Architecture Discussion on SRv6 Mobile User plane

draft-kohno-dmm-srv6mob-arch-00

18 Nov. 2019 IETF106

Miya Kohno, Francois Clad, Pablo Camarillo, Zafar Ali

Agenda

- Motivation & Goal
- Architecture Discussion
- Exemplification
  - Network Slicing
  - Edge Computing
  - URLLC
- Next step

Motivation and Goal

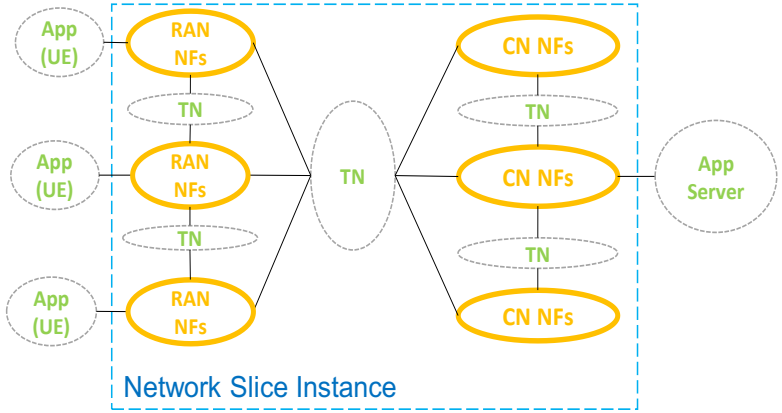
- System Architecture need to be reviewed holistically and across layers, when a drastic architectural transition is required, for example:
  - in the 5G era where various SLAs are to be supported
  - Where completely new data intensive services (IoT / Analytic / Distributed Computing) are assumed

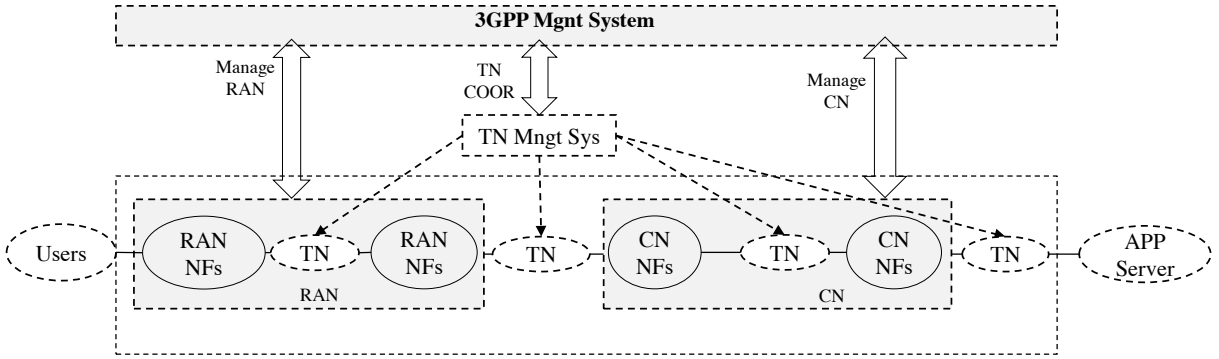
- This document discusses the architectural implications of applying SRv6 mobile user plane, especially regarding the possible optimization of existing conventional layers.

- Hence, it suggests that SRv6 mobile use plane is a right architectural choice for the 5G era.

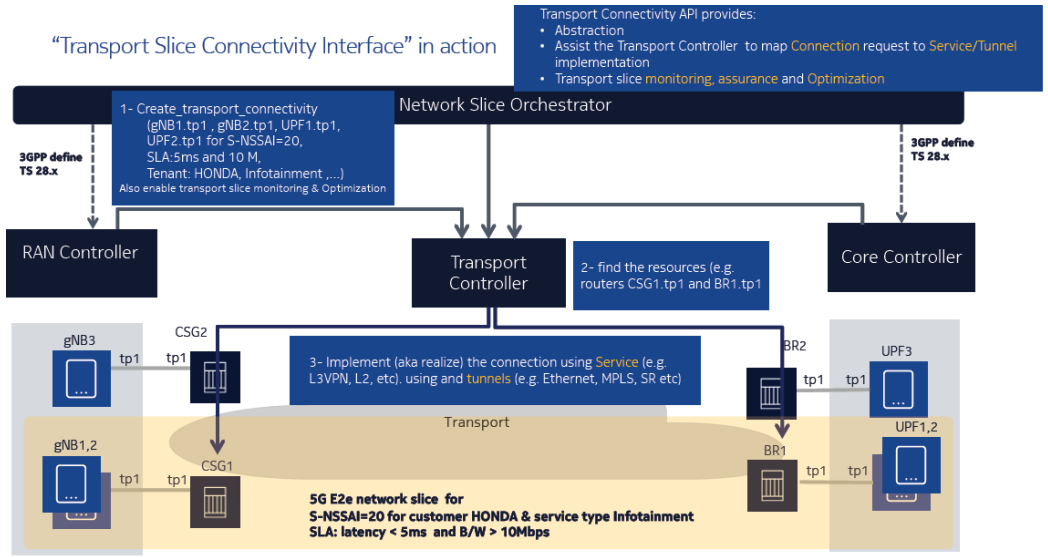
Mobility network (RAN/CN) and Transport network (TN) are separated by layers

- 3GPP TS 28.530





- draft-rokui-5g-transport-slice



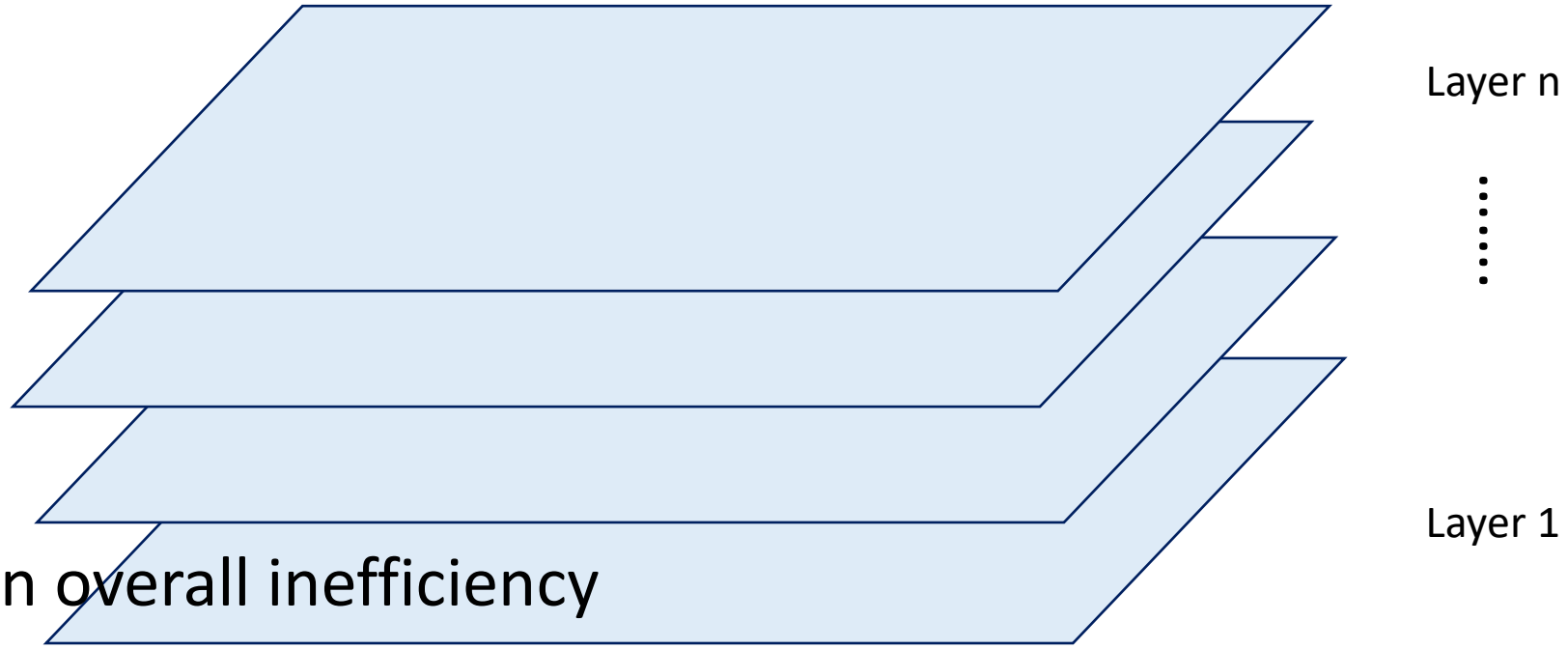
- TN is an underlay layer to the Mobility network
- GTP-U is an overlay tunnel in the Mobility Network

RAN: Radio Access Network
CN: Core Network
TN: Transport Network

Layers solve any problem, but..

Each layer evolves in order to solve any problems

- GTP-U
- VXLAN
- GENEVE
- NSH
- PPPoE/L2TP
- MPLS
- ……



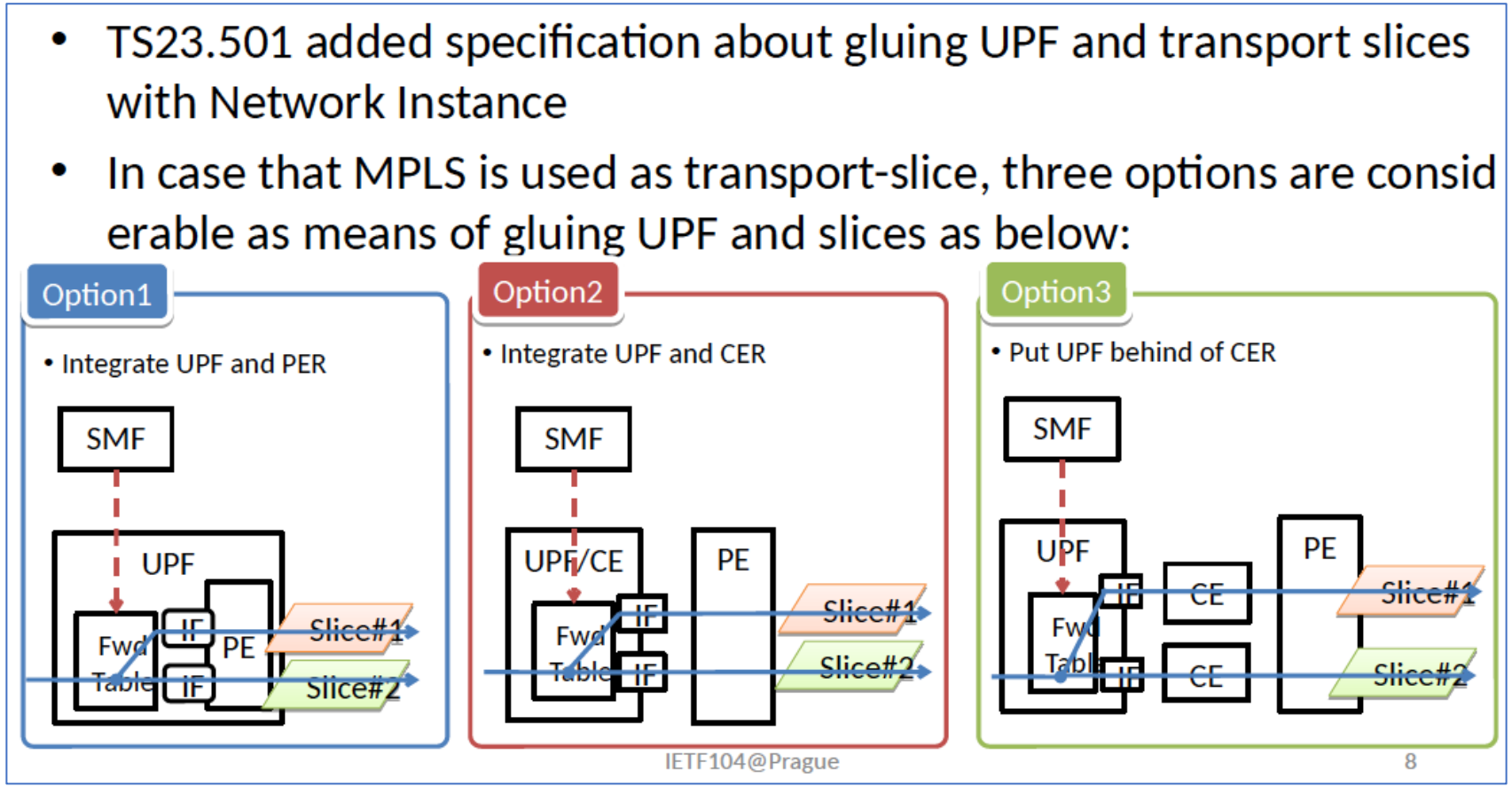
Which may results in overall inefficiency

> “We can solve any problem by introducing an extra level of indirection.
> ...but that usually will create another problem.”
> – David J Wheeler

https://en.wikipedia.org/wiki/Fundamental_theorem_of_software_engineering

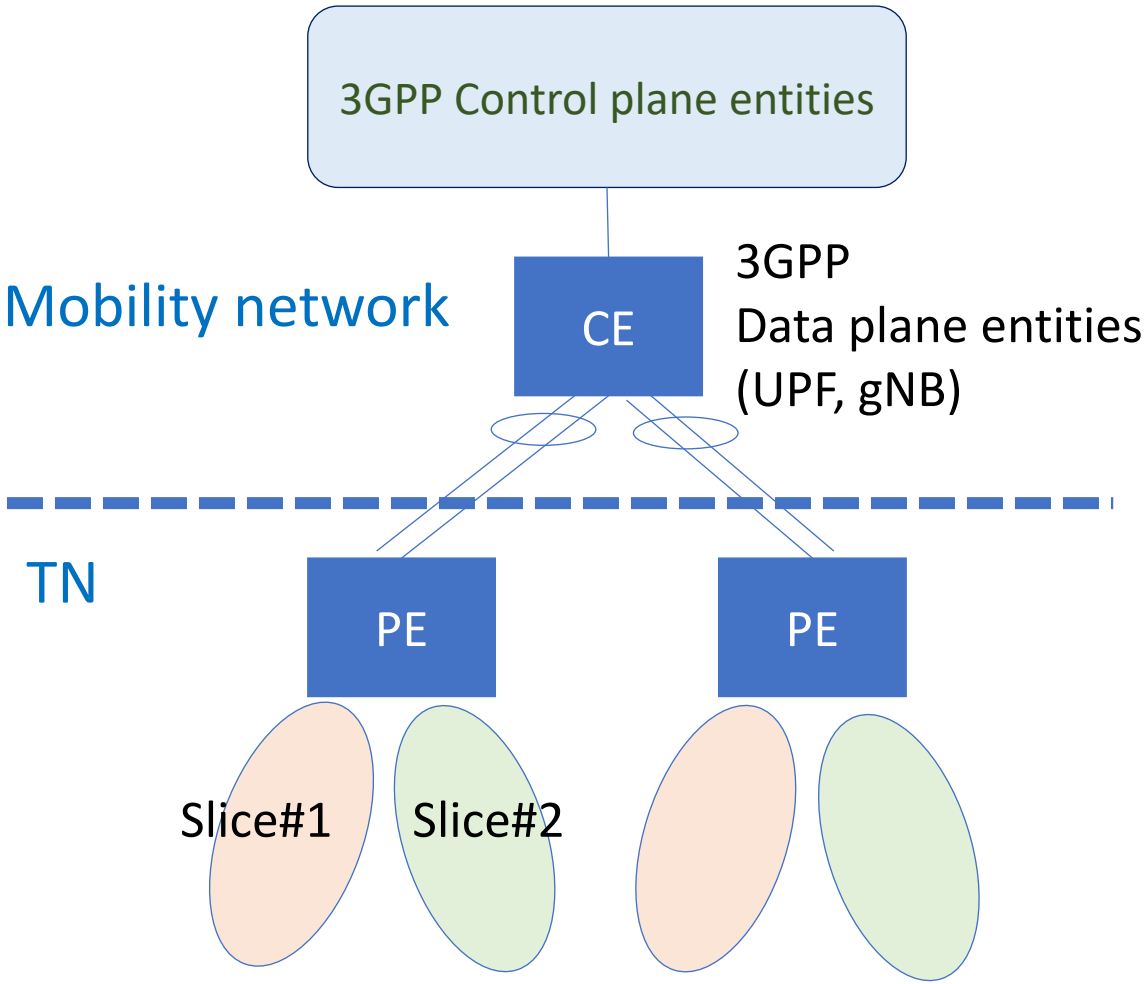
Network Slicing [1/4]

In the typical GTP-U over IP/MPLS/SR configuration, 3GPP data plane entity such as UPF is a CE to the transport networks PE. (Or even need extra CEs)



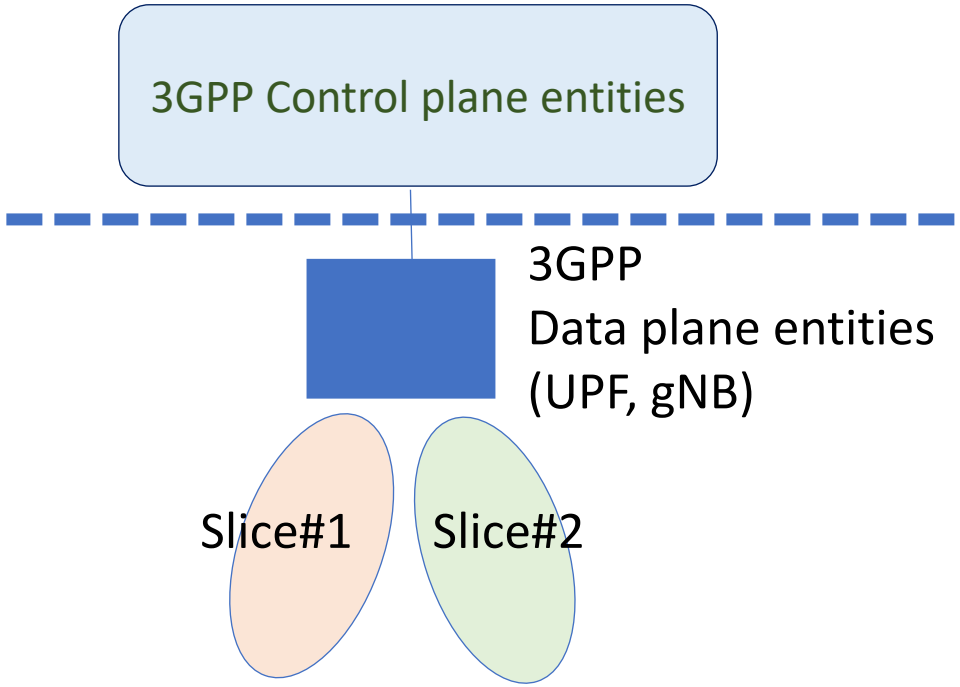
Reference: User Plane Protocol and Architectural Analysis on 3GPP 5G System – Shunsuke Homma @IETF104
https://datatracker.ietf.org/meeting/104/materials/slides-104-dmm-user-plane-protocol-and-architectural-analysis-on-3gpp-5g-system-00

Network Slicing [2/4] – current practice

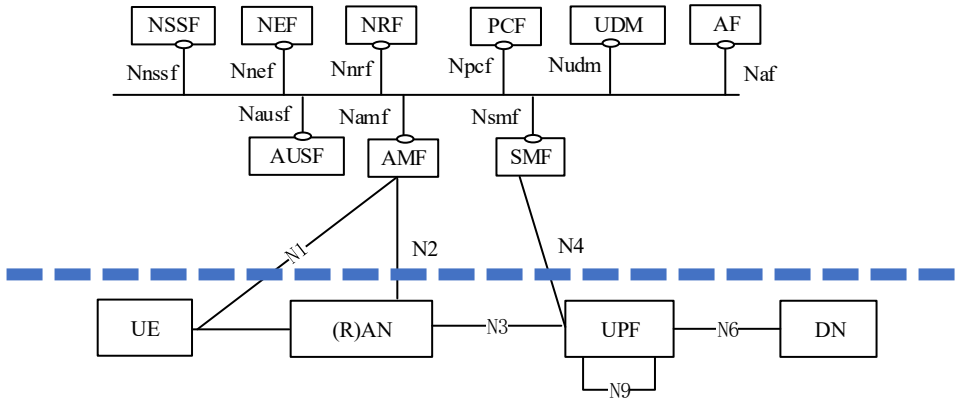


- A certain extra ID such as VLAN-ID is needed for segregating traffic and mapping it onto a designated slice.
- PE and the PE-CE connection is a single point of failure, so some form of PE redundancy (using routing protocols, MC-LAG, etc.) is required, which makes systems inefficient and complex.

Network Slicing [3/4] – moving the border



- Now that CUPS[*] is a main stream for 5GC, and user plane entities are dedicated to forwarding, it is reasonable to have 3GPP Data plane entities like UPF be a part of TN



[*] Reference 3GPP TS23.501

Merit of this model

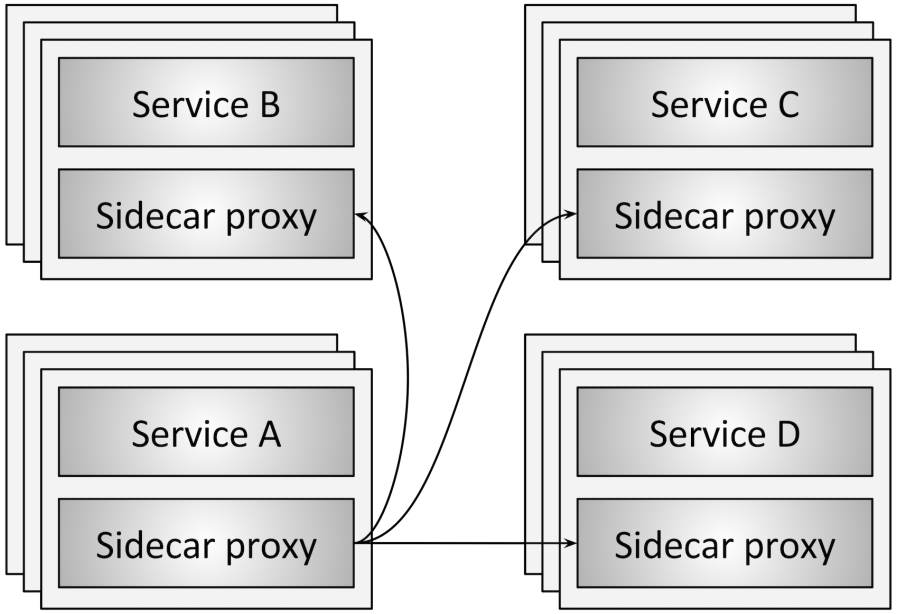
- No need for PE-CE hierarchy
- No need for extra ID (e.g. vlan ID) for mapping
- Can directly control the underlying SLAs

Network Slicing [4/4] – moving the border → implementation

It’s unrealistic, since 3GPP entities don’t care of IP routing..?

It’s realistic!

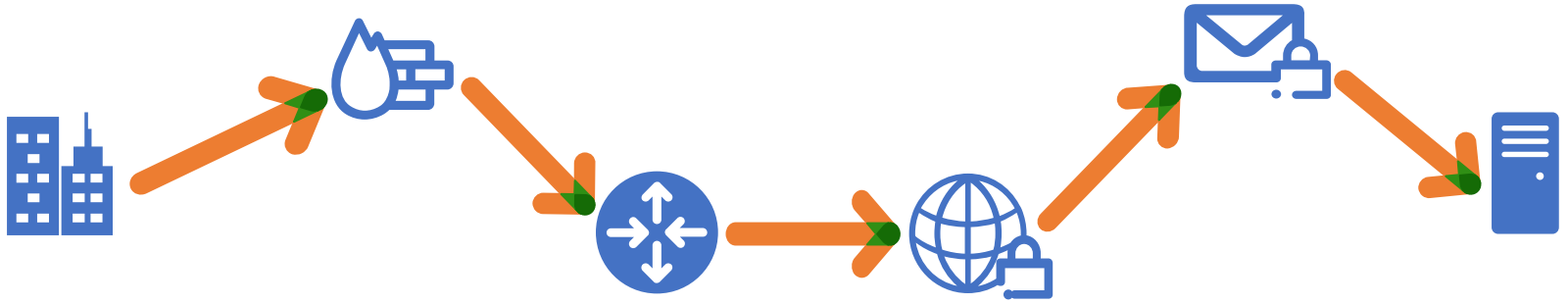
- 5G use cases rely on flexibility of cloud native.
- In the cloud native service mesh deployment, Sidecar/Proxy [*] on the same server machine (or the same container pod) would take care of communication (routing/forwarding).
- SR BSID can be used if topology needs to be hidden.



[*] https://blog.envoyproxy.io/service-mesh-data-plane-vs-control-plane-2774e720f7fc

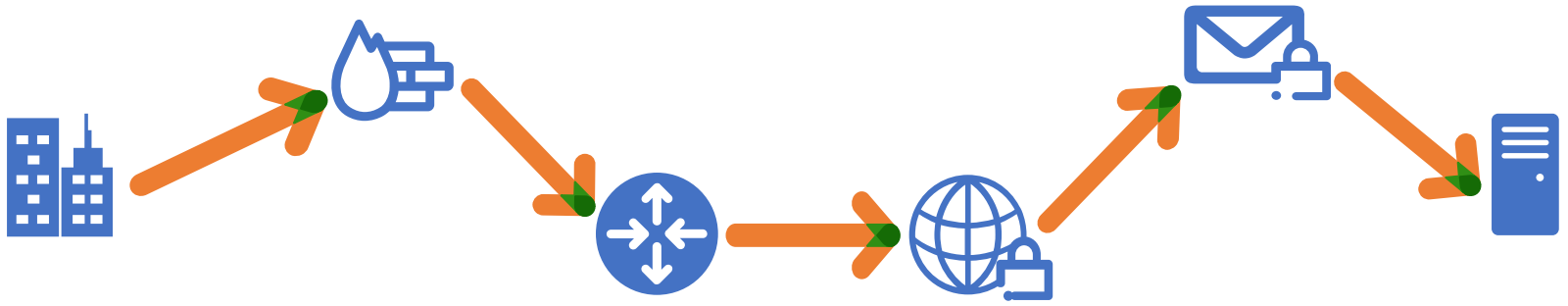
Edge Computing [1/2]

- SRv6's flexible traffic steering capabilities and the Network Programming concept of freely describing instructions and meta data are per se suitable for providing Edge / Distributed Computing.
- In addition, since SRv6 can be a common data plane regardless of the domains such as access, WAN, mobility and data center, Service Placement and Service Chain that used to be concentrated in Data Center can be expanded over a wide area.



Edge Computing [2/2]

- With SRv6, session and QoS information can be exposed in IP header.
- It does not affect performance, thanks to the longest match mechanism in the IP routing. Only the services/applications who need the information for granular processing are to lookup.
- This would allow flexible placement of services/applications.

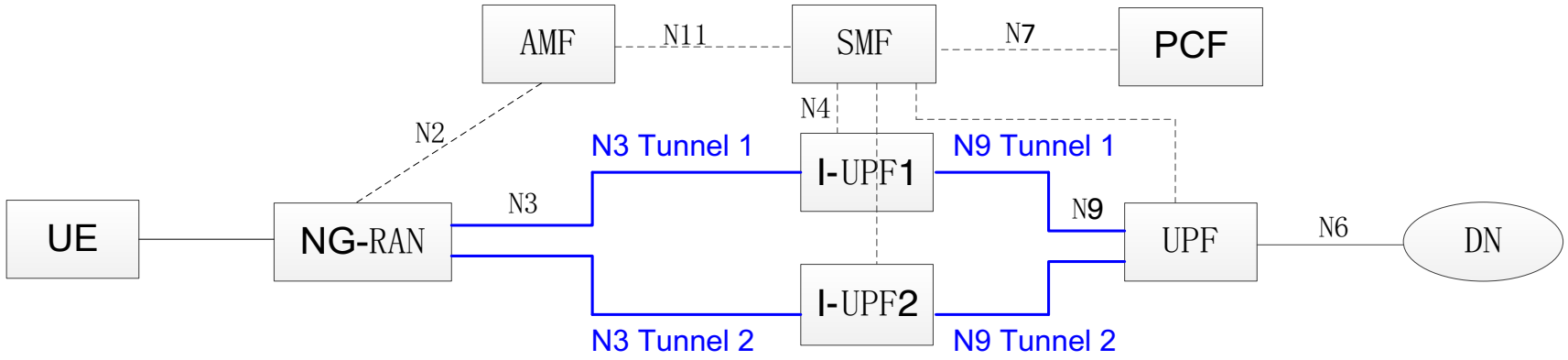


URLLC [1/2]

- 3GPP [TR.23725] investigates the key issues for meeting the URLLC requirements on latency, jitter and reliability in the 5G System.
- However, the solutions provided in such document are focused at improving the overlay protocol (GTP-U) and limit to provide a few hints into how to map such tight-SLA into the transport network.
- These hints are based on static configuration or static mapping for steering the overlay packet into the right transport SLA. Such solutions do not scale and hinder network economics.

URLLC [2/2]

- 3GPP [TR.23725] Section 6.4 addresses the issues on how to supporting redundant data transmission via single UPF and single RAN node.
- But how to ensure the disjoint path is not enough (it just says “e.g. different IP addresses or different Network Instances”). Further, 3GPP Data plane entities need to support packet duplication and elimination. This would require the modification of GTP-U protocol itself. The SRv6 mobile user plane also has an advantage in this respect, thanks to the net programming capability.



Reference: 3GPP TR 23.725 Figure 6.4.1-2 Two N3 and N9 tunnels between NG-RAN and UPF for redundant transmission

Next step

- Comments/Discussions are welcome!!
- DMM WG adoption ?!