

5G E2E Slicing Technology Update

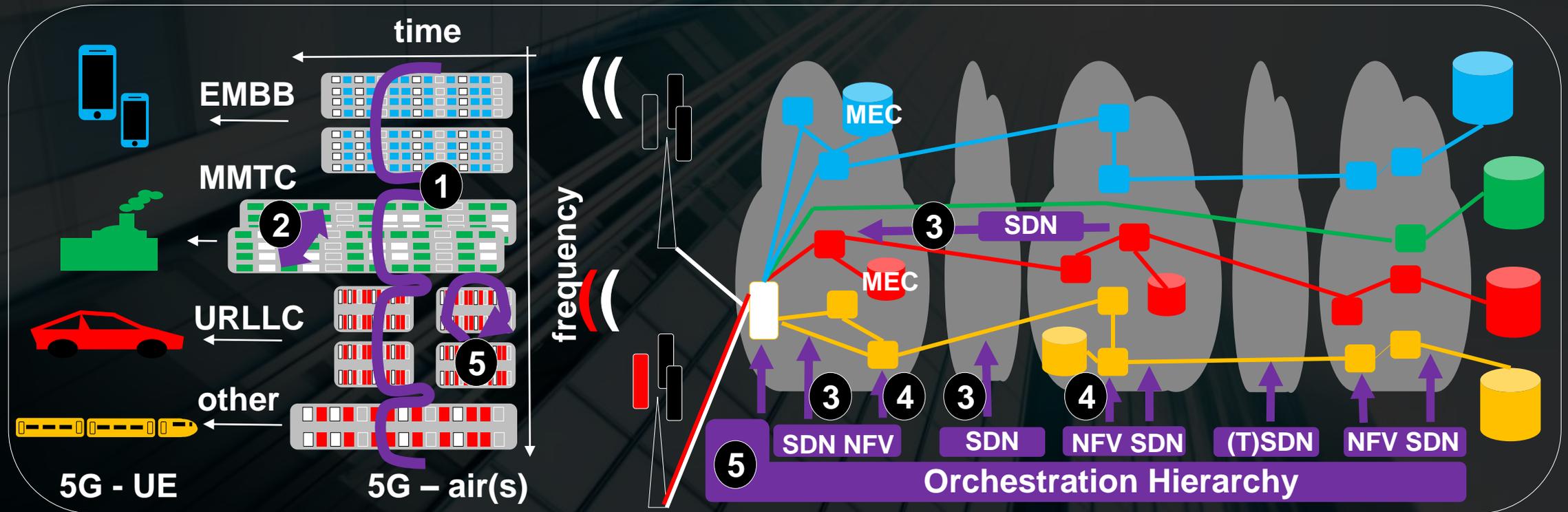
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June 28th, 2018

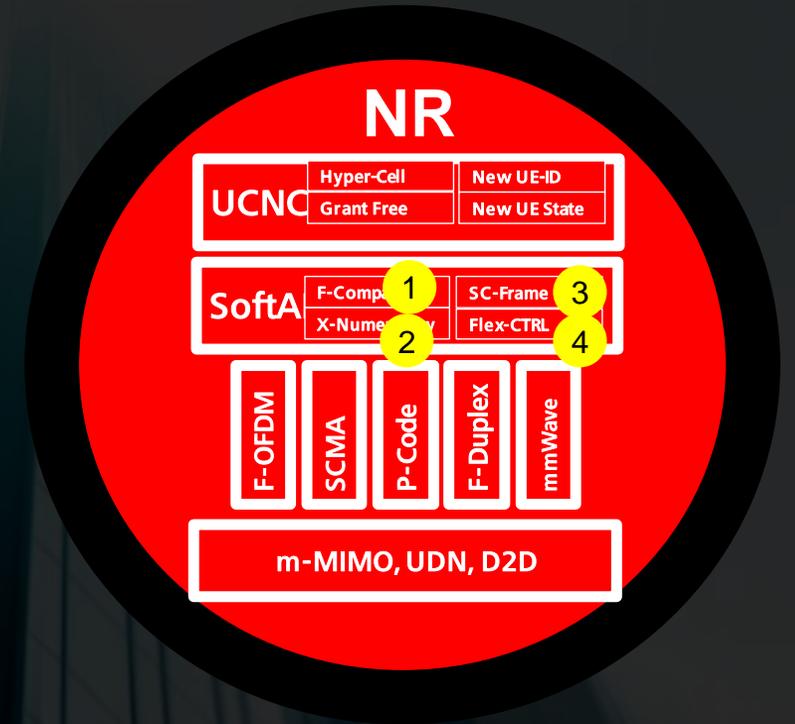
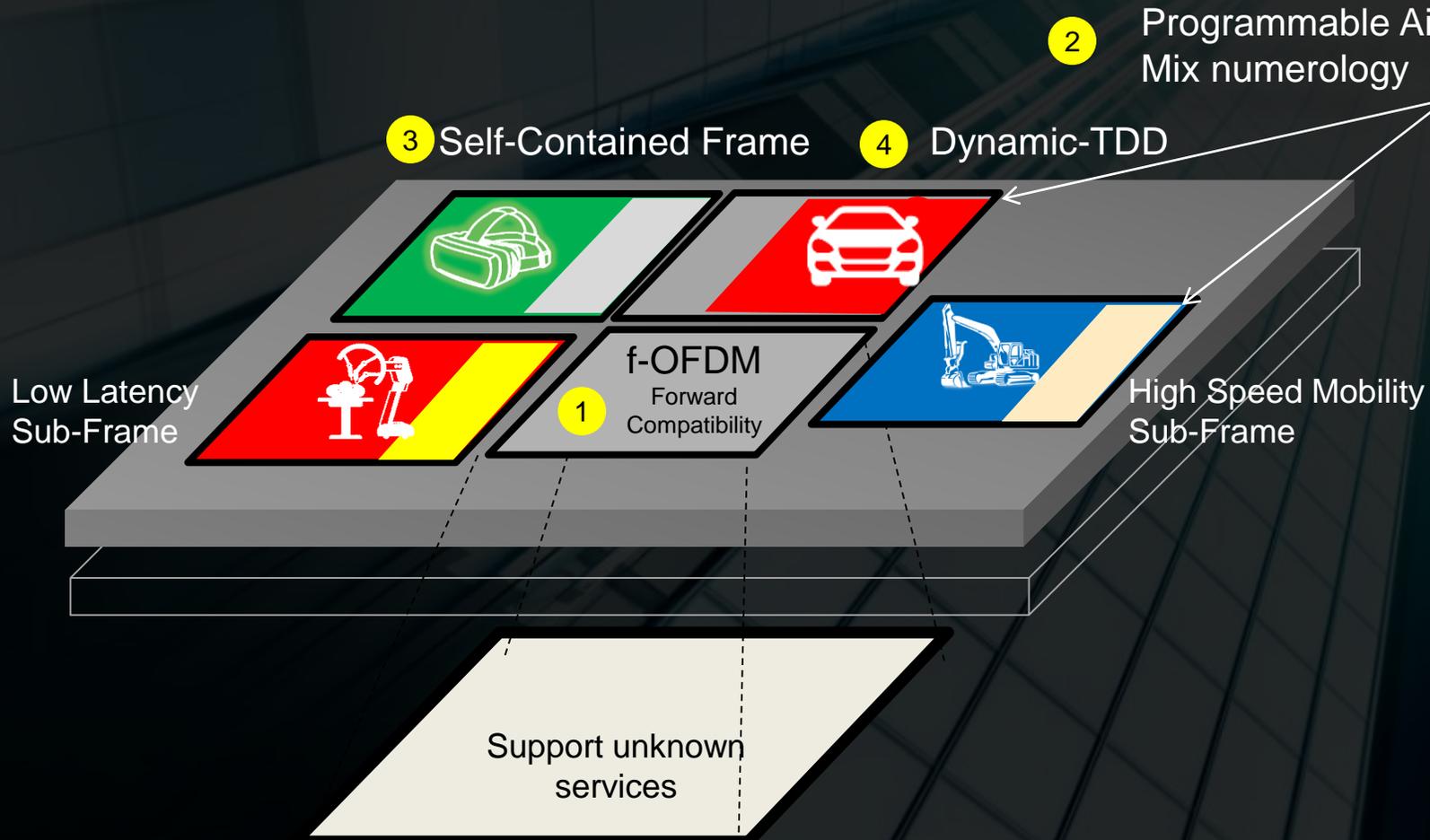


Major Components of 5G Slicing

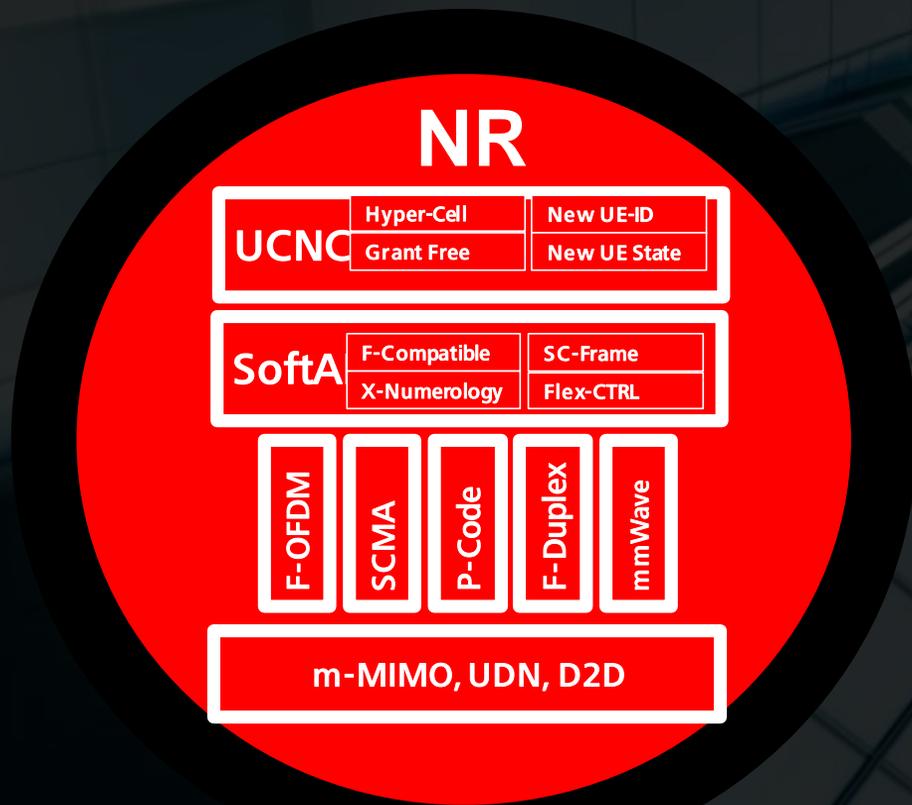


- a) F-OFDM – Filtered OFDM – flexibly isolates the bands allowing different behaviors
- b) Mixed Numerology – enable the different slicing features within RAN Slicing part
- c) Slicing Breathe – Must be possible for slices to change size and to exchange physical resources

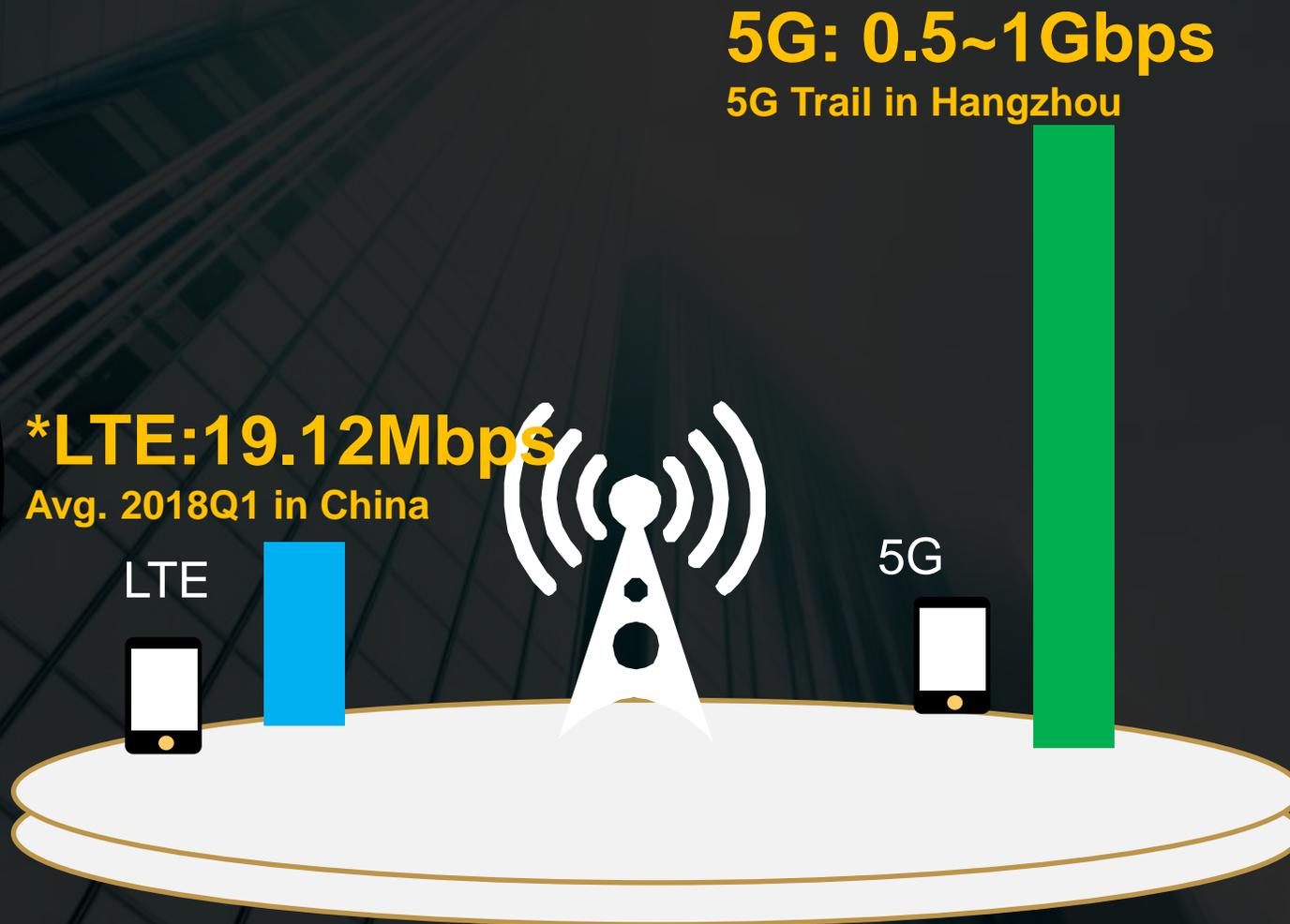
Technology Components in RAN Slicing



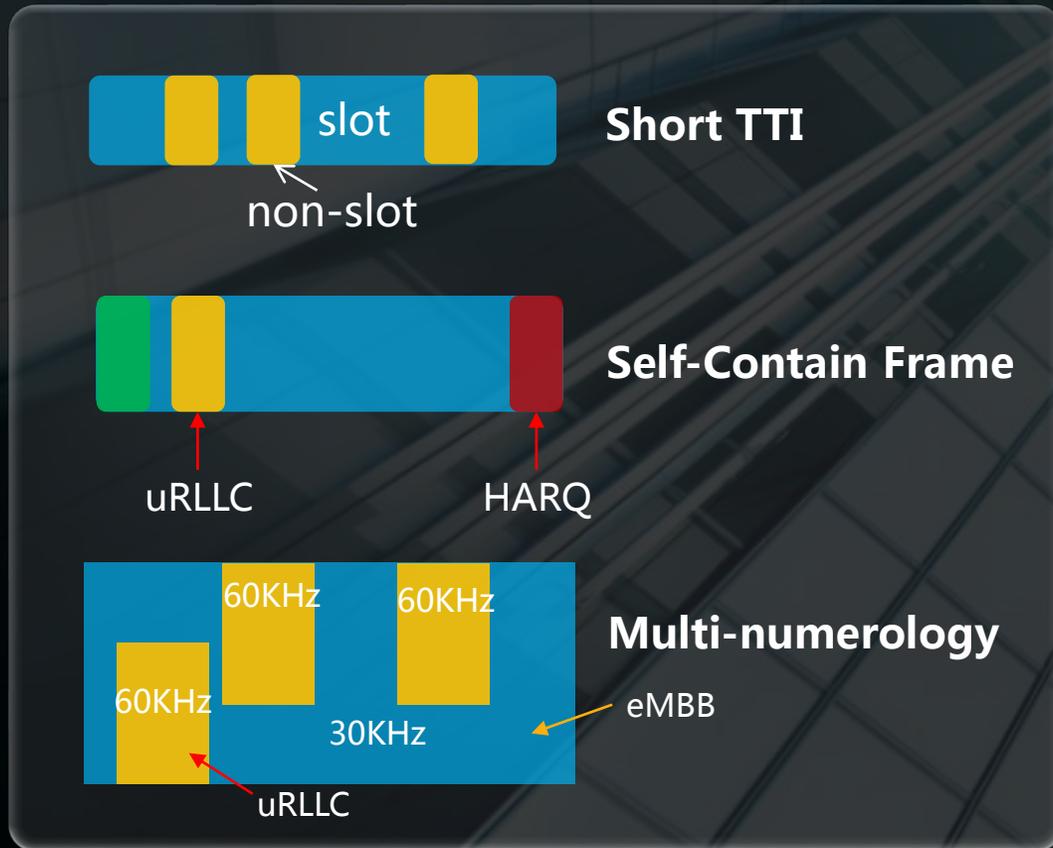
Throughput with RAN Slicing



***LTE: 19.12Mbps**
Avg. 2018Q1 in China



Flexible RTT with RAN Slicing



4G: 30-50ms

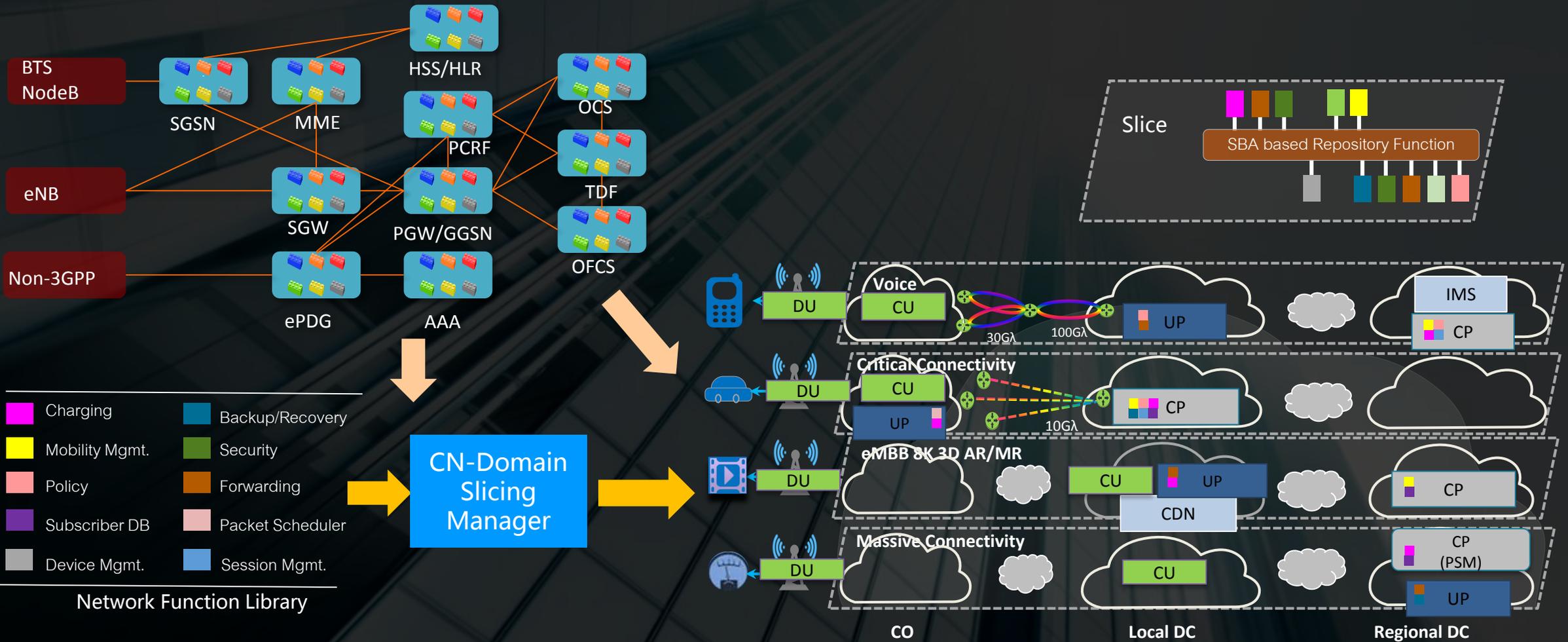


5G: 10-20ms

6-10ms



Flexible Service Delivery with CN Slicing



Terminal: Network Slicing Awareness

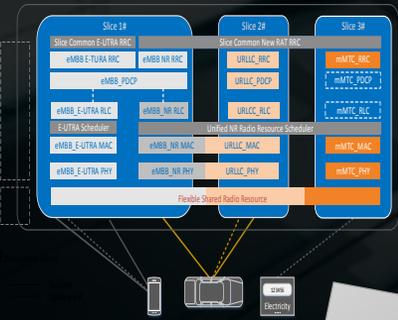
Smart phone may support differentiated performance in different layers



Technology is not Bottleneck Anymore

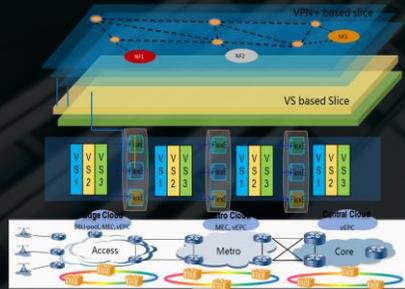
1. Access Network

- Flexible Air Interface, Scheduling optimization
- RAN functions flexible configuration



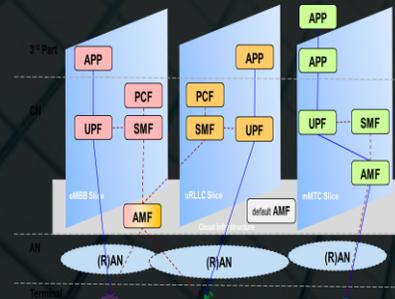
2. Transport Network

- VPN/VPN+
- FlexE
- OTN



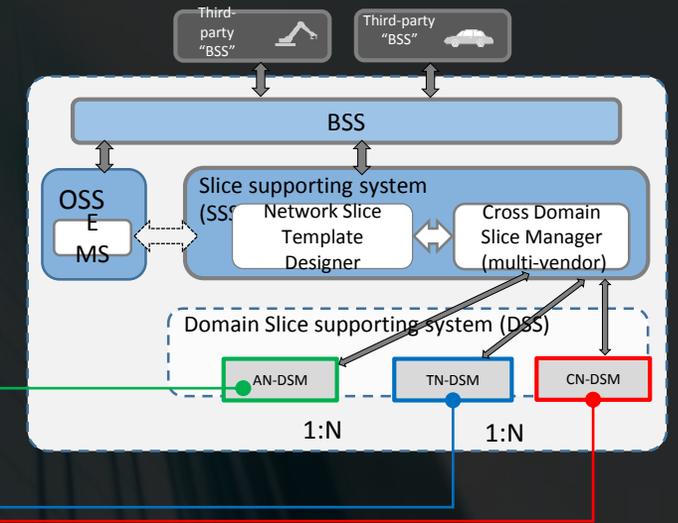
3. Core Network

- Service-based Architecture
- Modularization
- Virtualization



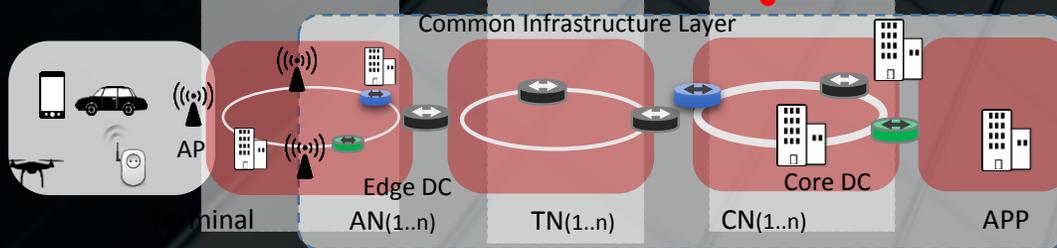
4. Network Mgmt.

- API towards 3rd party
- Cross domain mgmt.
- Autonomous mgmt.



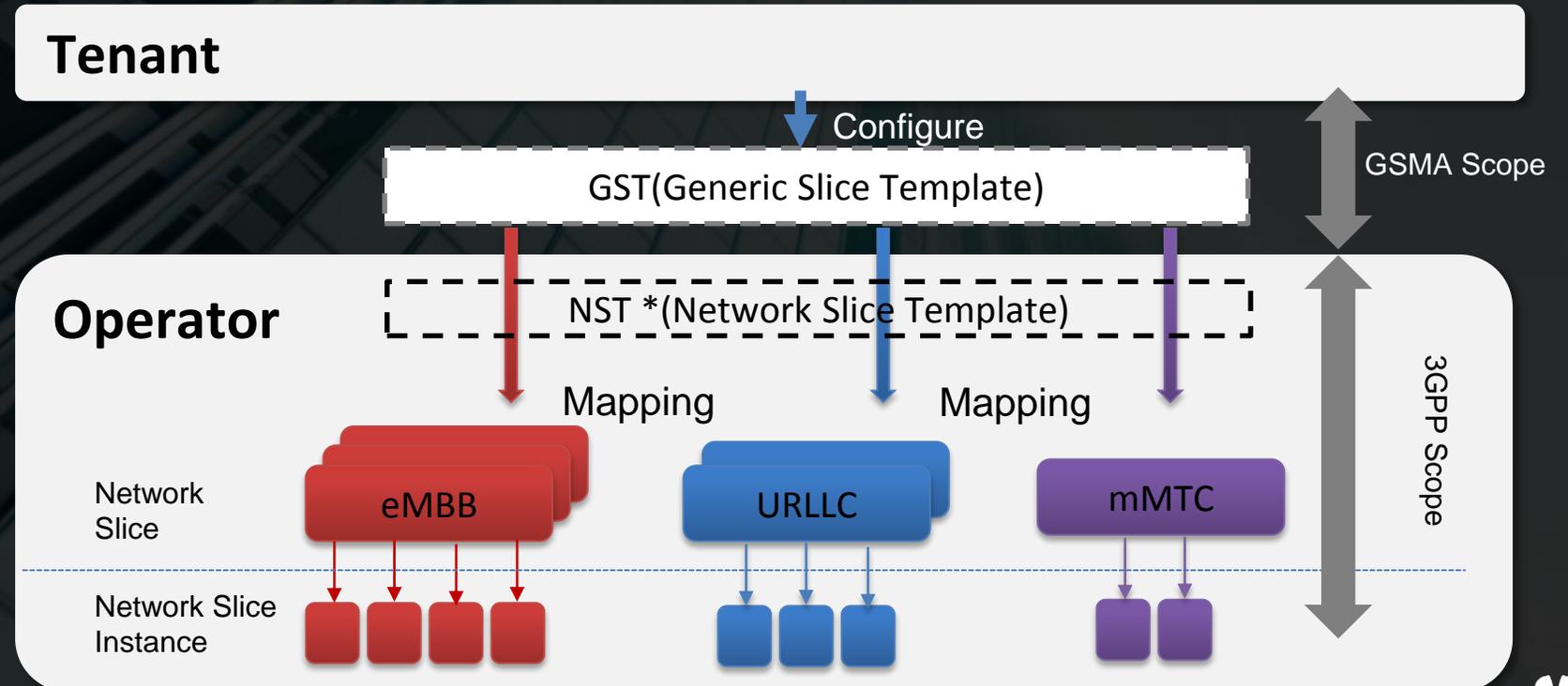
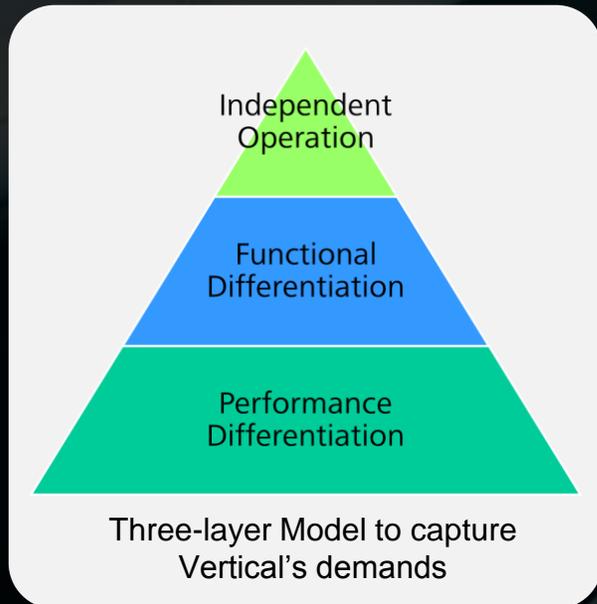
5. Terminal

- OS
- Protocol stack
- Access



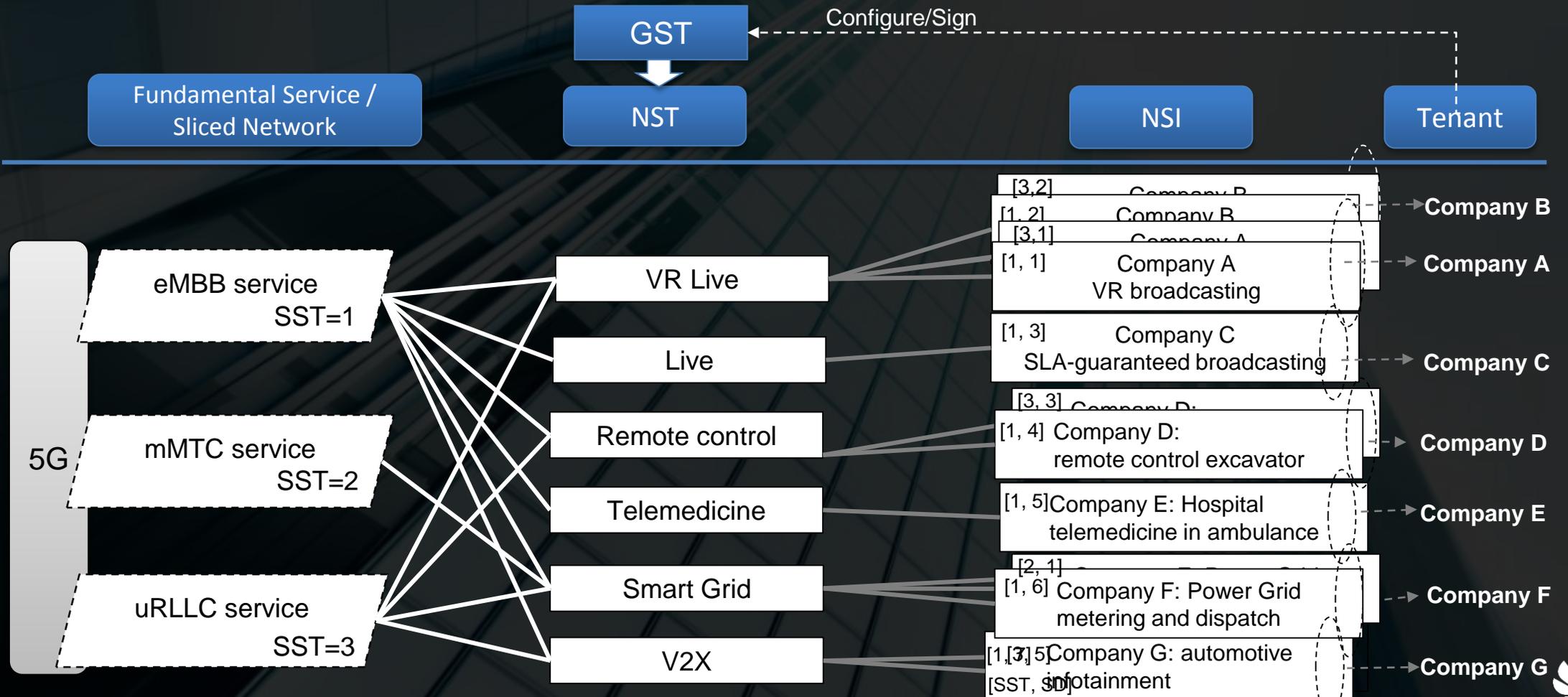
Network Slicing Deployment

- Generic Slice Template: From tenant requirements to network slice deployment
- Network slice instances are constructed based on tenants, and its execution is to enforce the SLA within specific network slice. Network slice is pre-constructed Network.



Network Slicing Deployment

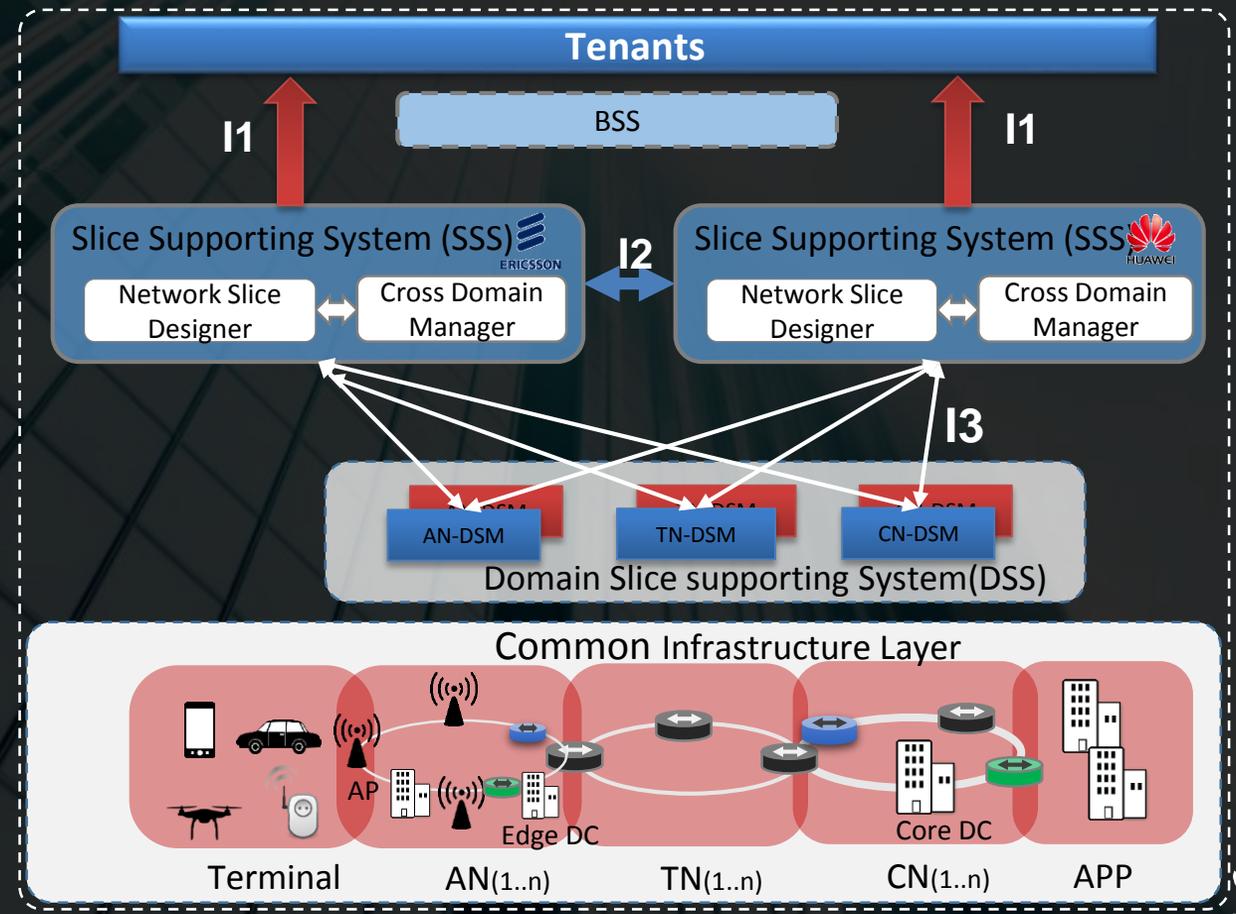
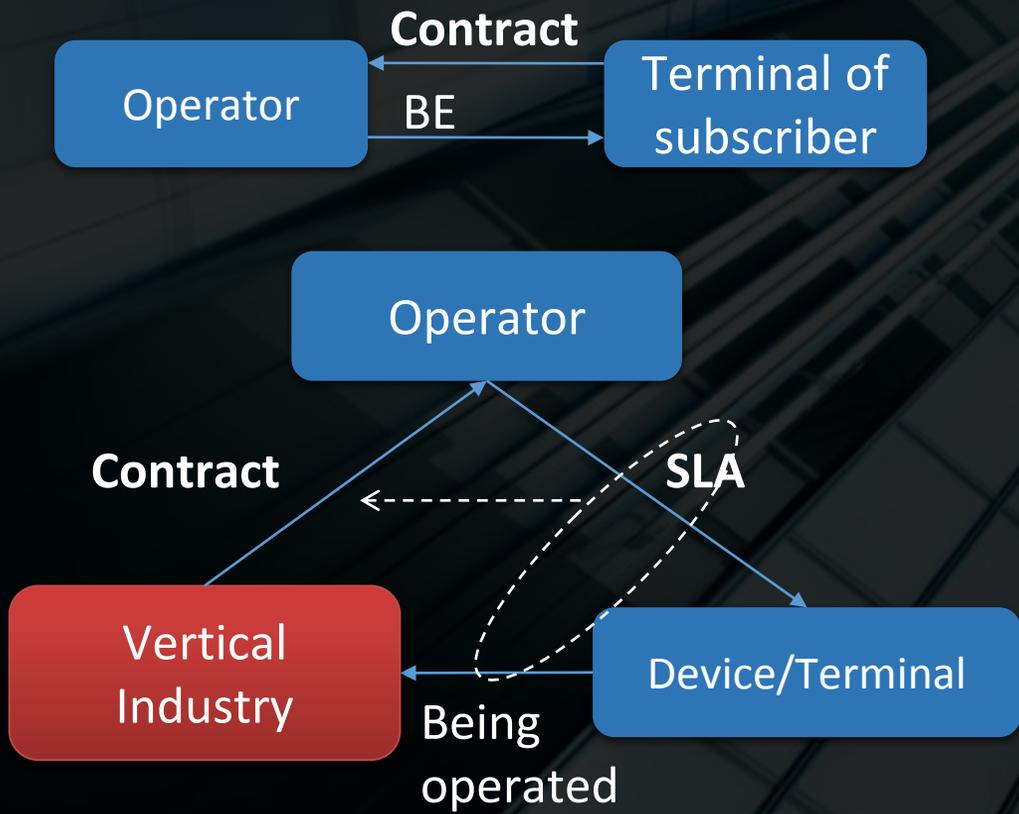
The essence of NSI is to support business application based on network capabilities



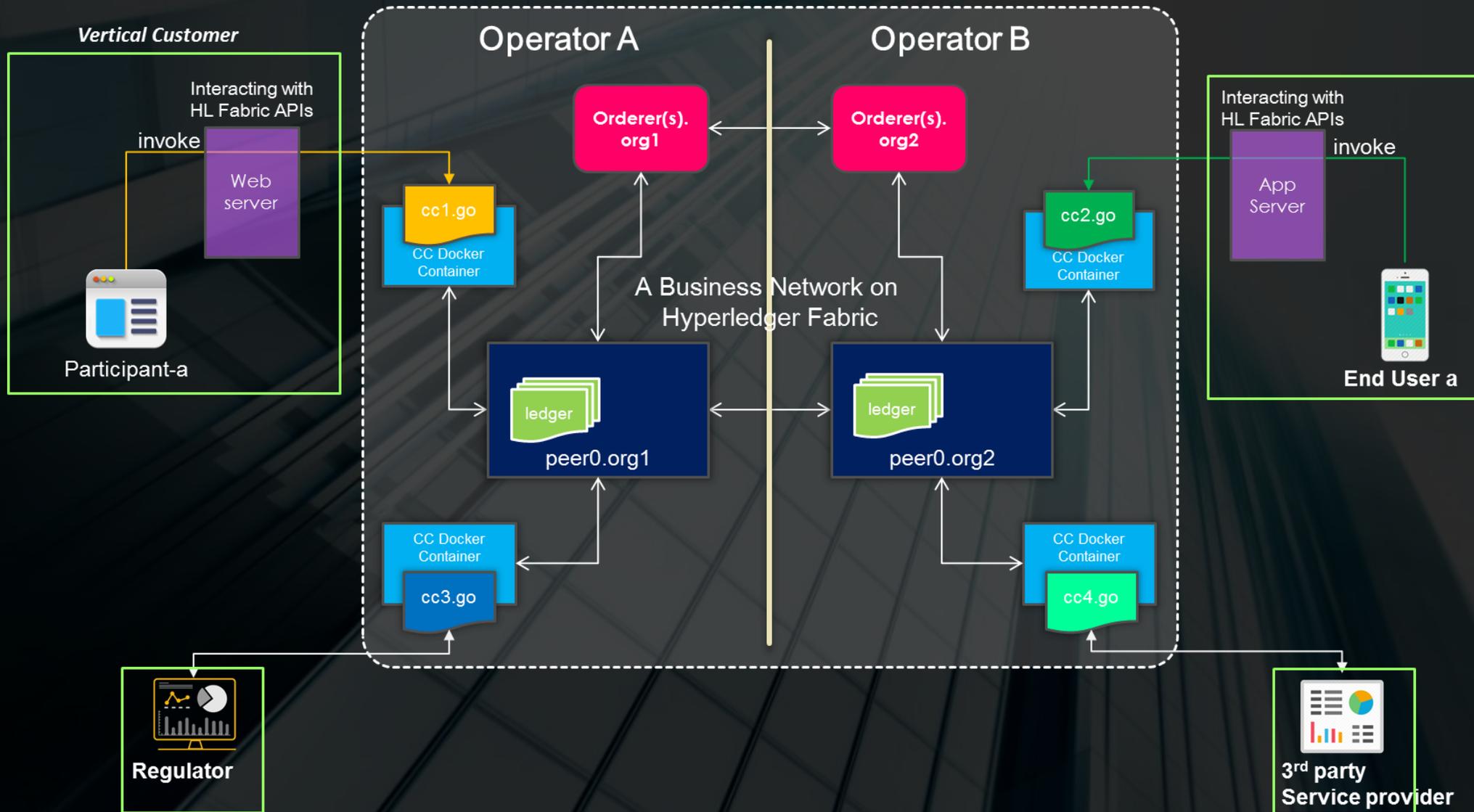
New Network Operation and Services

Bring business innovation, enable differentiated customer experience

How to establish transparent, collaborative, effective Slicing ecosystem is the key for 5G success.



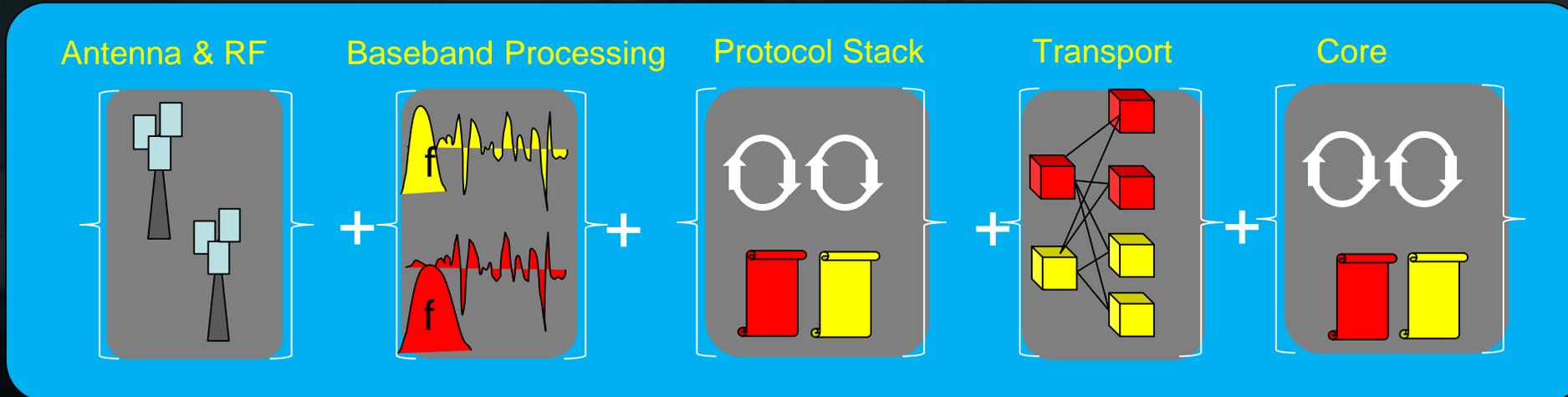
Blockchain enabled Slicing Ecosystem



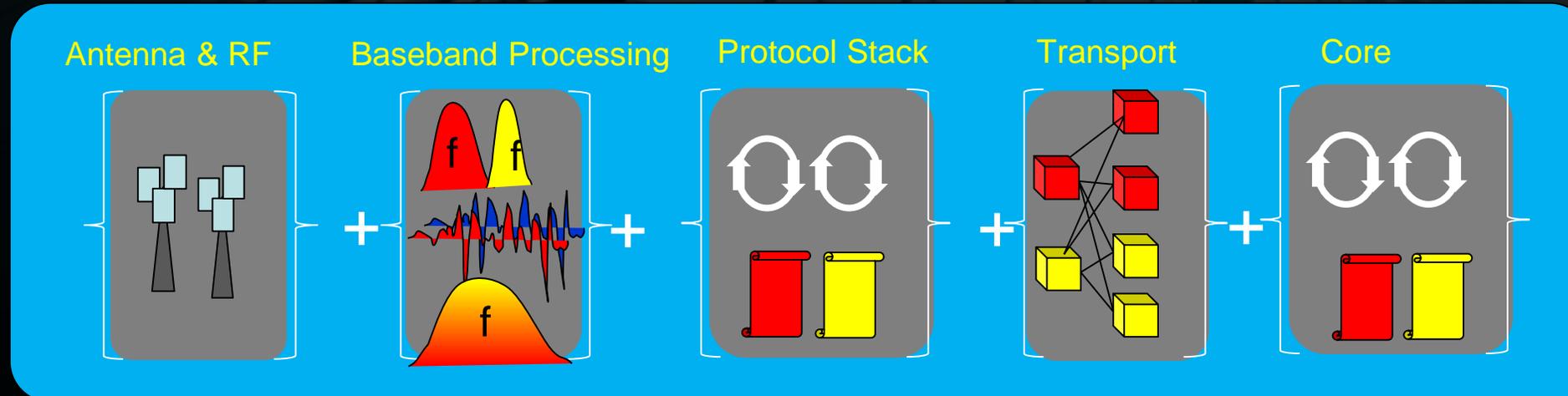
Network Slicing Deployment - Operators

How to build sliced networks from operators point of view?
- Sharing the same bandwidth or dedicated spectrum?

 URLLC slice
 eMBB slice



Option 1



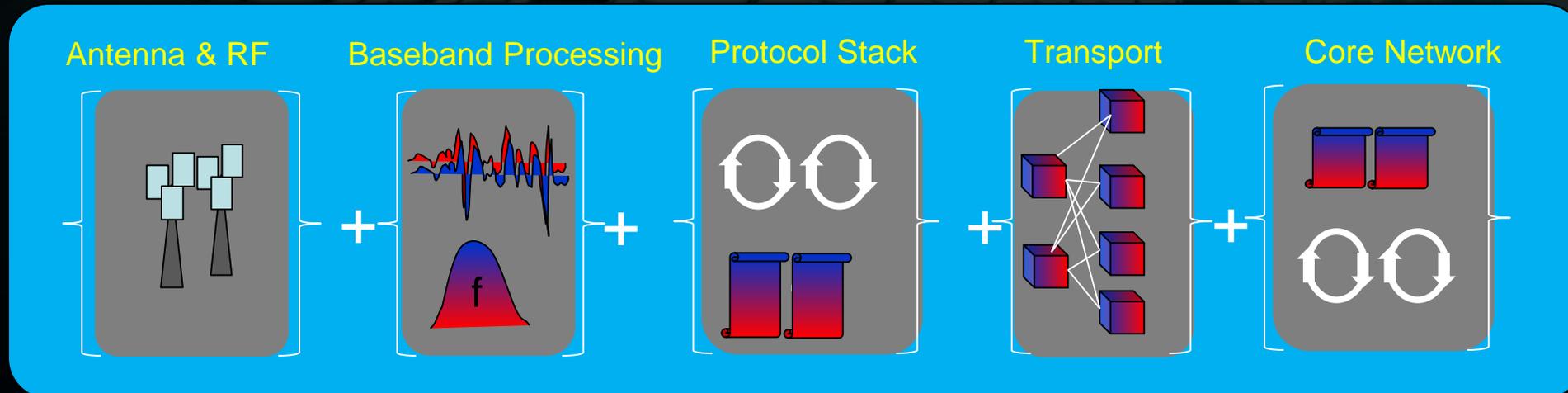
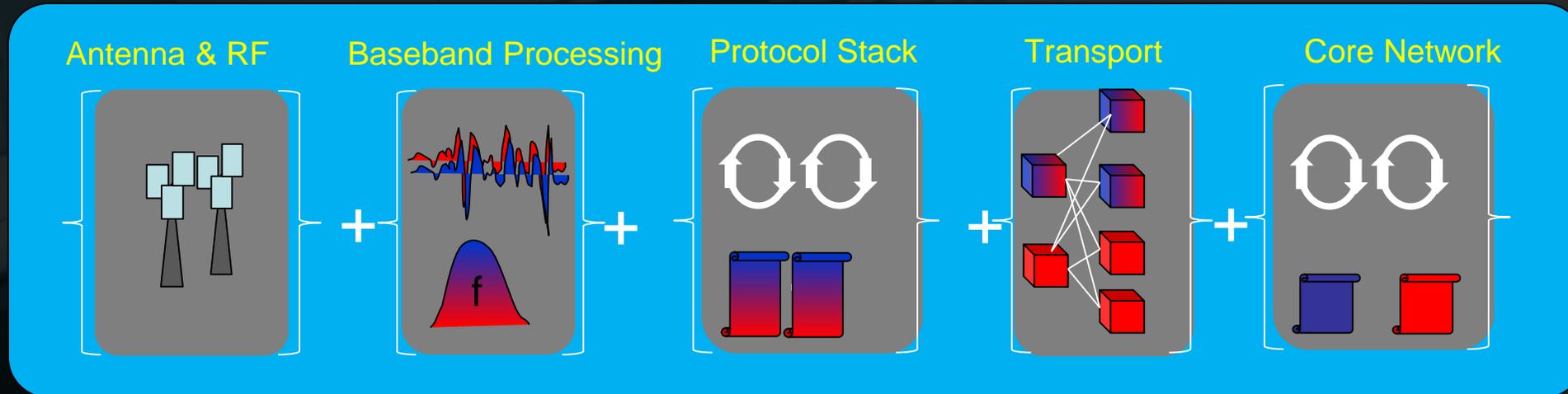
Option 2

Network Slicing Deployment - Tenants

 Tenant 1 slice
 Tenant 2 slice

How to GET the slice from Tenants point of view?

- How to get a real piece of sliced network, especially in RAN side ?
- The technical components can offer many possibilities, but does tenant really need this, also want to pay for it ?



Network Slicing related Industry Activities

GSMA Network Slicing Task Force (NEST)



Business Incentives

Where will new operator revenues in 5G come from?

Category	Enterprise (e.g. B2B, B2G)	Consumer (e.g. B2C)	Other (e.g. ADP)	Govt (e.g. B2G, B2B2C)	Others (please specify)
Enterprise (e.g. B2B, B2G)	45%	15%	10%	10%	10%
Consumer (e.g. B2C)	15%	55%	15%	10%	5%
Other (e.g. ADP)	10%	15%	55%	10%	5%
Govt (e.g. B2G, B2B2C)	10%	10%	15%	55%	5%
Others (please specify)	10%	5%	5%	10%	55%

Source: Survey of 750 operator CEOs (GSMA, Oct 2016)

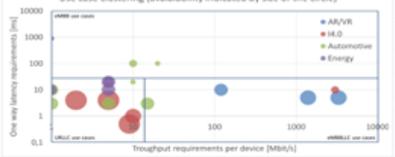
5G opportunity for operators

Targetable revenue opportunity by 2025: \$300Bn

Industry verticals / sectors: Transport, Logistics, Manufacturing, etc.

Vertical Requirements

Use case clustering (availability indicated by size of the circle)



- NEST is defining the GST
- NEST is analysing use cases from a commercial point of view as well as from technical requirements point of view
- NEST could define a set of standardised Slice Instance Descriptor (NSIDs), based on existing or new SSTs that all operators support. In addition to the operator-specific slices
- A set of industry wide S-NSIDs can unlock "basic" roaming models and simplify network slicing rollout.

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5G Slicing Association (SA)



2017 Progress

- 1st meeting at MWC'17 (2017-02-27)
 - Identify challenges slicing
 - No coherent actions
 - No common understanding
 - No Vertical requirement
- 2nd meeting at Bonn (2017-06-08)
 - Decide to name the group as '5G Slicing Association'
 - Converge on 5GSA mission, charters and objectives
 - Define task packages with owners and timelines
- 3rd meeting at Shanghai (2017-07-11)
 - Review 5GSA MoU
 - Good progress on slice definition and terminology
 - Develop the strategy of engaging with more industry players

2018 Progress

- 4th meeting at Albany (2017-10-25)
 - Finalize 5GSA MoU
 - Progressing network slice industry white paper
 - Plan 5GSA summit in early 2018

Officially launched during MWC 2018

Network Slicing supported network services fuel the industry digitization though:

- cost-effectiveness
- customization
- guaranteed performance



Designed to meet industry-specific SLAs via E2E performance assurance and security control

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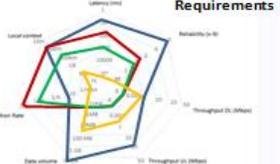
5GAA: Business Aspects and Requirements of 5G Network Slicing



5GAA Prioritized Use Cases:

- Hazard warning (critical, e.g. short distance)
- Hazard warning (non-critical)
- Software update
- Remote driving/Tele-operation
- High density Platooning
- Infotainment
- Cooperative driving (H)

Requirements

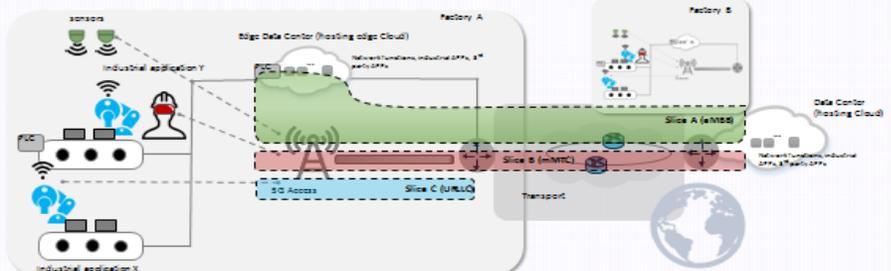


Example business roles

Network Slicing Stakeholder	Tele-operated Driving Stakeholders
Network Slicing Tenant	Vehicle OEMs, Fleet Operators, ToB Service Providers
Sliced Network Operator	CSPs, ICT Solution Providers, ToB Service Providers, Autonomy Service Providers
Network Slicing Provider	CSPs, ICT Solution Providers
Infrastructure Provider (Terminal, network, Cloud)	CSPs, ICT Solution Providers, Tier Suppliers, Chipset Module, E-Device Makers

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Network Slicing Enabled Manufacturing Industry

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5G Slicing Technologies are Ready,

More collaboration for business innovation
are needed!

Thank you!