5G Smart Cities

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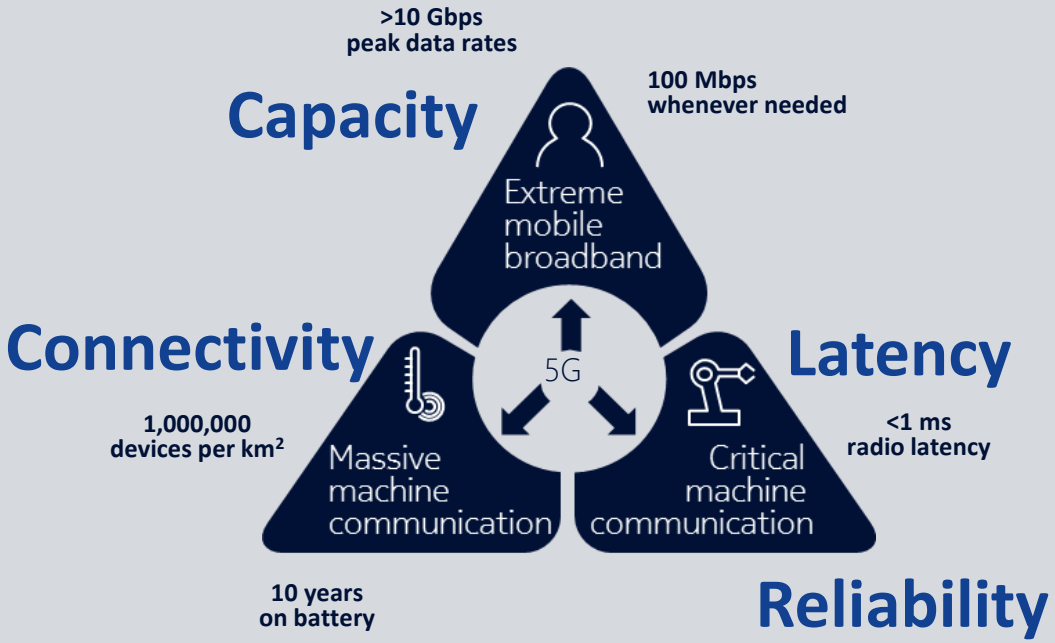
How ready are we

Future X Architecture as network slice enabler

Path to 5G - Use Cases & Verticals



eMBB	Pervasive Video
	Video Surveillance
	Remote Diagnostics
mMTC	Non-critical Massive Sensors
	Remote eHealth monitoring
	Wearables
	Tracking / Monitoring
	...
URLLC	Tactile Networks - AR/VR
	Automated Driving
	Collaborative Robots
	Tele-protection

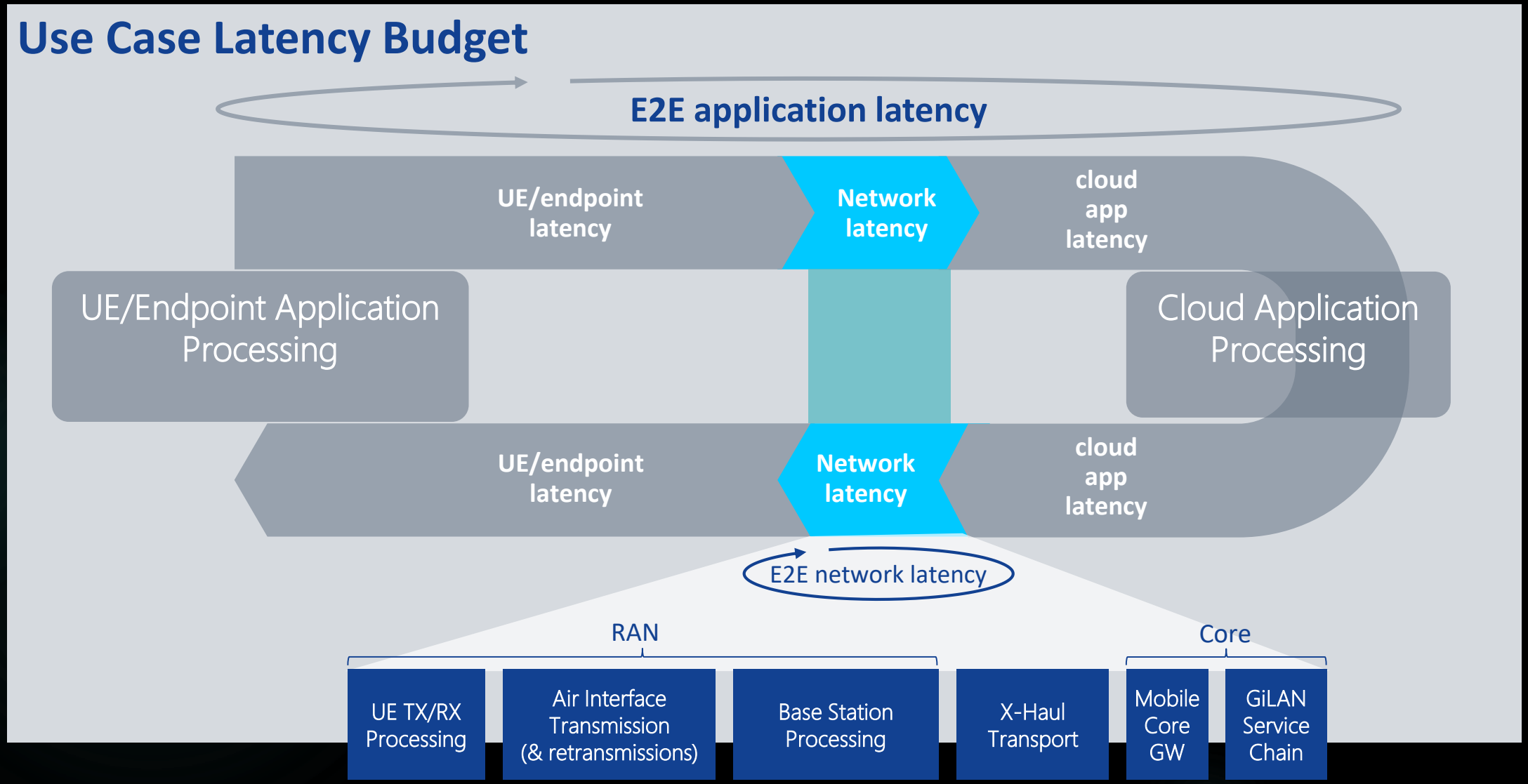
5G Use Case Baseline Considerations

Media Sizes & Data Rates

PHOTO	12 MP smartphone photo	3MB	30-50MB	180deg photo digital sculpture
WEB	Average web page size in 2016	3MB	30-50MB	3D web scene
VIDEO CALL	Video chat apps (e.g. iPhone 7plus 2.1MP, H.265)	1-5Mbps	25-50Mbps	Holo-chat 1 person
VIDEO	HD 4K	5-20Mbps	100Mbps - 1 Gbps	Free viewpoint video

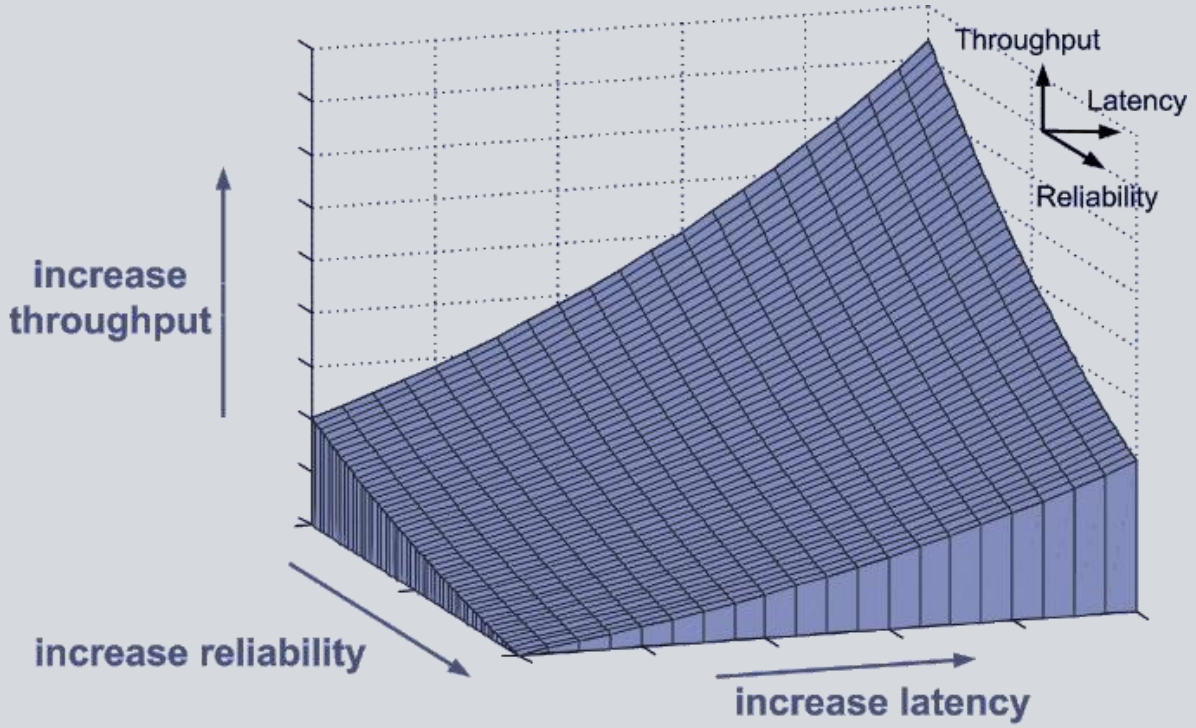
10x

5G Use Case Baseline Considerations



5G Use Case Baseline Considerations

Tradeoff between Throughput, Reliability and Latency

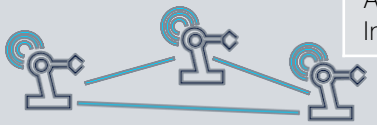


5G Enablers for new use cases How to slice?

Resilient, secure & low-latency comms

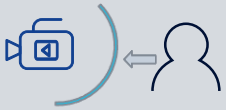
Latency ~ 5ms

Automation, mission critical, Interactive VR



Process Automation

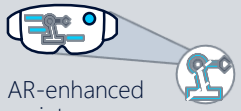
Critical comms



Security

Network slicing

Service Level Agreements



Public MNO slice

AR-enhanced maintenance

DL Peak Rates ~ 10Gbps

Immersive video, 4k-8k video, massive HD

UL Capacity ~350Mbps/km2

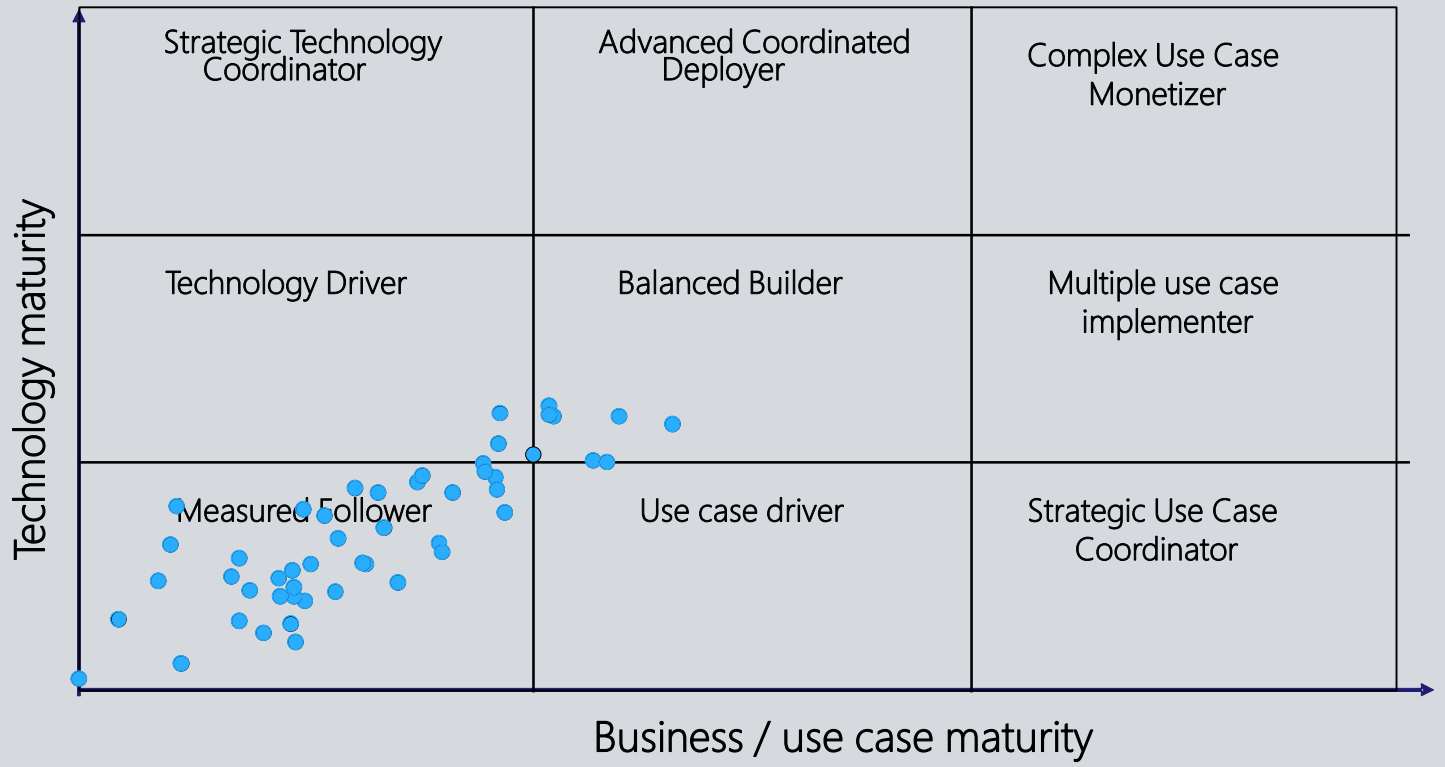
Security video, event sharing, SoMe

High Bandwidth

Both the **business perspective** and the **technology solution** must be defined hand-in-hand.

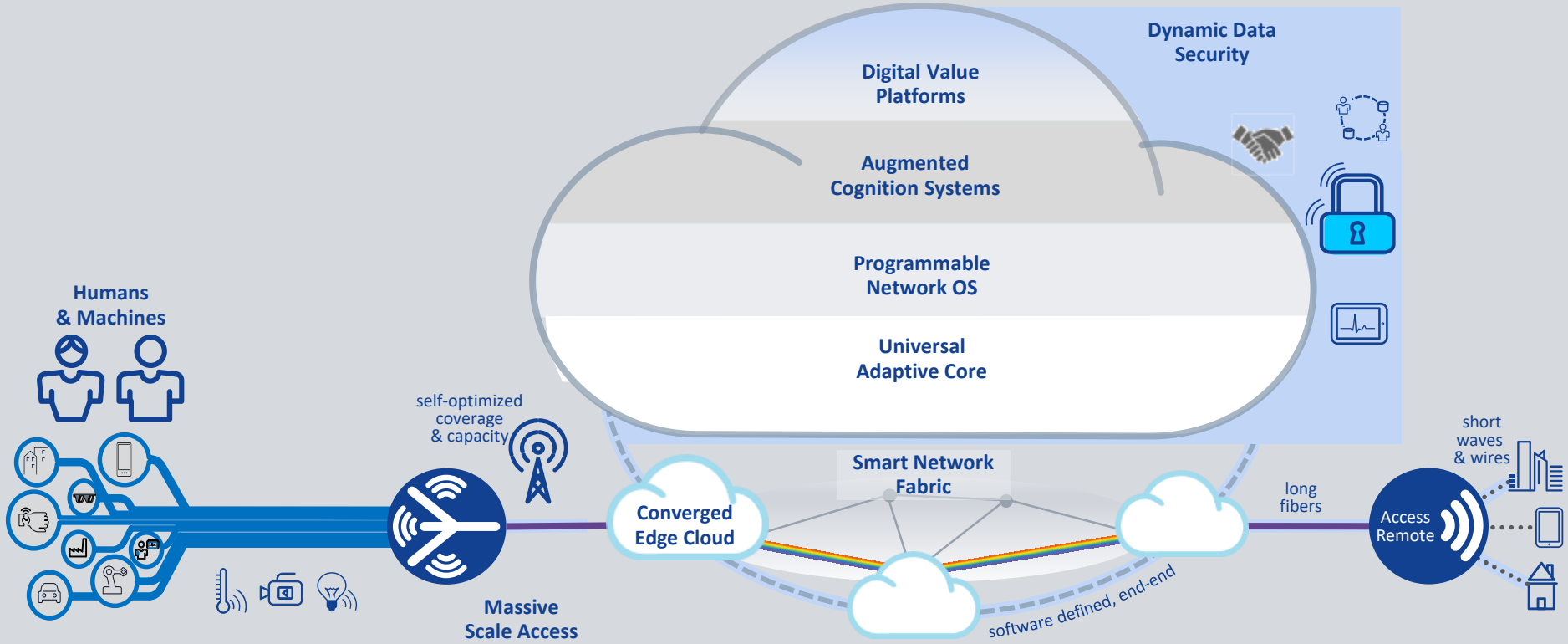
How close are we

Framework: Benchmarking operators on their 5G maturity



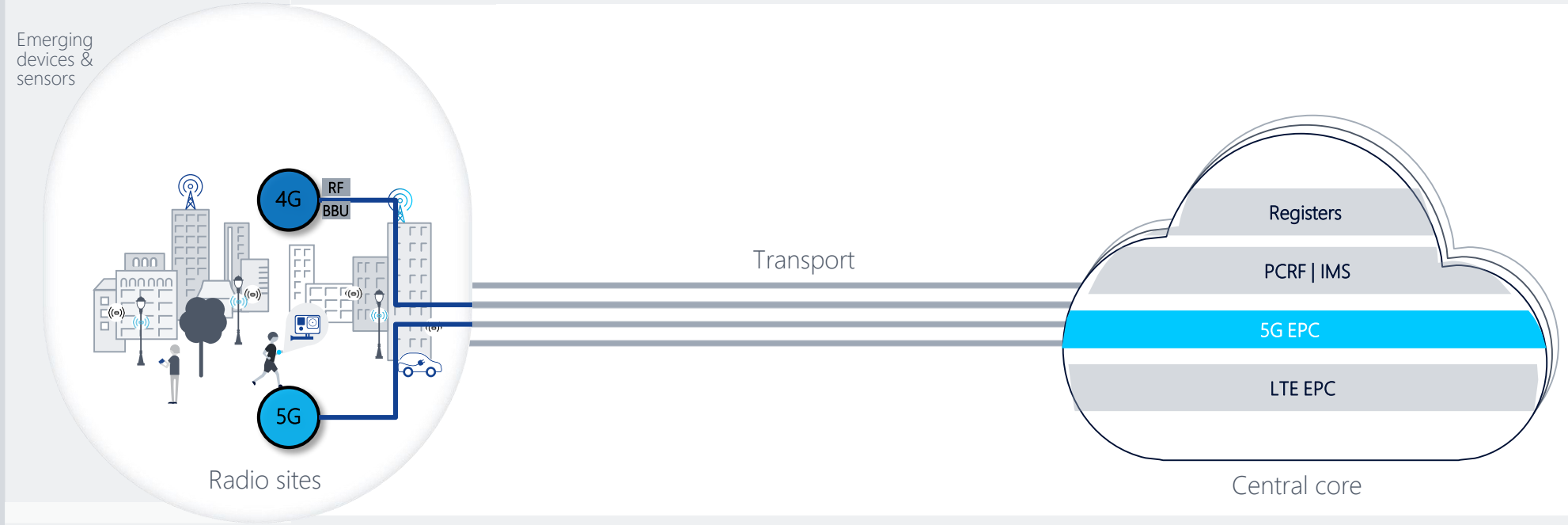
5G is a lot of different components that all have to come together!

End to end 5G capability based on Future X architecture



Future X network: cognitive + converged + cloud-optimized network (r)evolution

Introduction of the 5G NSA 3x Architecture



Evolution to 5G SA 2 Architecture

Emerging devices & sensors

Massive scale access

Radio sites

Converged edge cloud

C-plane

U-plane

Edge

Cloud native core

C-plane

U-plane

Central core

Programmable and scalable Anyhaul

Evolution to 5G SA 2 Architecture

Emerging devices & sensors

Massive scale access

Converged edge cloud

Cloud native core

Centralize RAN CU functions
→ Lever pooling gains

Flexible placement of VNFs, apps & content
→ Lowest latency and reliability

C-plane
↕
U-plane

C-plane
↕
U-plane

Radio sites

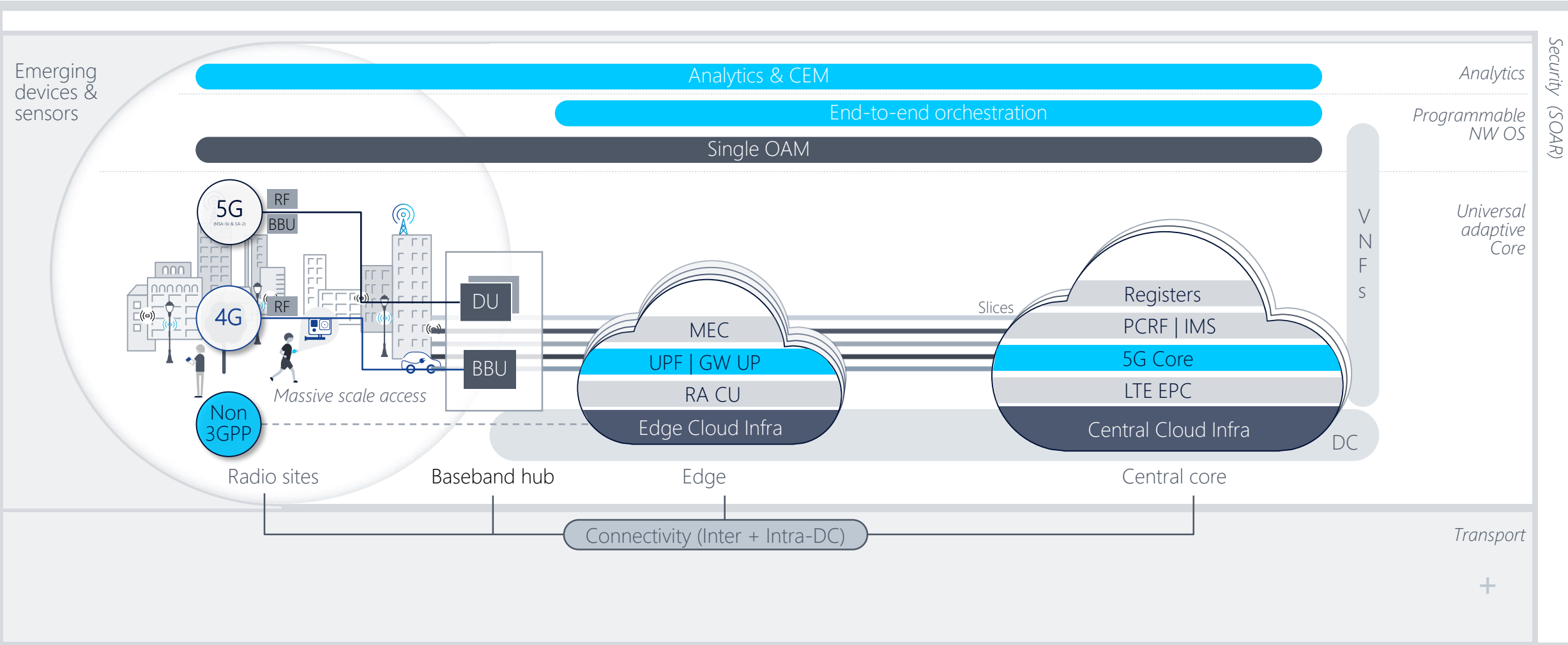
Edge

Central core

Programmable and scalable Anyhaul

Cross-domain performance optimization, process automation & security

5G SA-2



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Network Slicing example: eMBB low latency

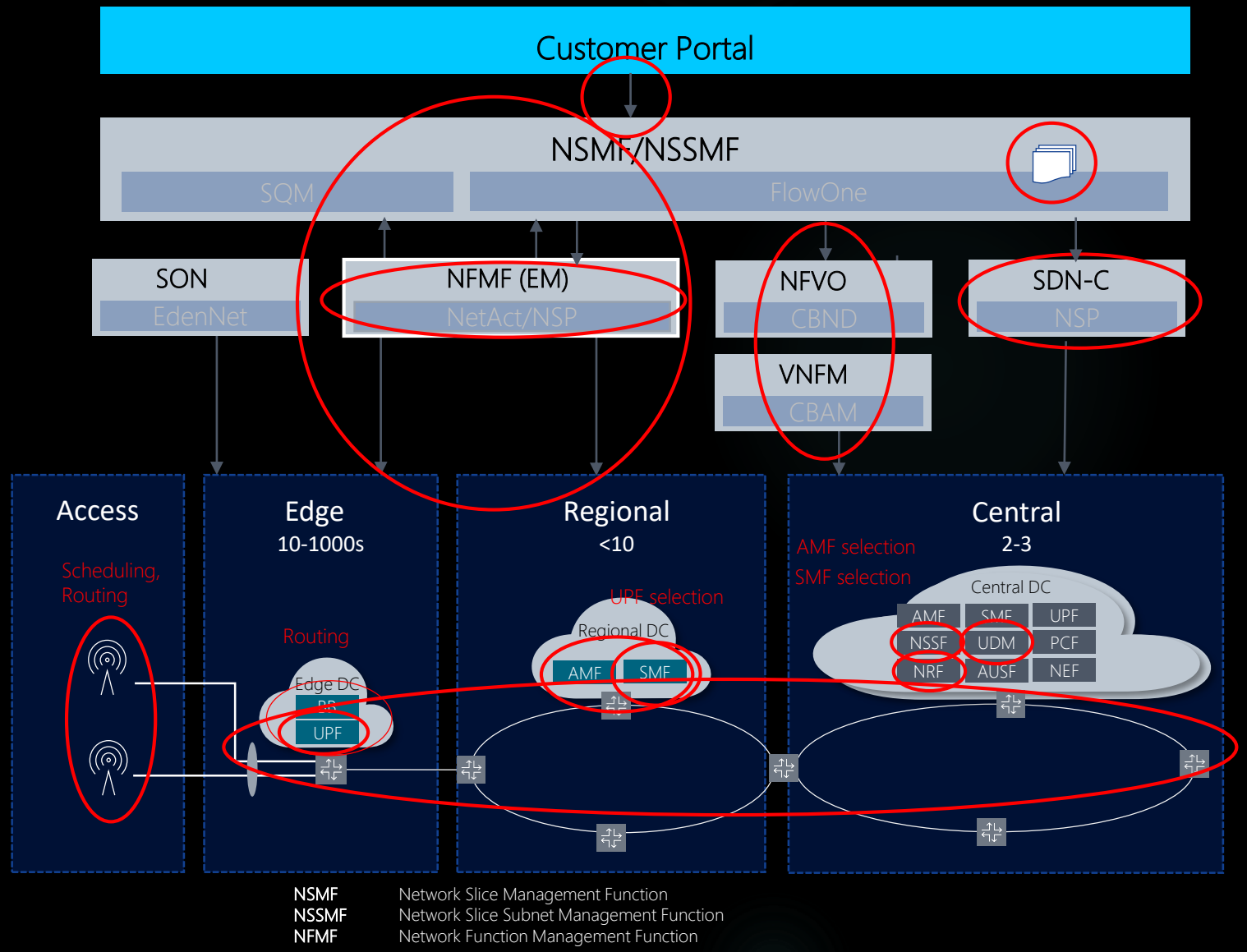
1. eMBB low latency Slice template is designed against certain Service level (e.g. speed, latency) and added to offering

2. Customer orders Slice for certain capacity

3. Slice template descriptors is decomposed to actions for different domain subnets
    1. Network resource allocation and instantiation via NFVO&VNFM
    2. NF(SLA configuration/parameter) provisioning via NFMF
    3. Connectivity is created between/inside Data Centers through Transport Subnets and traffic prioritization and routing rules are set for User plane (using SDN Controller)

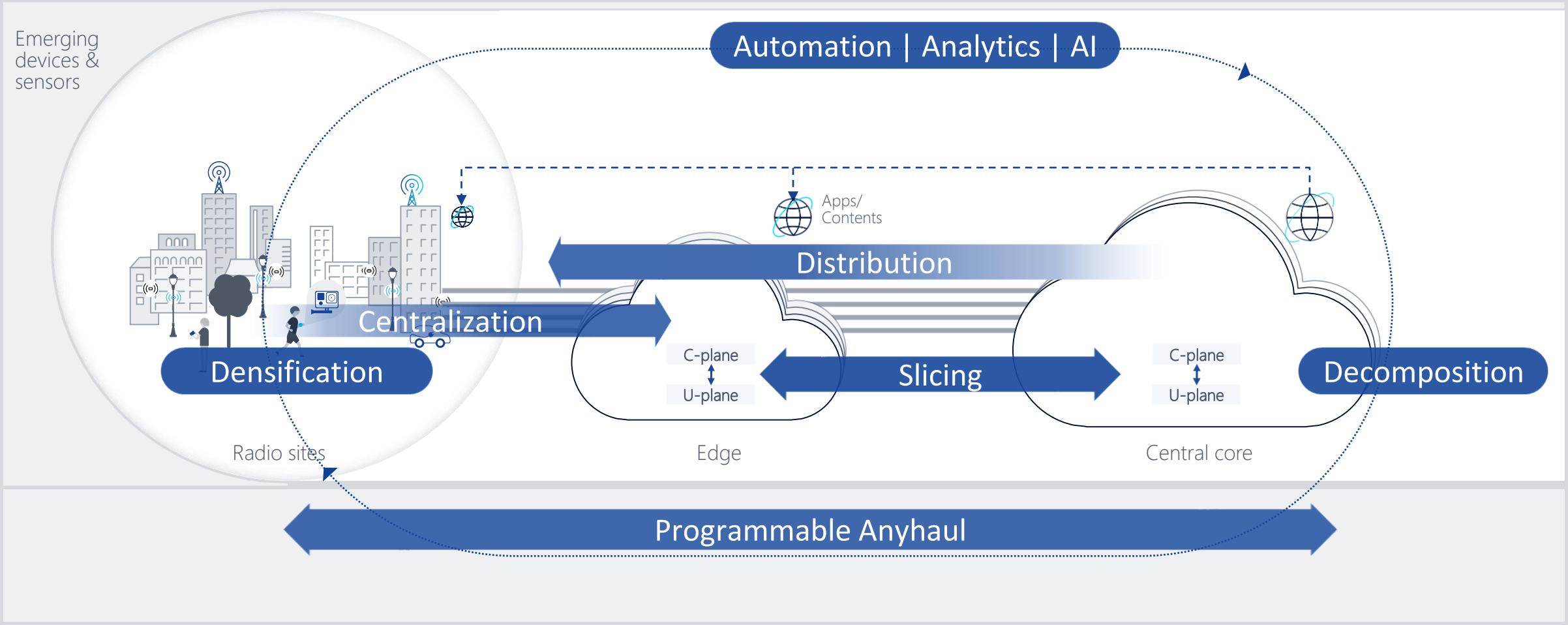
4. NSSAI is provisioned from UDM/UDR for those UEs that are allowed to access this service

5. NFMF correlates certain individual NE level faults/performances info into slice/tenant level and forwards to NSSMF. In addition to Slice monitoring NSSMF can trigger closed loop action to fine tune the slice parameters.



The path to 5G contains much more than radio

7 closely synchronized streams towards 5G network



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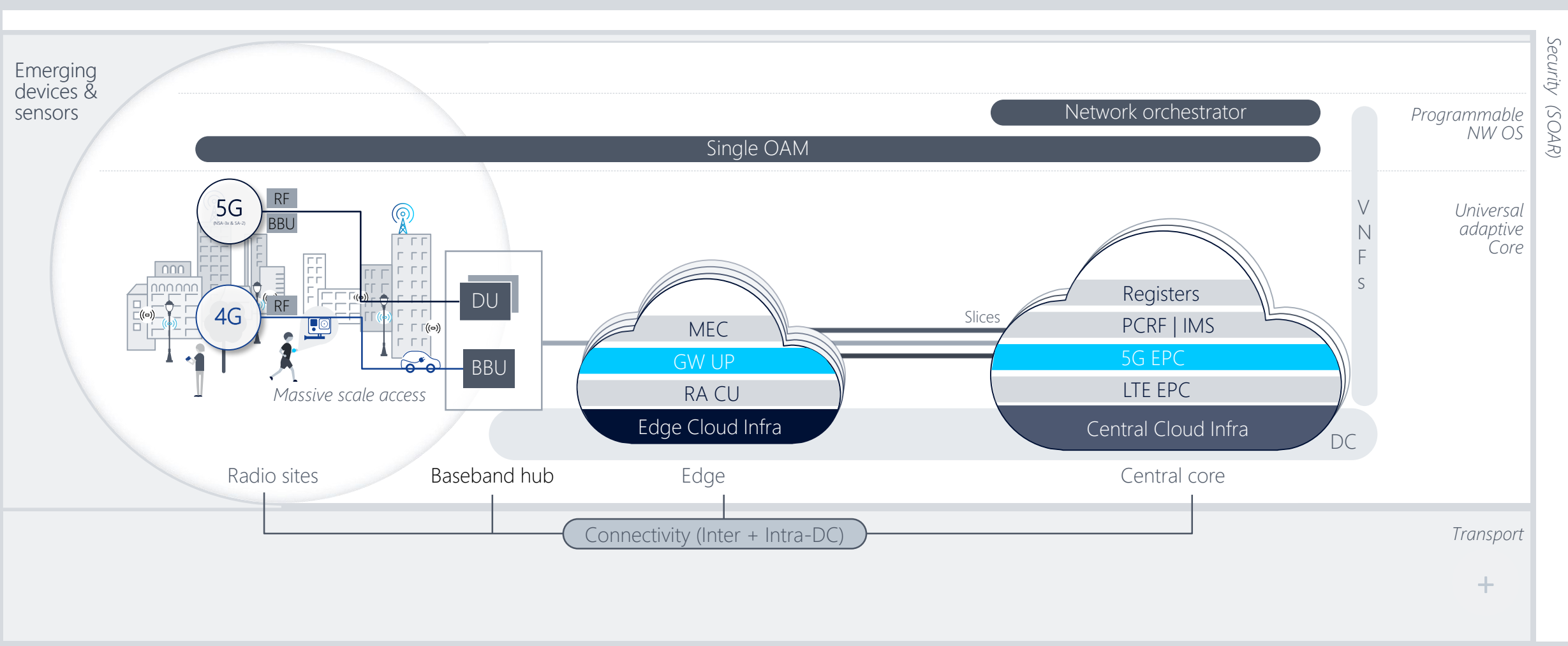
Thank you

5G NSA-3x



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