

Rakuten Mobile end-to-end 5G network slicing using SRv6 uSID

Experiences and views from a Service Provider

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Agenda

SRv6 u-SID design & benefits

SRv6 Summarization with BGP PIC Edge

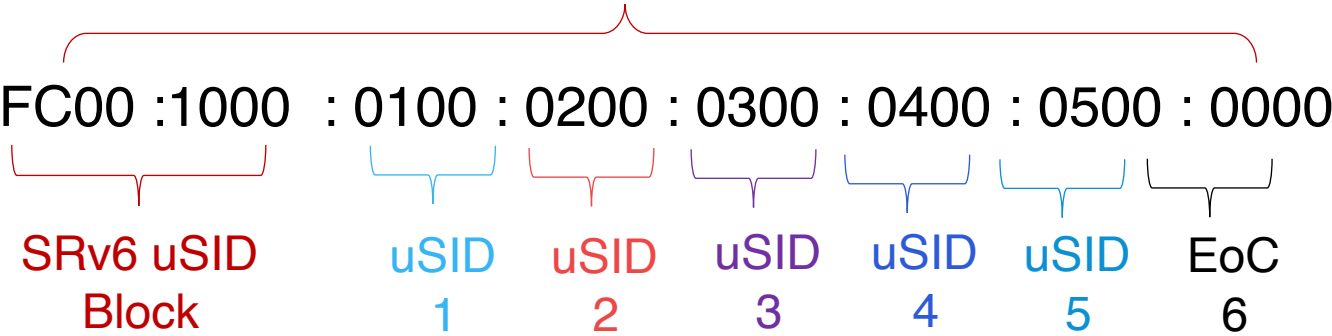
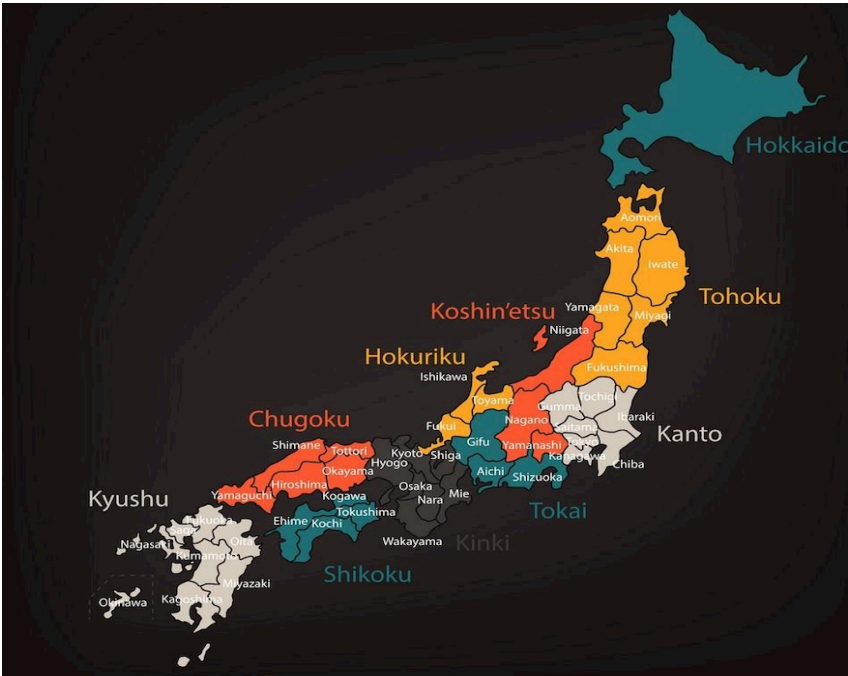
end-to-end 5G network slicing

Challenges and Slicing analytics

Summary & Conclusion

SRv6 u-SID Design

- Extensive SRv6 u-SID for 5G SA architecture.
- ULA addressing with route summarization on boundary nodes.
- uSID block in /32, uSID ID in 16-bits, uSID Node Locator in /48.
- Loopbacks and Locator blocks are synchronized.
- Features: L3VPNs / EVPN / SRH / TI-LFA / u-Loops/ BGP-PIC and FA.



SA:2001::1
DA:FC00:10a:100:200:300:400:500::
NH:Ipv4

SA:7.5.4.3
DA:11.6.19.71
Port:UDP

UDP Header/Data

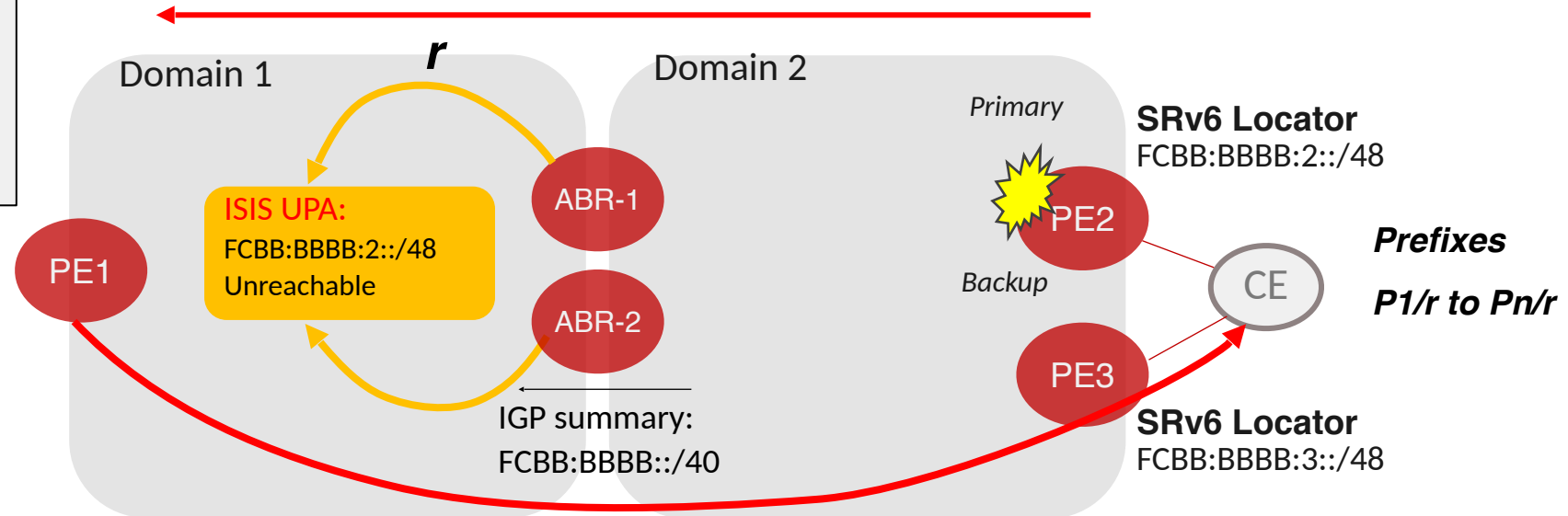
SRV6 uSID Encapsulation

Effectiveness of u-SID: Compression Algorithm

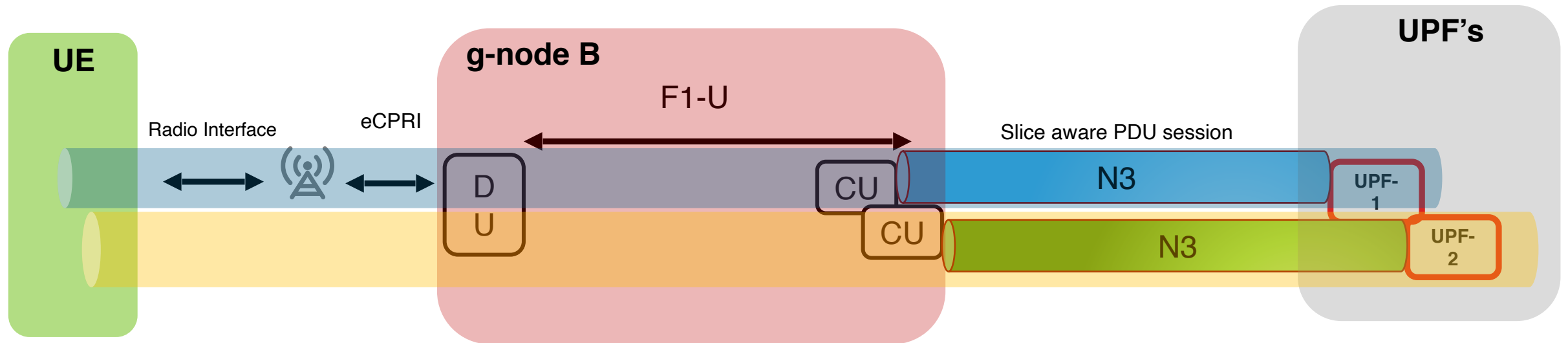
26 u-SID Imposition
POC – [SR.NET](#)

- SRv6 Native
 - Perfect integration with SRH (RFC8754) and SRv6 Network Programming (RFC 8986).
- *SRv6 efficient compression mechanism*
 - Highest number of uSID's with lowest MTU overhead.
- Seamless Deployment
 - Host and Legacy access can interwork.
 - Host nodes push 6 uSID's with "classic" IPinIP (6 uSID's in DA)
- Longest match lookup
 - CIDR & Longest-match lookup : Leveraging feature of any IP NPU longest-match lookup.
- Line rate validation of 26 uSID's push on **Cisco NCS 5700 platform (J2)**.

resolved via FCBB:BBBB::/40



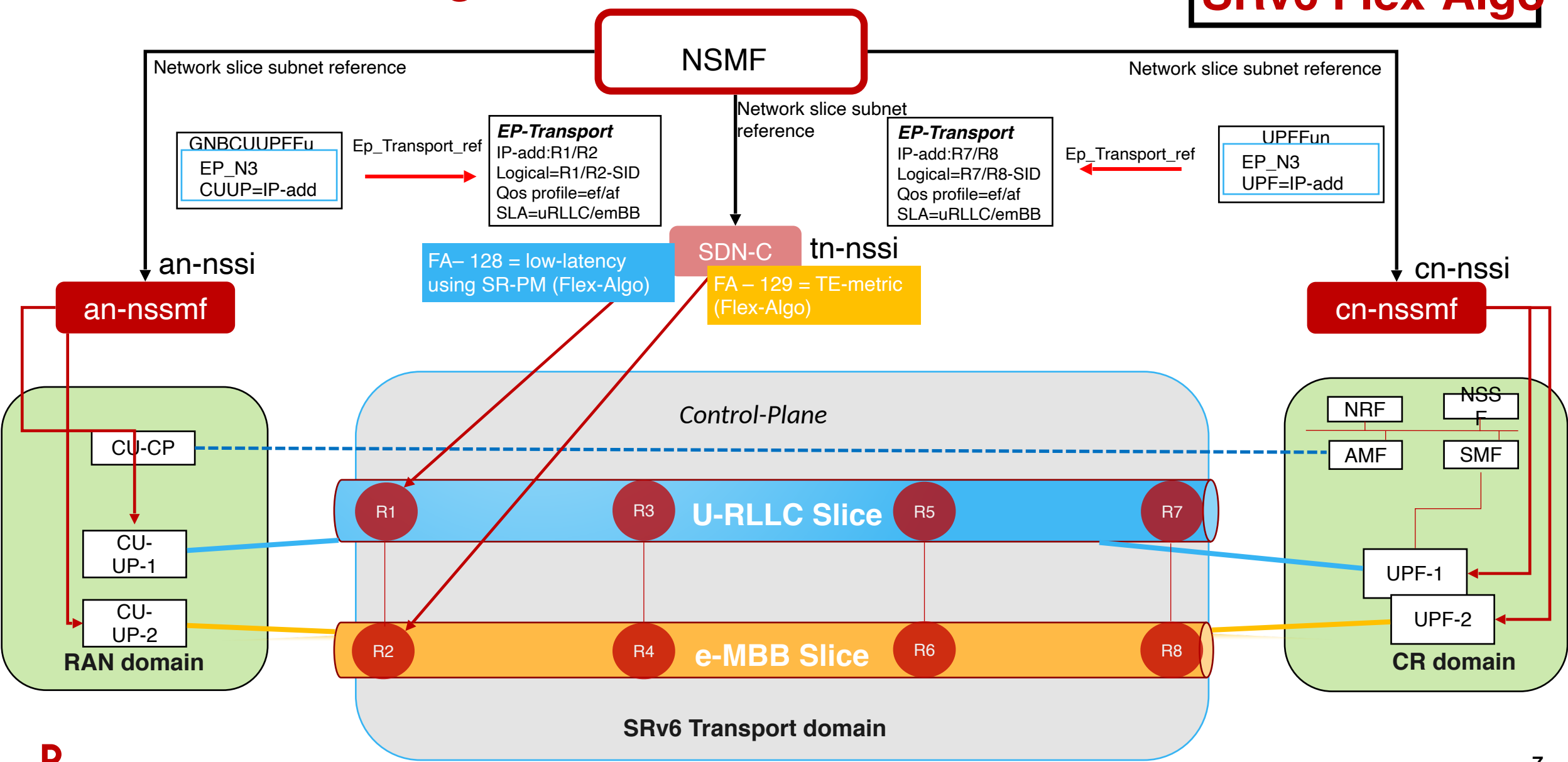
End-to-end network slicing state of art



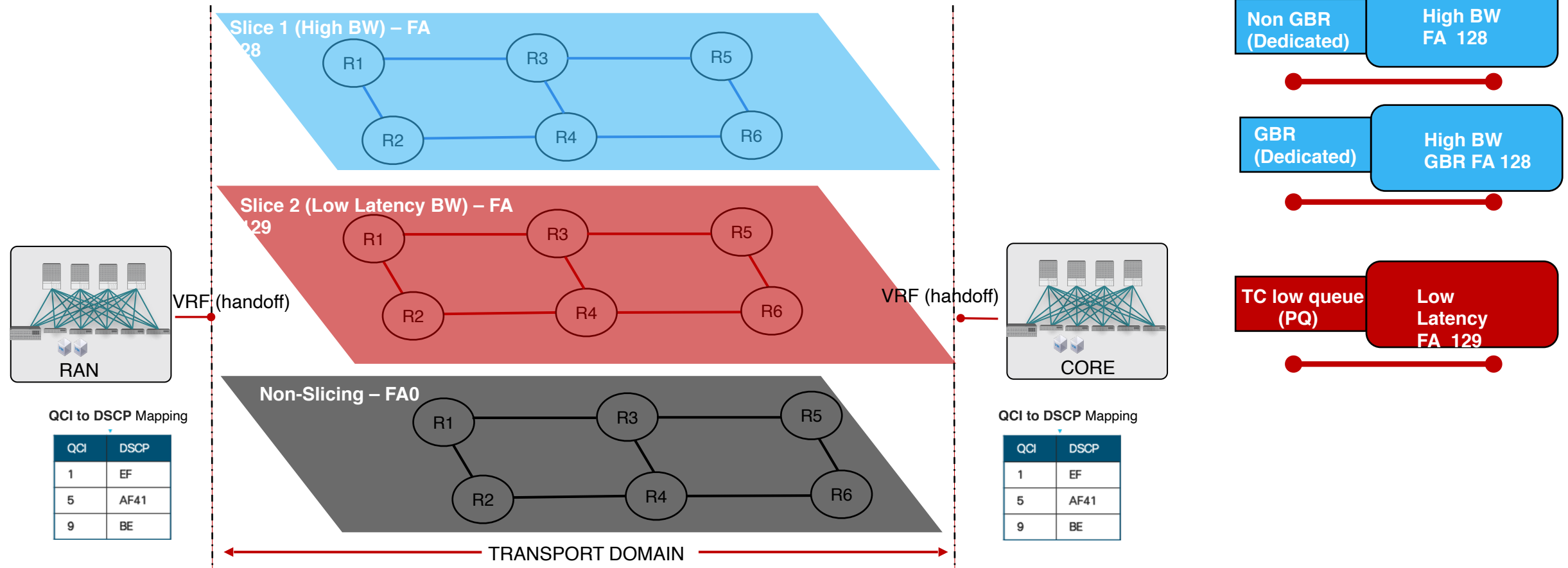
- Slicing dedicated resource reservation in each domain (RAN/Transport and Core)
- Slicing is **N3-U aware** at the 5G user plane as per the 3GPP architecture.
- Per Slice PDU connections **and UE subscribe multiple slices**.

Slice creations using NSMF

SRv6 Flex-Algo

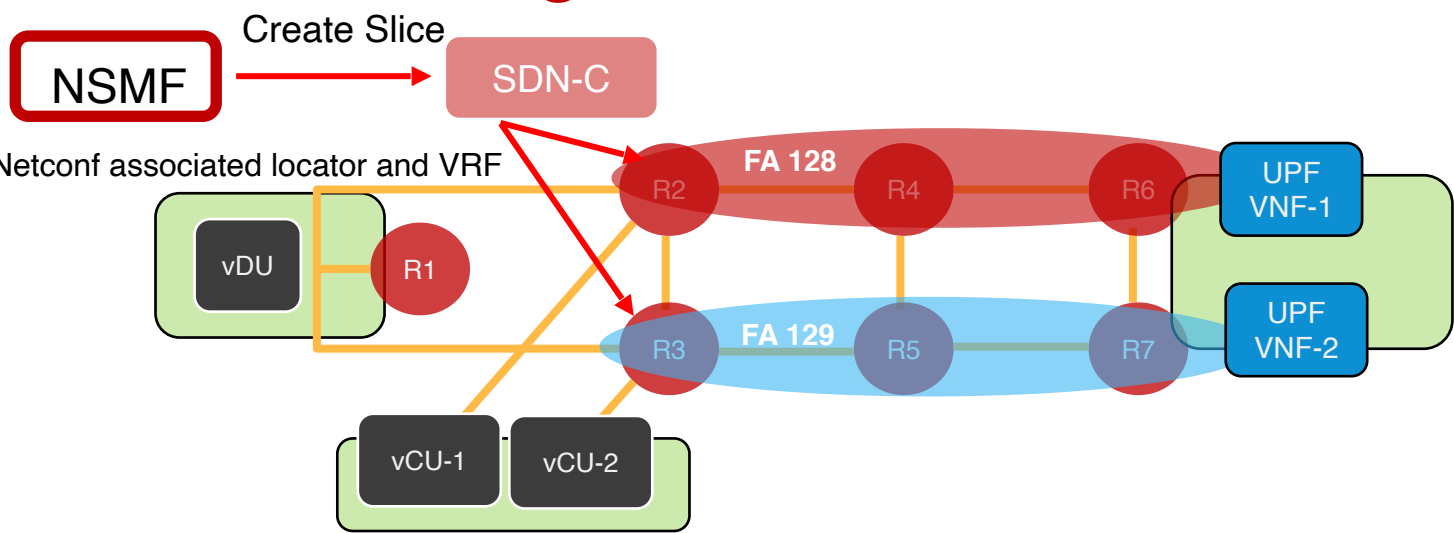


Transport Domain : FA with resource reservations



- Slicing architecture key building blocks are **VPNs, QoS and Flex-Algo**.
- Flex-Algo provides the **slice marking** for each application – **SRv6 Segment ID**.
- Simplified architecture with no per path state and lower SID depth – Ultra scalability.

Network Slicing



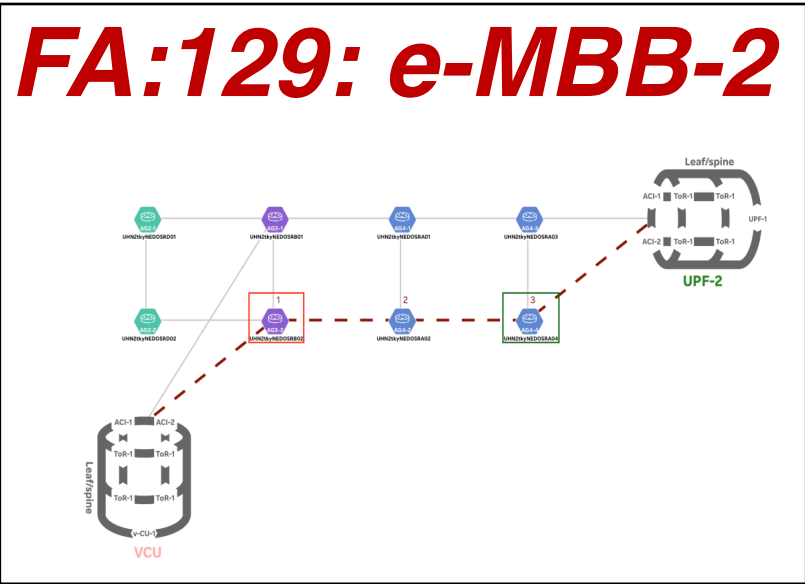
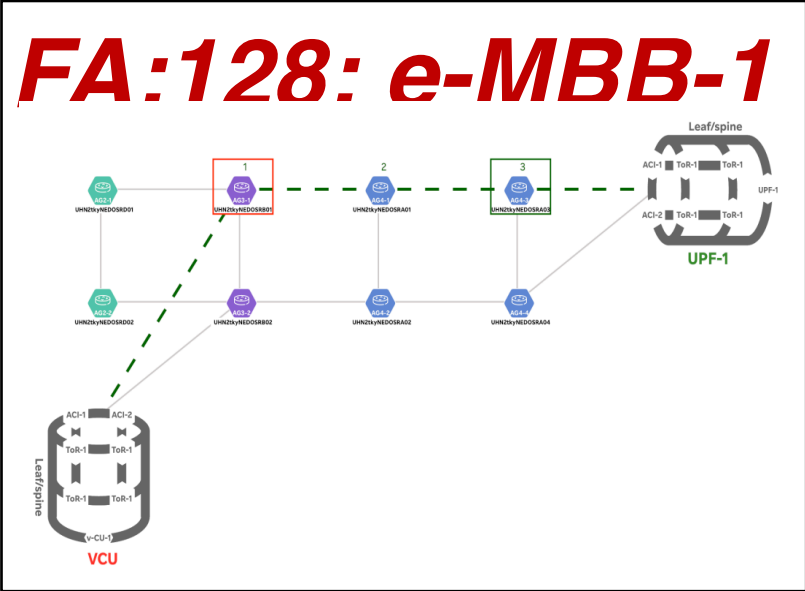
Single VRF: Per destination VRF steering based on UPF/CU prefixes

```
route-policy setLOC
  if destination in prefix-set-Slice1 then
    set srv6-alloc-mode per-vrf locator loc129
  else
    set srv6-alloc-mode per-vrf locator loc128
  endif
!
```

FA: Per UPF steering!

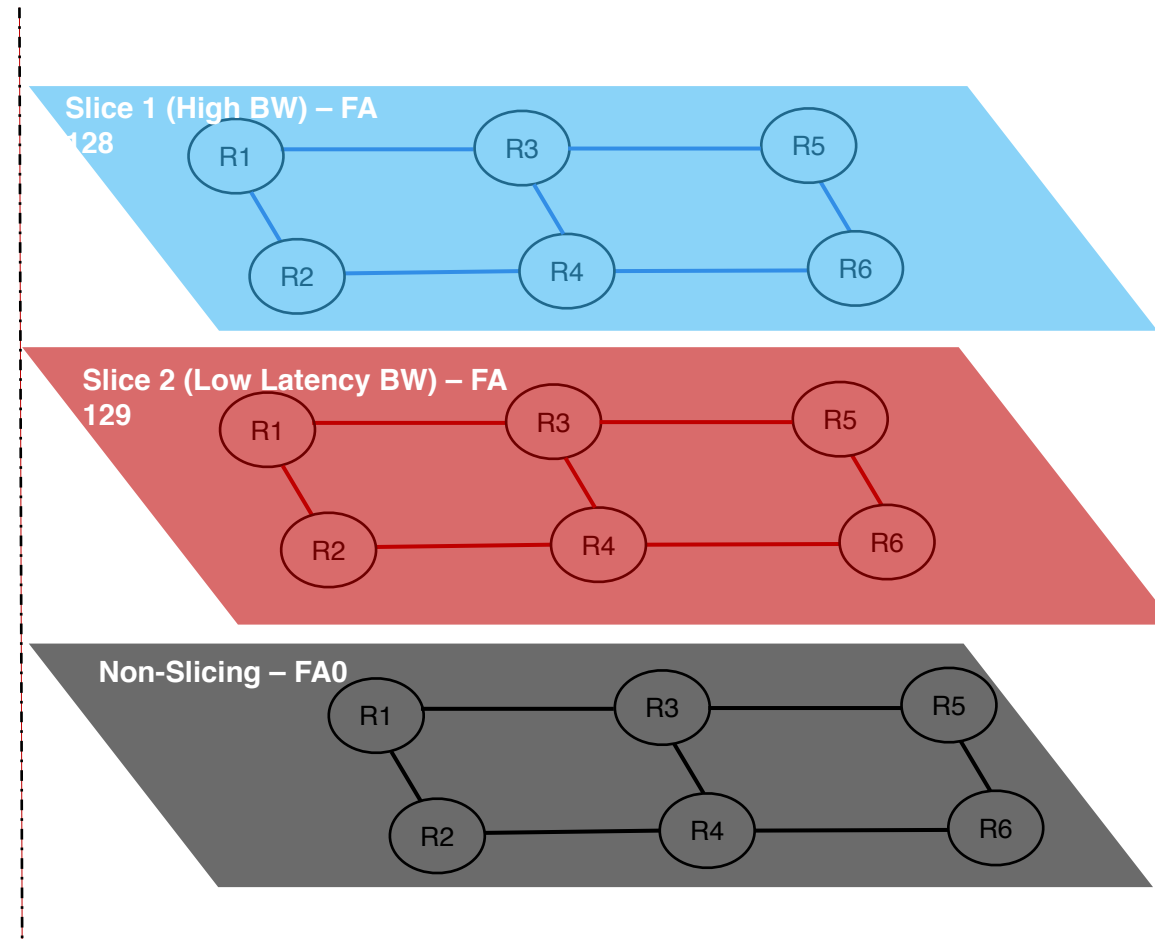
!e-MBB1

!e-MBB2



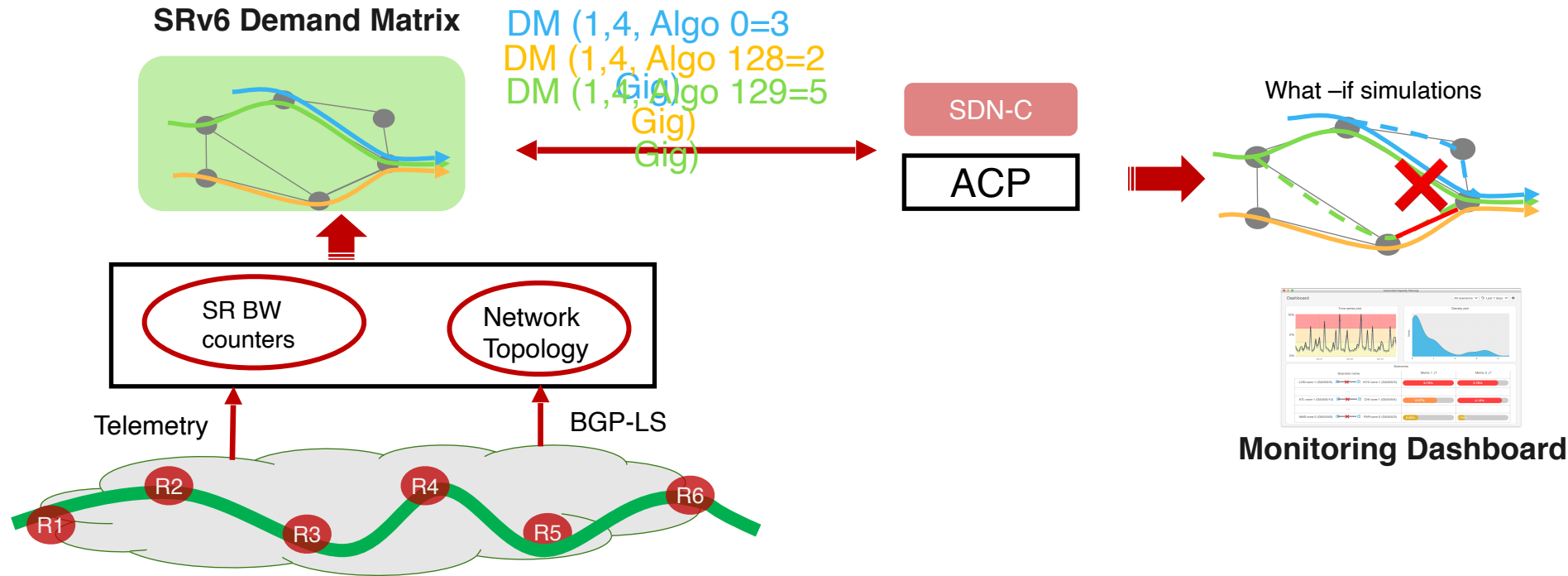
Challenges in transport slicing architecture

- How to:
 - monitor the slice's topology and traffic?
 - congestion scenarios: reroute individual flows in the transport domain?
 - what-if simulations on transport slicing?



Slicing analytics solution using Demand matrix

Cisco ACP
Demo –
[SR.NET](#)



- **A novel hardware traffic counters – Provides accurate demand matrix**
 - Amount of traffic from each source, to each destination, via the routing path (IGP, Flex-Algo) – **Traffic Matrix**.
 - **Accounts for all SRv6 traffic transmitted on infra links.**
- Counters stats pushed periodically via telemetry.
- **SDN-C incepts the Demand-matrix to provide the optimize bandwidth on-demand (congestion) use cases.**

Summary & Conclusion

u-SID brings network simplicity, scalability & efficiency to network.

UPA & DM are paramount for network slicing and resiliency.

Slicing solutions blend PCEP and Flex-algo for scalability & future use cases .

Thank you
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Rakuten

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