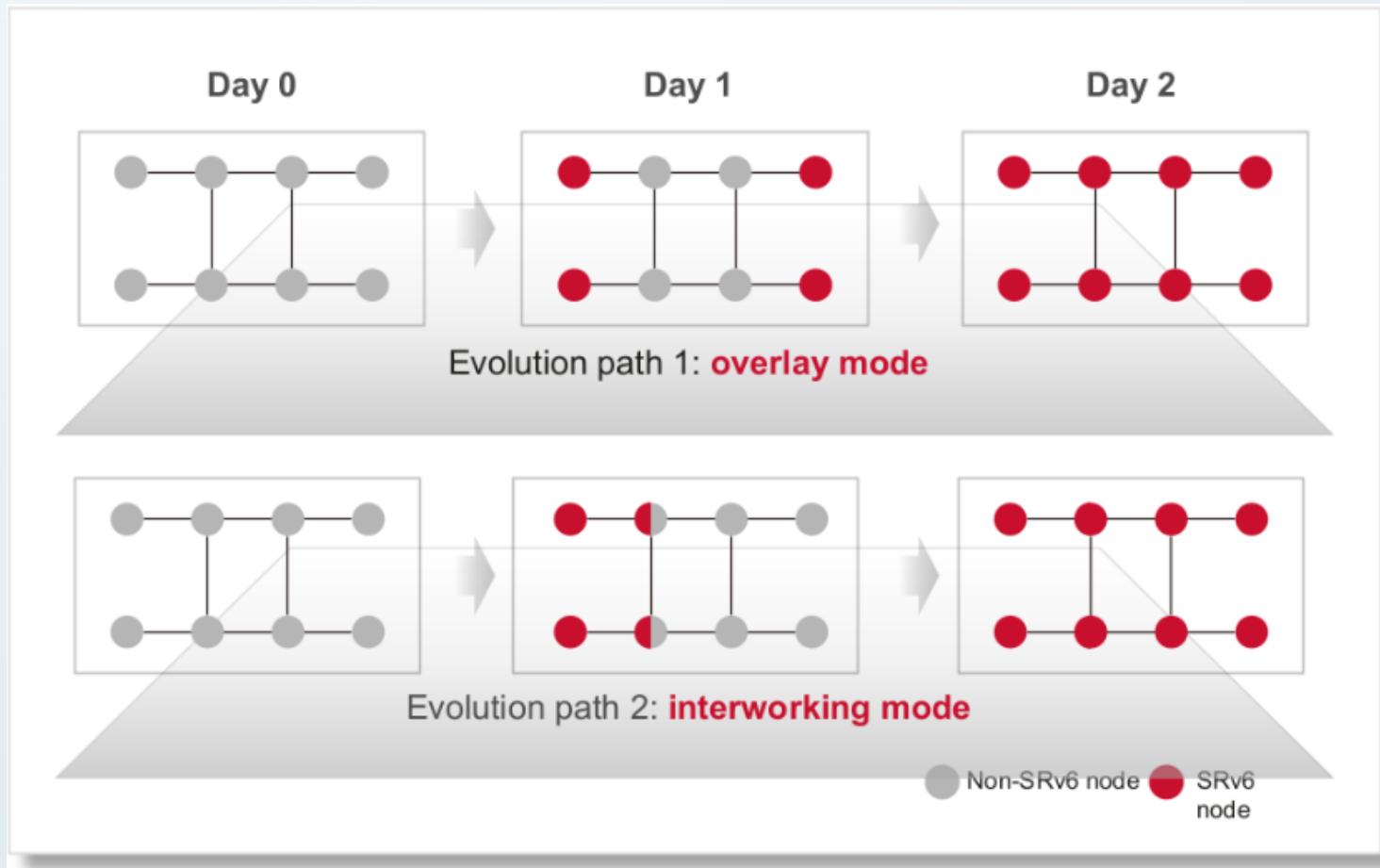
Fast Deployment

Incremental deployment, on-demand reconstruction, and fast SRv6 introduction

Reduced Investment

Network devices can be flexibly reused, minimizing one-time investment

Easy Evolution

Multiple evolution paths, supporting flexible and on-demand selection

Our Lab

Huawei

NE8000-M1C

NE8000-M4

NE8000-F1A

Juniper

MX204

NE8000 M4
PE

NE8000 F1A
PE

MX204
PE

NE8000 M1C
P - RR
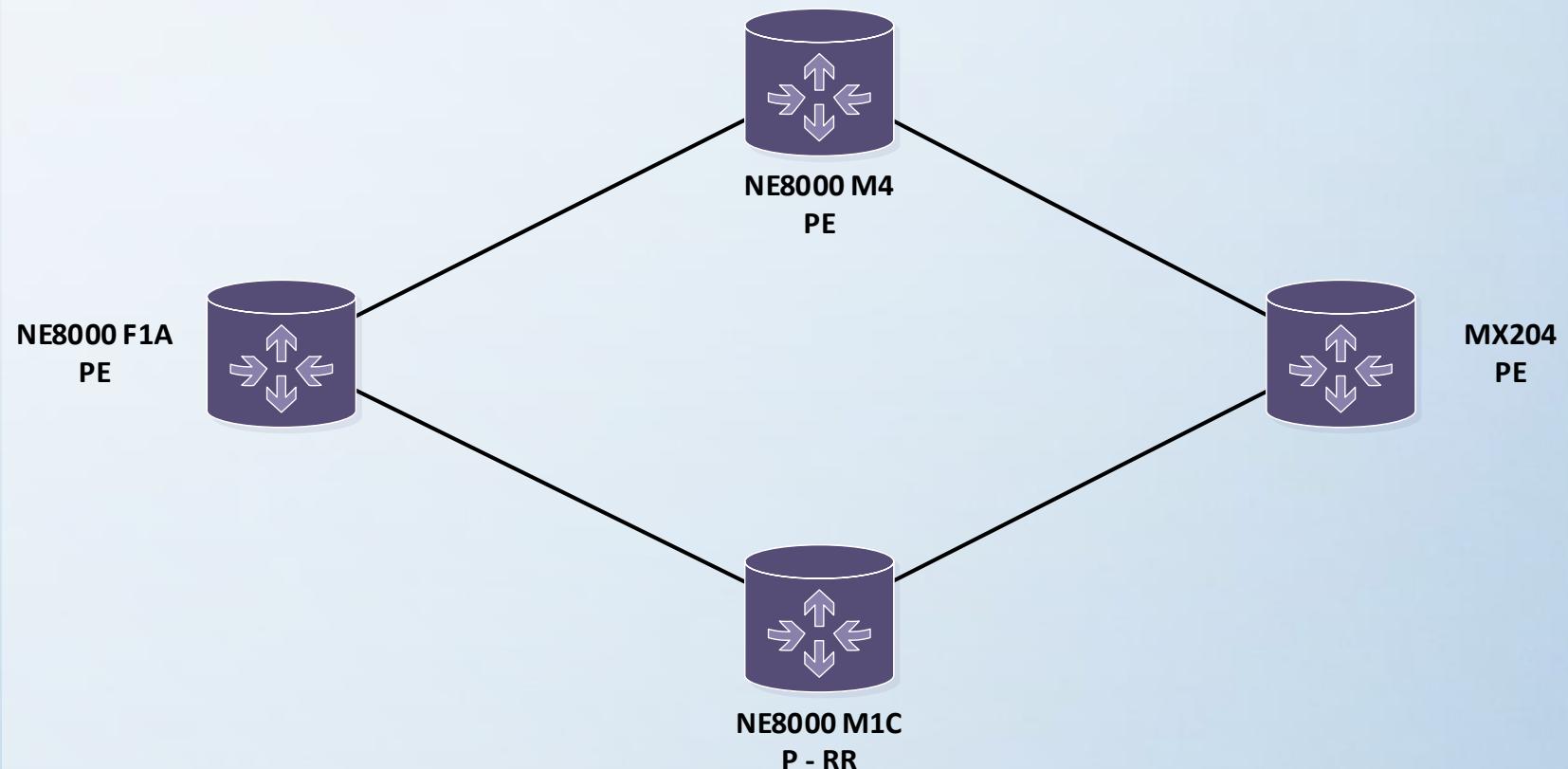
Our Lab – Basic Configuration

Huawei

```
interface GigabitEthernet0/1/0
 description TO-P-M1C
 undo shutdown
 ipv6 enable
 ipv6 address 192:14:15::1/126
 ipv6 mtu 9000

interface LoopBack0
 ipv6 enable
 ipv6 address 10::14/128
```

Juniper

```
set interfaces xe-0/1/2 description TO-M1C-15
set interfaces xe-0/1/2 mtu 9192
set interfaces xe-0/1/2 unit 0 family inet6 mtu 9000
set interfaces xe-0/1/2 unit 0 family inet6 address 192:14:8::2/126

set interfaces lo0 description Loopback
set interfaces lo0 unit 0 family inet6 address 10::8/128
```

Our Lab – Routing Huawei

```
isis 100
 is-level level-2
 cost-style wide
 timer lsp-generation 1 50 50 level-2
 network-entity 86.0100.0001.0100.0000.0014.00
 is-name F1A-14
 timer spf 1 50 50
 set-overload on-startup send-sa-bit 120 allow external
 #
 ipv6 enable topology ipv6
 ipv6 bfd all-interfaces enable
 ipv6 bfd all-interfaces min-tx-interval 10 min-rx-interval 10 frr-
binding
 segment-routing ipv6 locator srv6be
 ipv6 avoid-microloop segment-routing
 ipv6 avoid-microloop segment-routing rib-update-delay 10000
 ipv6 frr
  ti-lfa level-2

interface GigabitEthernet0/1/0
 isis ipv6 enable 100
 isis circuit-type p2p
 isis circuit-level level-2
 isis ipv6 cost 100

interface LoopBack0
 isis ipv6 enable 100
```

```
bgp 100
 router-id 10.0.0.14
 peer 10::15 as-number 100
 peer 10::15 connect-interface LoopBack0
 #
 ipv4-family unicast
  undo synchronization
 #
 ipv4-family vpnv4
  policy vpn-target
  peer 10::15 enable
  peer 10::15 prefix-sid sid-type5 advertise-srv6-locator
 #
 l2vpn-family evpn
  policy vpn-target
  peer 10::15 enable
  peer 10::15 route-policy test export
  peer 10::15 advertise encap-type srv6


route-policy test permit node 10
 apply ipv6 next-hop 2002:10:0:14::
```

Our Lab – Routing Juniper

```
set protocols isis interface xe-0/1/2.0 level 2 metric 100
set protocols isis interface xe-0/1/2.0 level 2 topology ipv6-unicast
set protocols isis interface xe-0/1/2.0 point-to-point
set protocols isis interface xe-0/1/2.0 family inet6 bfd-liveness-detection minimum-interval 10
set protocols isis interface xe-0/1/2.0 family inet6 bfd-liveness-detection minimum-receive-interval 10
set protocols isis interface xe-0/1/2.0 family inet6 bfd-liveness-detection multiplier 3
set protocols isis interface lo0.0 passive
set protocols isis source-packet-routing srv6 locator srv6be end-sid 2002:10:0:8::1001:0 flavor usd
set protocols isis source-packet-routing srv6 locator srv6be end-sid 2002:10:0:8::1002:0 flavor psp
set protocols isis level 2 wide-metrics-only
set protocols isis traffic-engineering l3-unicast-topology
set protocols isis traffic-engineering advertisement always
set protocols isis topologies ipv6-unicast


set interfaces xe-0/1/2 unit 0 family iso
set interfaces lo0 unit 0 family iso address 86.0100.0001.0100.0000.0008.00
```

```
set routing-options route-distinguisher-id 10.0.0.8
set routing-options router-id 10.0.0.8
set routing-options autonomous-system 100

set protocols bgp group ibgp type internal
set protocols bgp group ibgp local-address 10::8
set protocols bgp group ibgp family inet-vpn unicast extended-nexthop
set protocols bgp group ibgp family inet-vpn unicast advertise-srv6-service
set protocols bgp group ibgp family inet-vpn unicast accept-srv6-service
set protocols bgp group ibgp family inet6-vpn unicast advertise-srv6-service
set protocols bgp group ibgp family inet6-vpn unicast accept-srv6-service
set protocols bgp group ibgp family evpn signaling advertise-srv6-service
set protocols bgp group ibgp family evpn signaling accept-srv6-service
set protocols bgp group ibgp neighbor 10::15 peer-as 100
set protocols bgp group ibgp vpn-apply-export
```

Our Lab – SRv6

SRv6 Huawei

segment-routing ipv6
 encapsulation source-address 10::14
 locator srv6be ipv6-prefix 2002:10:0:14:: 84 static 12 args 16
  opcode ::2 end-op

SRv6 Juniper

set routing-options source-packet-routing srv6 locator srv6be 2002:10:0:8::/84

Our Lab – L2EVPN –VPWS over SRv6

NE8000 M4
PE

NE8000 F1A
PE

VPWS

MX204
PE

VPWS

HOST #1
10.10.10.1/30

NE8000 M1C
P - RR

HOST #2
10.10.10.2/30
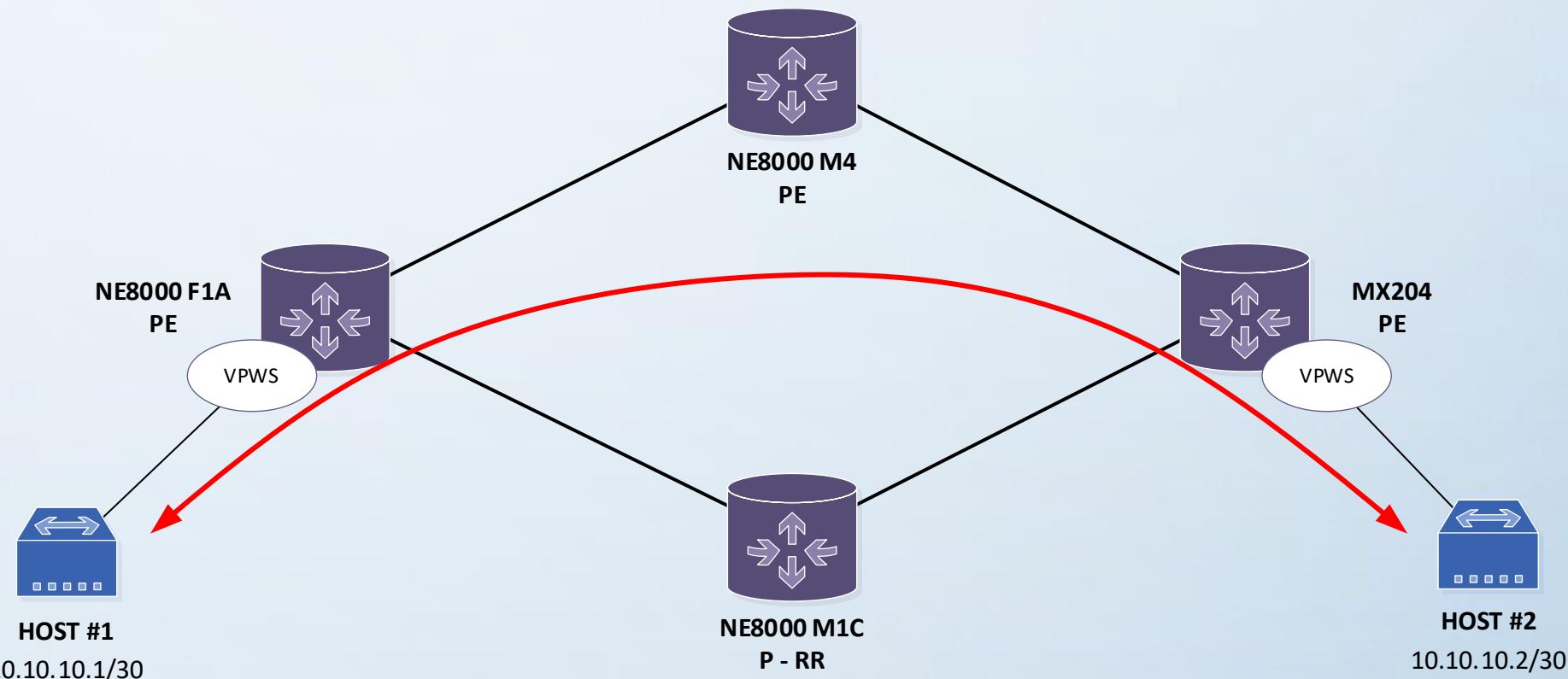
# Our Lab – L2EVPN –VPWS over SRv6

Huawei

```
evpn vpn-instance test_evpn_MX_dynamic vpws
 route-distinguisher 203:1
 segment-routing ipv6 best-effort
 vpn-target 203:1 export-extcommunity
 vpn-target 203:1 import-extcommunity
#
evpl instance 203
 evpn binding vpn-instance
test_evpn_MX_dynamic
 local-service-id 203 remote-service-id 2003
 mtu-match ignore
 segment-routing ipv6 locator srv6be
#
interface GigabitEthernet0/1/11.103 mode l2
 encapsulation dot1q vid 203
 evpl instance 203
```

Juniper

```
set interfaces xe-0/1/7 unit 103 encapsulation vlan-ccc
set interfaces xe-0/1/7 unit 103 vlan-id 203
set routing-instances test_evpn_MX_dynamic instance-type evpn-vpws
set routing-instances test_evpn_MX_dynamic protocols evpn interface xe-0/1/7.103
vpws-service-id local 2003
set routing-instances test_evpn_MX_dynamic protocols evpn interface xe-0/1/7.103
vpws-service-id remote 203
set routing-instances test_evpn_MX_dynamic protocols evpn interface xe-0/1/7.103
vpws-service-id source-packet-routing srv6 locator srv6be
set routing-instances test_evpn_MX_dynamic protocols evpn encapsulation srv6
set routing-instances test_evpn_MX_dynamic interface xe-0/1/7.103
set routing-instances test_evpn_MX_dynamic route-distinguisher 203:1
set routing-instances test_evpn_MX_dynamic vrf-target target:203:1
```

Our Lab – L3VPNv4 over SRv6
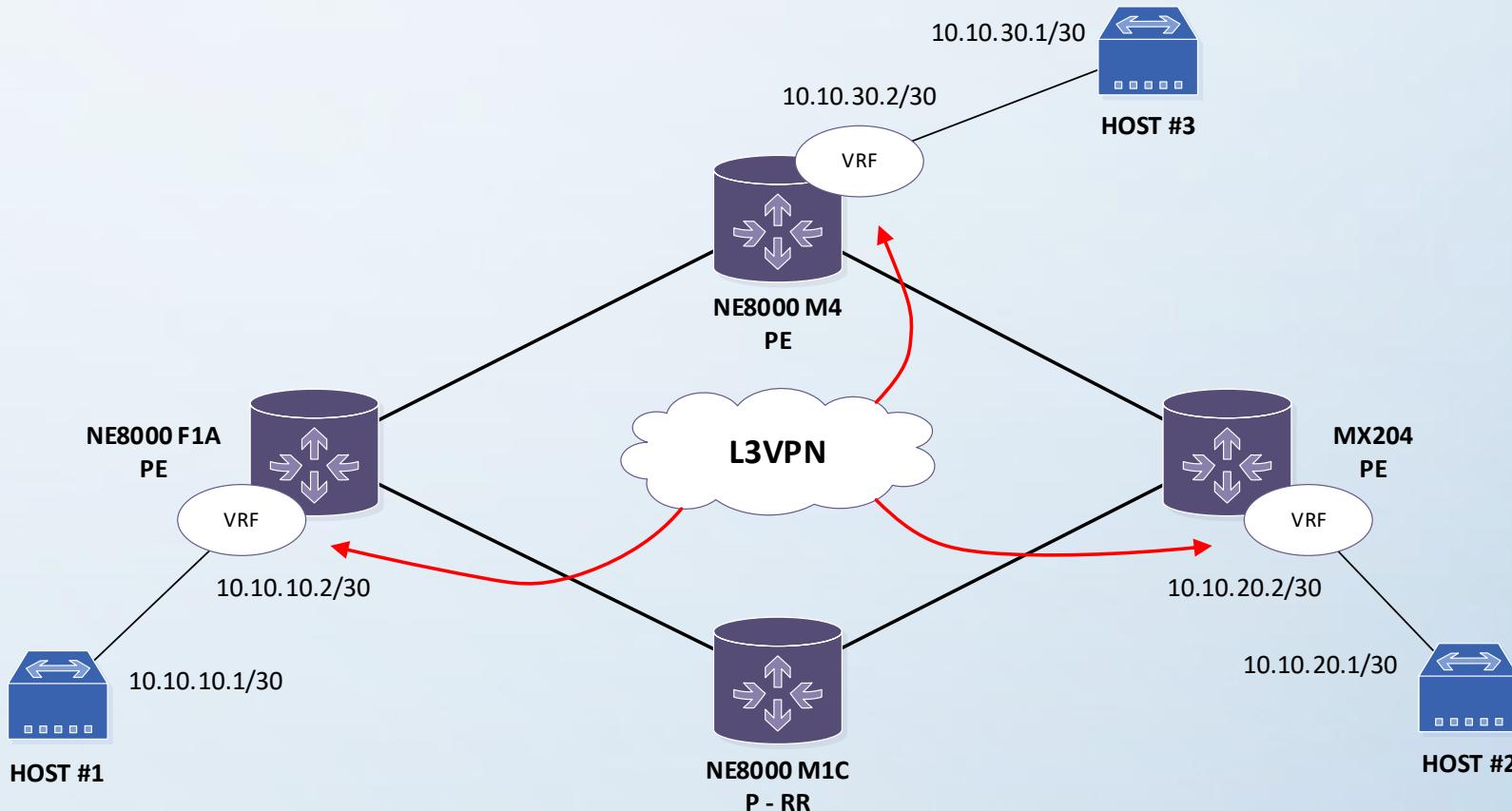
Our Lab – L3VPNv4 over SRv6

Huawei

```
ip vpn-instance test_L3VPN
 ipv4-family
  route-distinguisher 100:1
  apply-label per-instance
  vpn-target 100:1 export-extcommunity
  vpn-target 100:1 import-extcommunity

interface GigabitEthernet0/1/11.100
 vlan-type dot1q 1000
 ip binding vpn-instance test_L3VPN
 ip address 10.10.10.2 255.255.255.252

bgp 100
  ipv4-family vpn-instance test_L3VPN
  import-route direct
  auto-frr
  segment-routing ipv6 locator srv6be
  segment-routing ipv6 traffic-engineer best-effort
```

Juniper

```
set interfaces xe-0/1/7 unit 1000 vlan-id 1000
set interfaces xe-0/1/7 unit 1000 family inet address 10.10.20.2/30

set routing-instances test_L3VPN instance-type vrf
set routing-instances test_L3VPN protocols bgp source-packet-routing srv6 locator
srv6be end-dt4-sid 2002:10:0:8::1000:0
set routing-instances test_L3VPN interface xe-0/1/7.1000
set routing-instances test_L3VPN route-distinguisher 100:1
set routing-instances test_L3VPN vrf-target target:100:1
set routing-instances test_L3VPN vrf-table-label
```

Our Lab – L2EVPN – VPLS over SRv6

Huawei

```
evpn vpn-instance evpn_vpls bd-mode
 route-distinguisher 401:1
 segment-routing ipv6 best-effort
 segment-routing ipv6 locator srv6be
 vpn-target 401:1 export-extcommunity
 vpn-target 401:1 import-extcommunity
#
bridge-domain 401
evpn binding vpn-instance evpn_vpls
#
interface GigabitEthernet0/1/12.401 mode l2
 encapsulation qinq vid 401 ce-vid 4001
 bridge-domain 401
```

10.10.10.1/24

10.10.10.2/24

HOST #2

HOST #3

VPLS

VPLS

NE8000 M4
PE

NE8000 F1A
PE

VPLS

MX204
PE

10.10.10.3/24

HOST #1

NE8000 M1C
P - RR
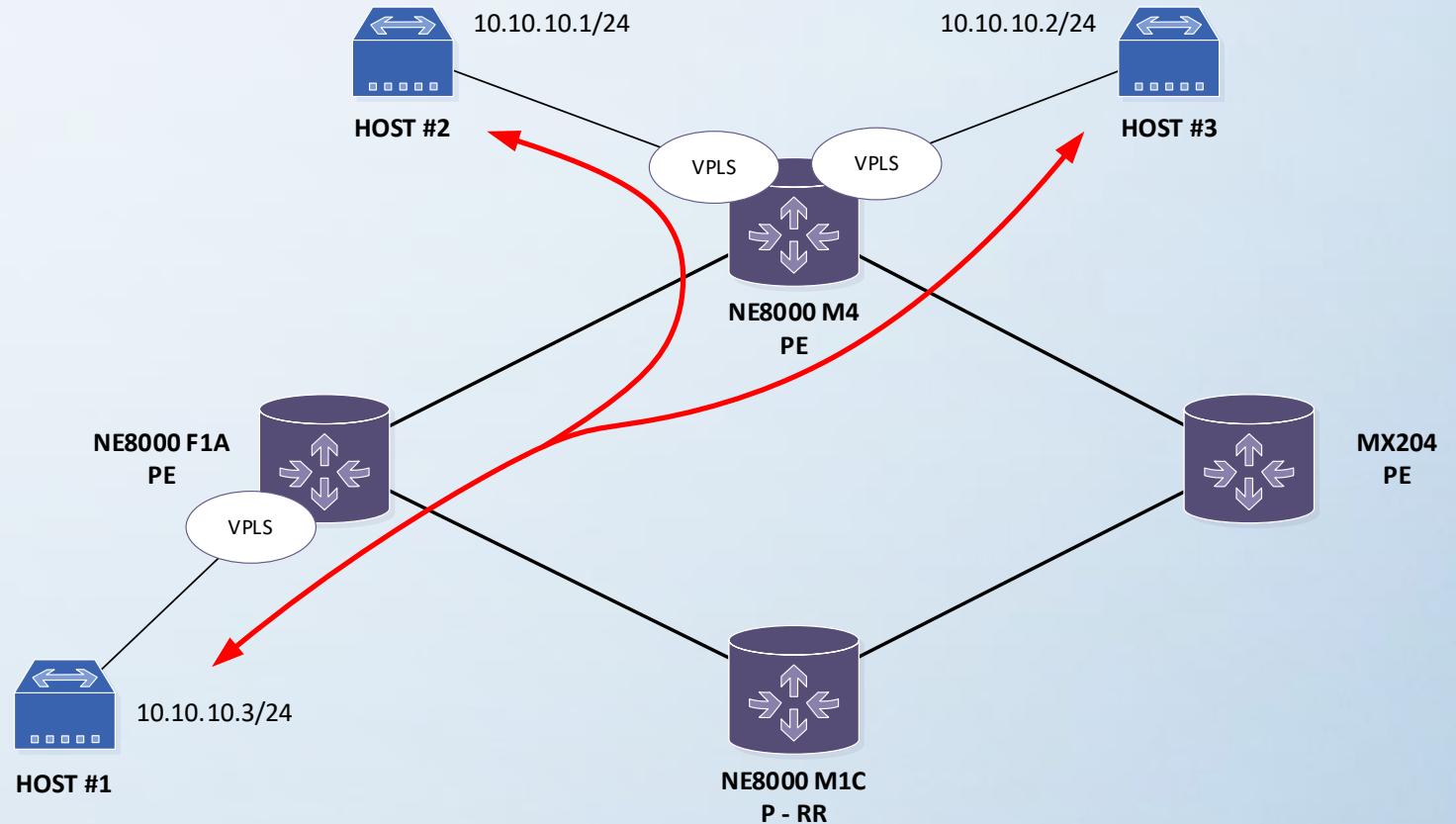
SRv6 – Case study

All-in-one backbone solution

UPSTREAM #2

KIT TIM/FW/OF

KIT FWA

VPLS

VPLS

NE8000 M4
PE & EBGP #2

VRF

VPLS

NE8000 F1A
PE & BRAS

VRF

VRF

MX204
PE & EBGP #1

VPWS

NE8000 M1C
P - RR

VPWS

UPSTREAM #1
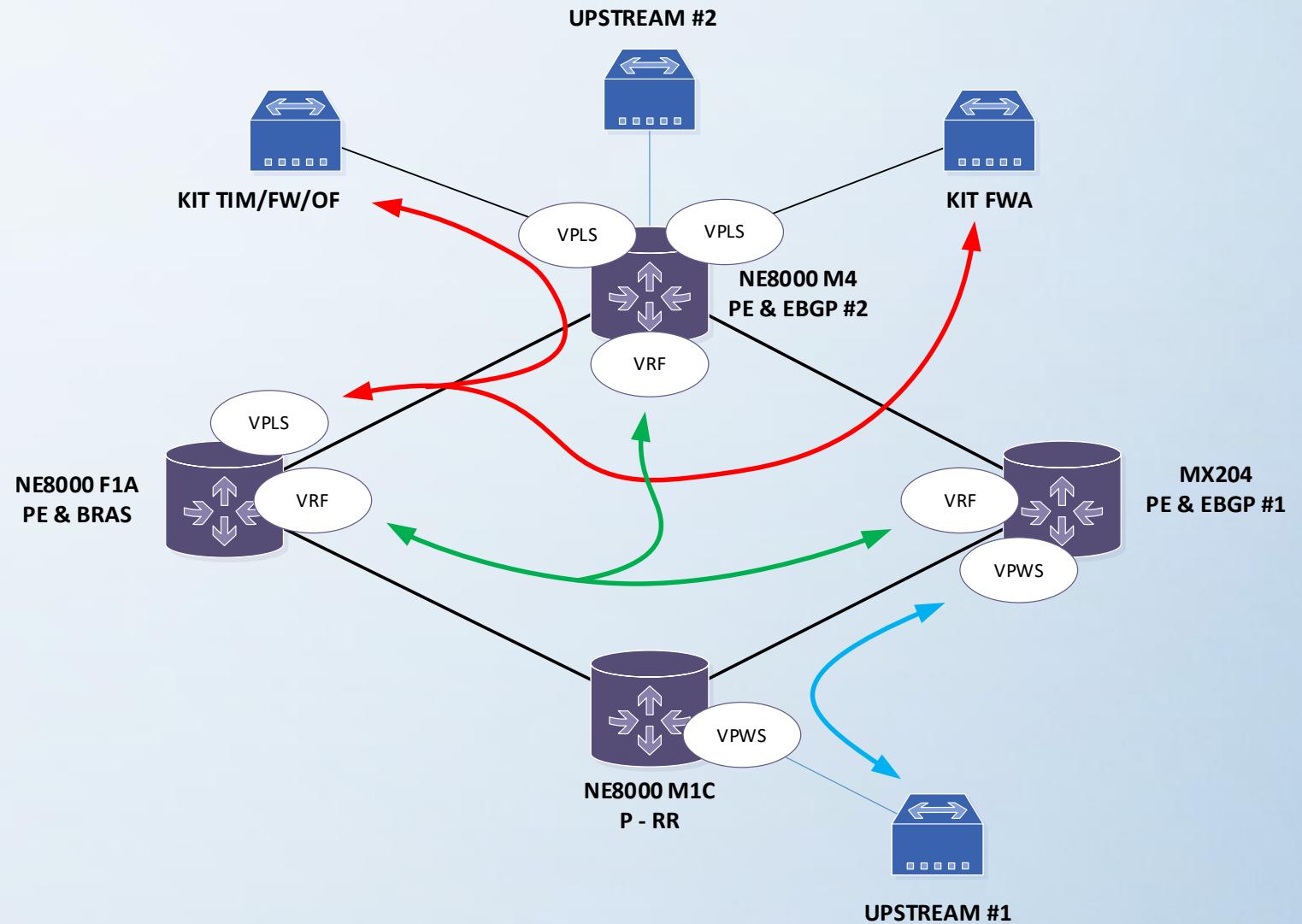
SRv6 Conclusion

- Complete industry chain ecosystem, chips, devices, applications, open source…

- Rich features: **flexible programming**, simplified protocols, ultra-high reliability, elastic scalability, smooth evolution

- All services with only one overlay standard

- Only IGP/BGP, SRv6 TE, TI-LFA, mirror SID, and BSID…

Why this Lab SRv6

The question was:

SRv... : SRv6 Today ?

Yes you can

Engineering
Team

- Chen Chen

- Federico

- Marco