5G Netzarchitektur, Anwendungsfälle, Spektrum

Infothek „5G für kommunale Unternehmen“
11. Oktober 2018 in Berlin

Rainer Liebhart
Head of 5G E2E Architecture
Nokia Mobile Networks Product Sales

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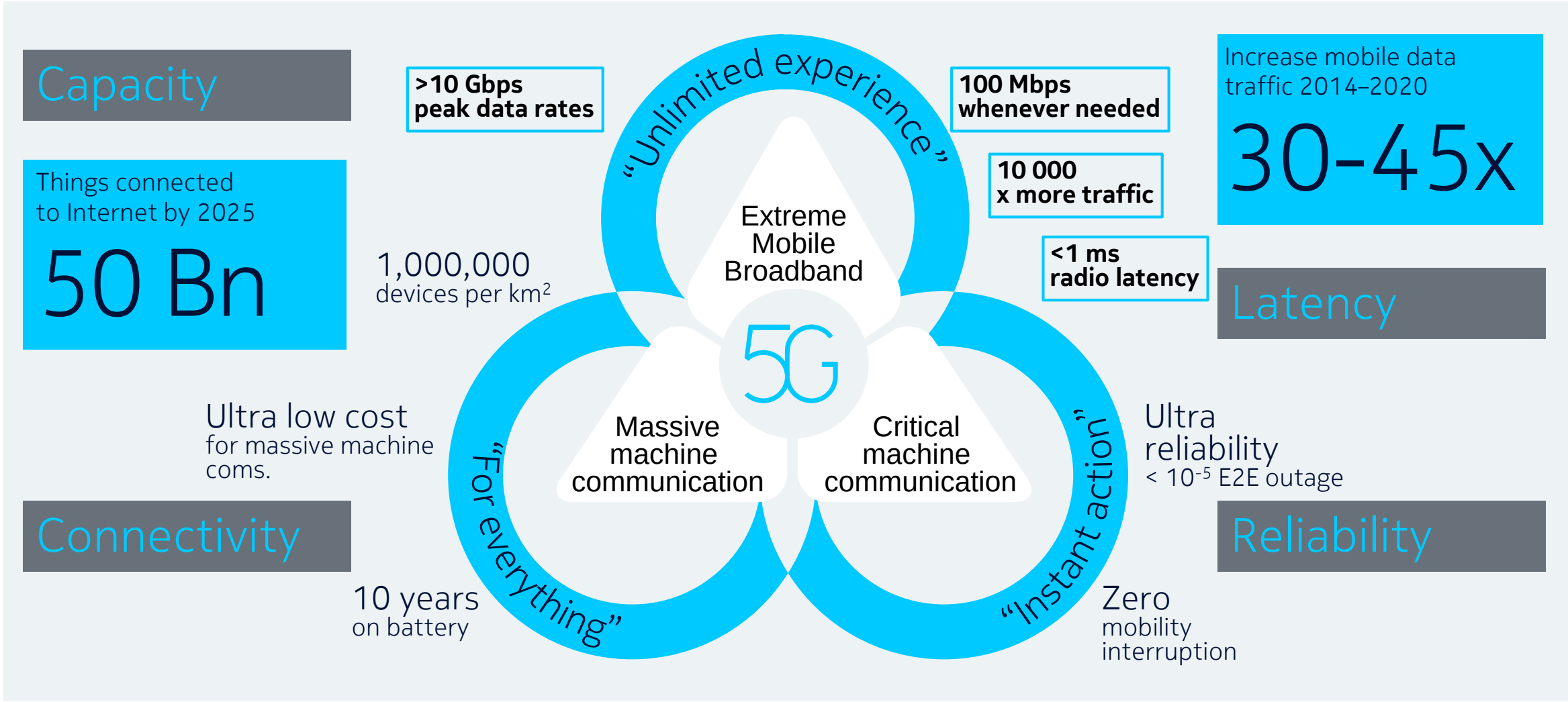
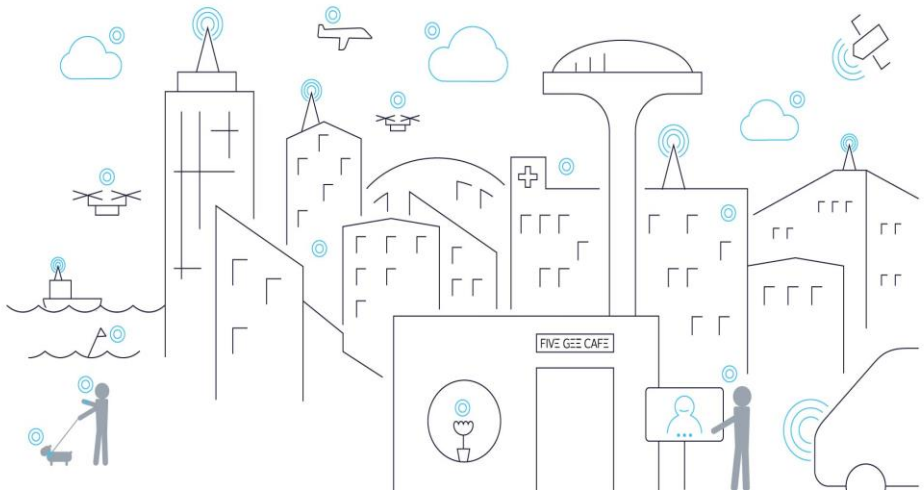
5G Treiber und Architektur

What is 5G about?



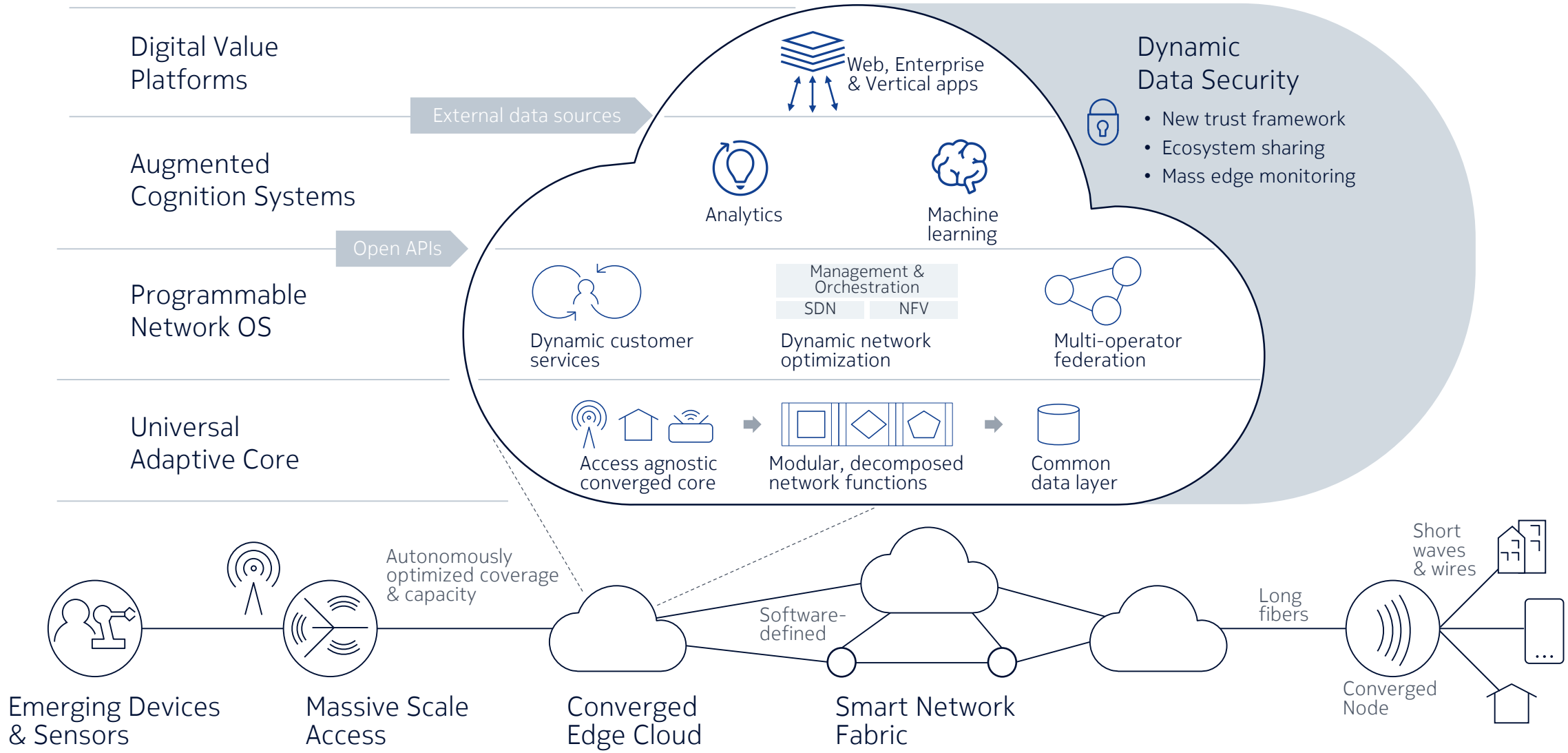
Communication at a turning point beyond Connectivity.



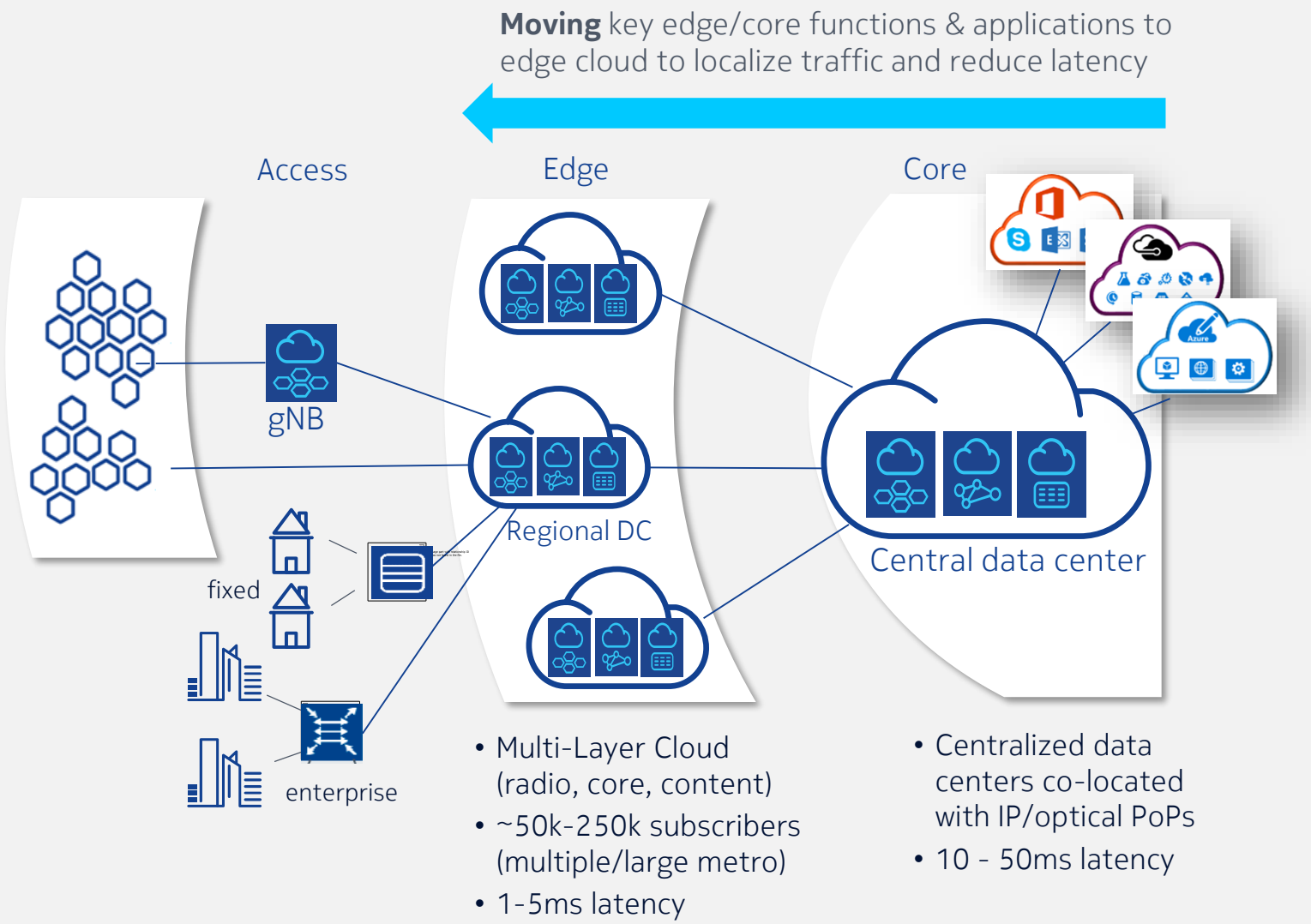
Solutions for CSPs, Enterprise and Public sector customers

V2X Ecosystem	Remote oil field	Connected Harbor	Smart Airport	Sports Arena
Industry 4.0	Connected Mining	Enterprise	Air-to-Ground	Smart City
Transportation	Retail & logistics	Edge Compute	Public Safety	Green Energy

How does a 5G end-to-end architecture look like?



Cloud: Architectural evolution towards the Cloud / Virtualization



Central Data Center

For massively scalable and less latency relevant applications / functionalities

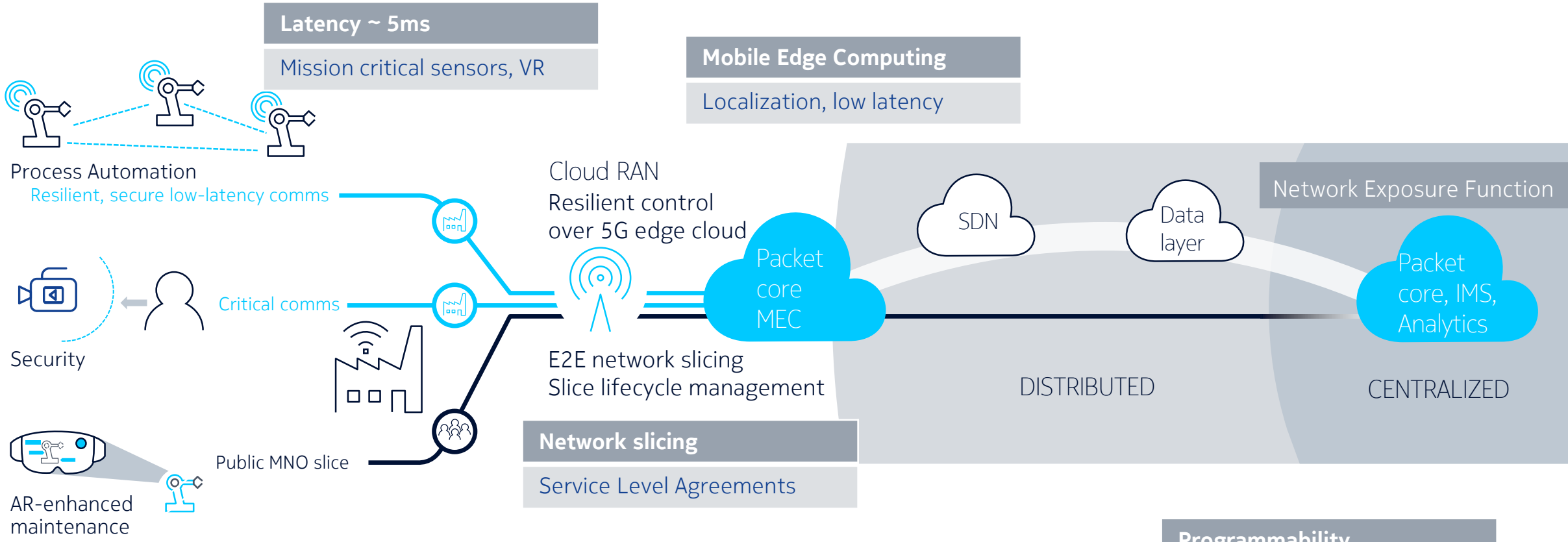
Regional/edge data centers

Low-latency applications, video offload

Mobile Edge Computing

For content caching or locally applicable applications and content

Enabling new use cases
5G and next generation architecture enhancements

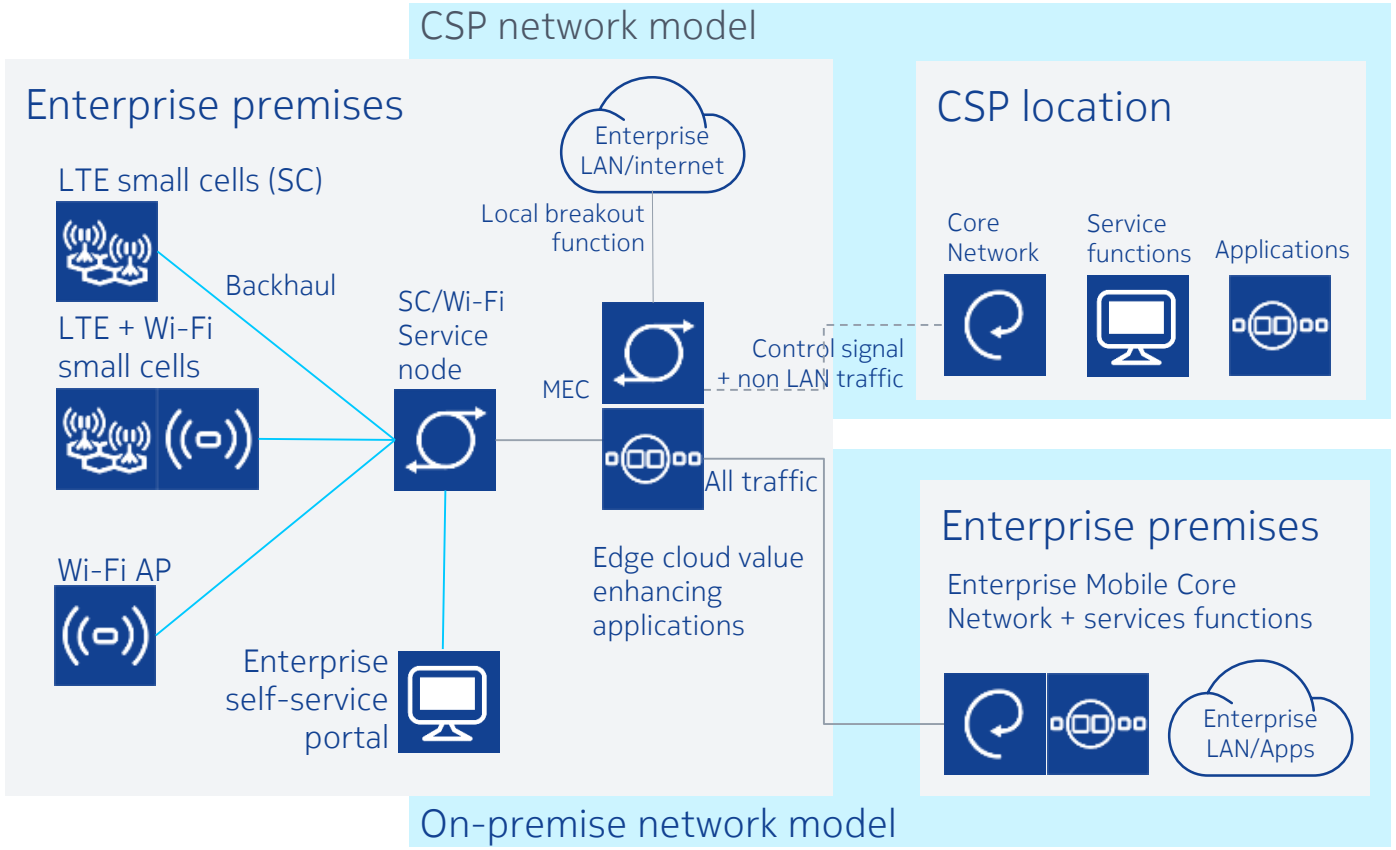


Enterprise Private LTE/5G network supporting MEC

Enabling Mobile Operators to serve and monetize industrial customers

Enterprise needs

- Wireless communication with single robust local network
- Consume network as a service (NaaS)
- Benefit from new wireless use cases, e.g. LTE/WiFi based video surveillance and object tracking



Operator opportunities

- Create revenue growth with enterprise customers
- Demonstrate a viable business case for LTE/5G deployments in enterprise environments
- Develop new use cases for LTE/5G
- Offer NaaS

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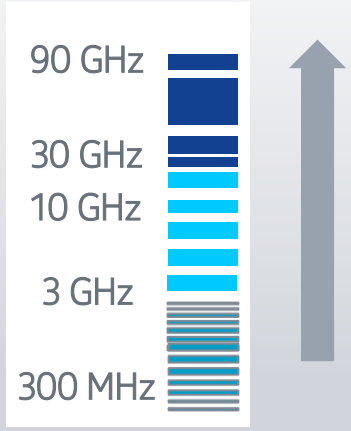
5G Radio and Spektrum

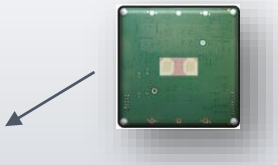
Key 5G Radio technology components

New spectrum



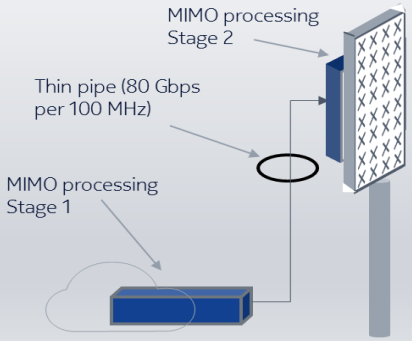
<6GHz – ~100Mhz/CSP
>6GHz - ~800Mhz/CSP

mmWave (high band)

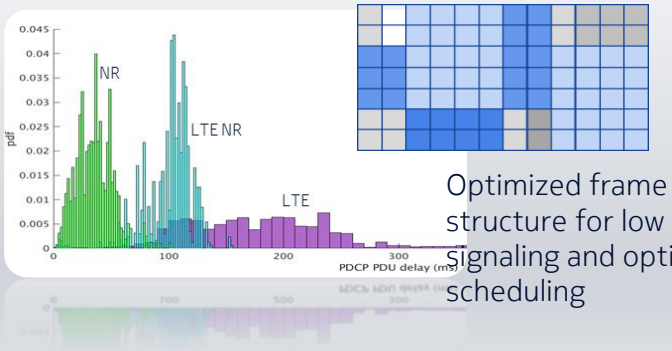


Ultrawideband RFIC with integrated antenna

Massive MIMO & Beamforming

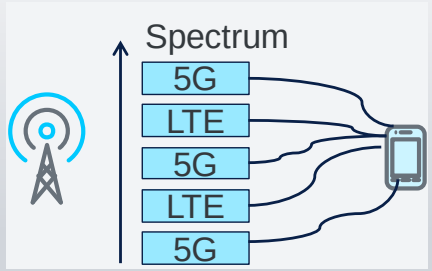


5G Optimized Solutions & Products

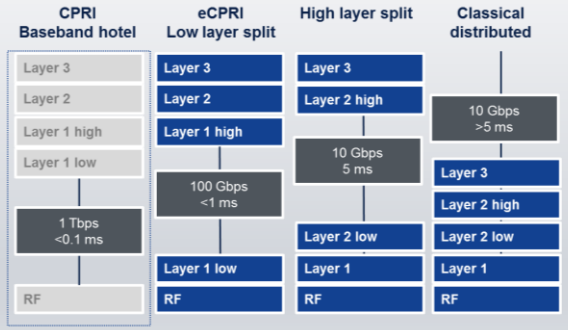


Optimized frame structure for low signaling and optimized scheduling

Multi-connectivity and aggregation



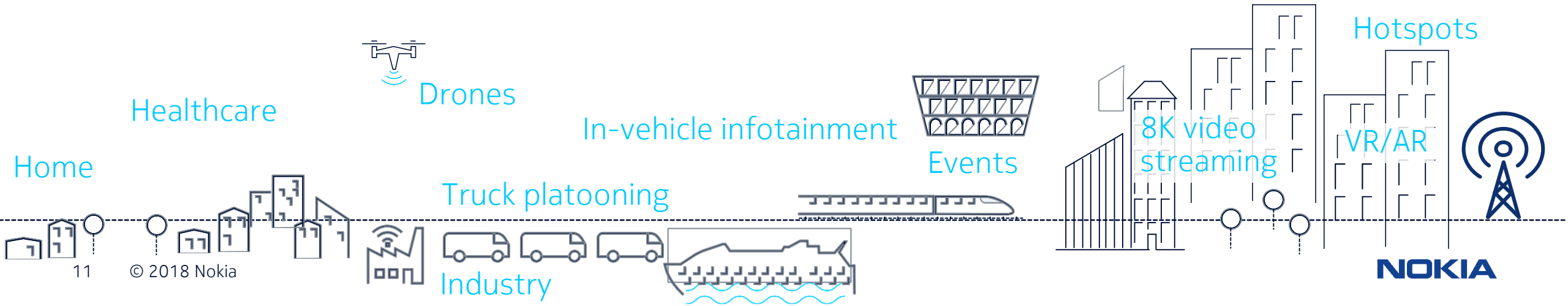
Optimized Architecture



Different spectrum for different use cases

Three key spectrum ranges

Cell range / Data rate	Spectrum range	Coverage	Peak Data rates	Bandwidth	Use Cases
	Low band < 3 GHz	• Deep indoor • >1 km	~100 Mbps	FDD 2x10 MHz or UL only	• Deep indoor coverage for e.g. MTC • Supplementary UL eMBB coverage • Coverage layer for MBB
	Mid-band 3 – 6 GHz	• Same grid as LTE1800 • ~1 km	~1 Gbps	TDD ~100 MHz	• 5G eMBB coverage on LTE grid • Major launches are expected here • UL challenge
	High-band > 24 GHz	• Hot spots • Line of sight • 100 m	~10 Gbps	TDD <1 GHz	• Extreme data rates for e.g. VR in local areas like stadiums • Used in US due to lack of 3-6 GHz



5G Spectrum Global View

Germany:
3.4-3.7 GHz: auction of nationwide licenses valid until E2040, 30 unpaired 10 MHz blocks
3.7-3.8 GHz: application procedure („Antragsverfahren“) for local and regional licenses
2100 MHz: auction of nationwide licenses valid until E2040, 12 paired 5 MHz blocks

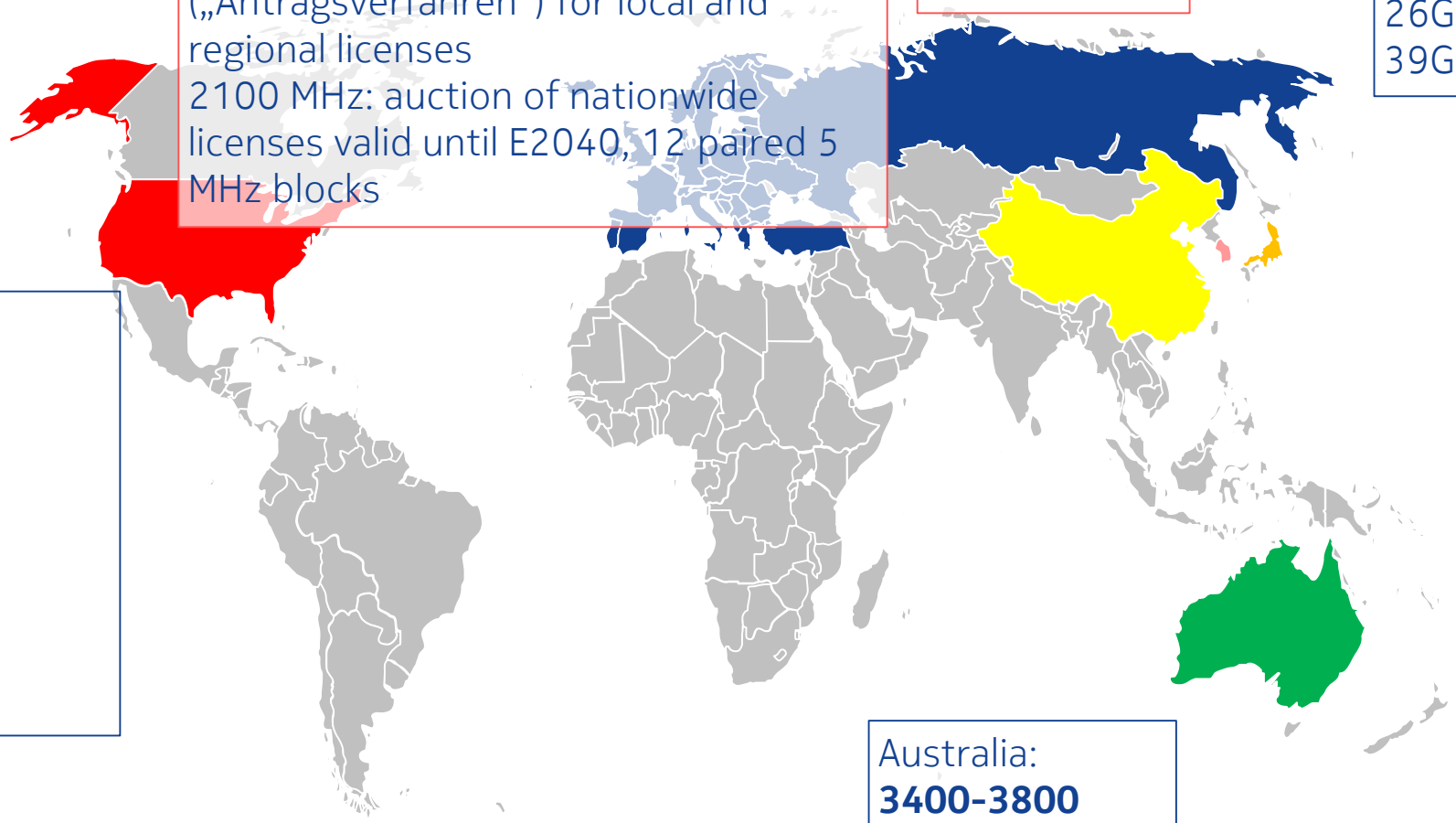
Europe:
700
3400-3800
26G

China:
900/1800 SUL
3300-3600
4800-5000
26G
39G

Japan:
3600-4200
4400-4900
28G

US:
600
850
2100
2500
3500-4200
24G
28G
39G

Korea:
3400-3700
28G



Australia:
3400-3800
26G

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Transport

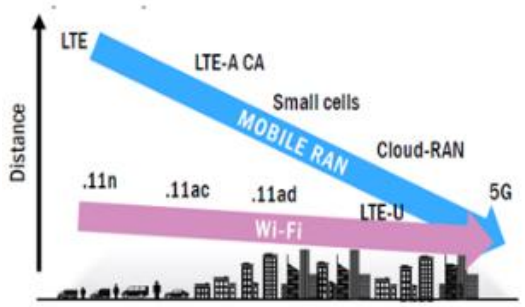
Factors driving the future of mobile transport infrastructure buildouts

Mobile Data Growth

>30x

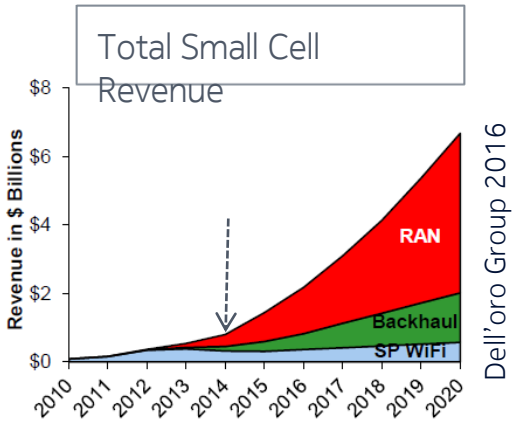
Data growth by 2020 with emerging markets seeing as high as 98x

RAN Densification



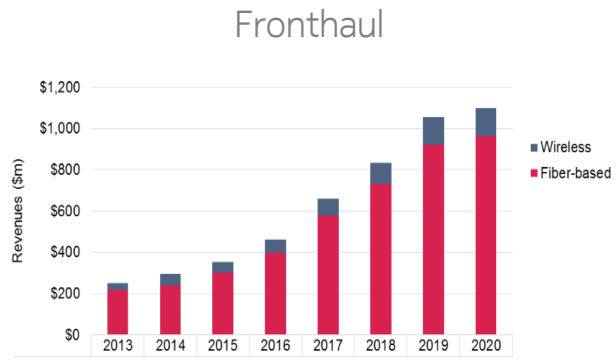
Analysis Mason 2016

Rise Of Small Cells



Dell'oro Group 2016

Shift To Fiber



Ovum 2016

CONNECTED EVERYTHING

Higher-resolution video, immersive communication, rise of Cloud services, IoT/ Wearables/M2M

SHIFT TOWARDS 5G

User experience & peak throughput driving deployments

COST-EFFICIENT SCALING

The Current Macro-cell-centric Solutions Will Have A Hard Time Keeping Pace

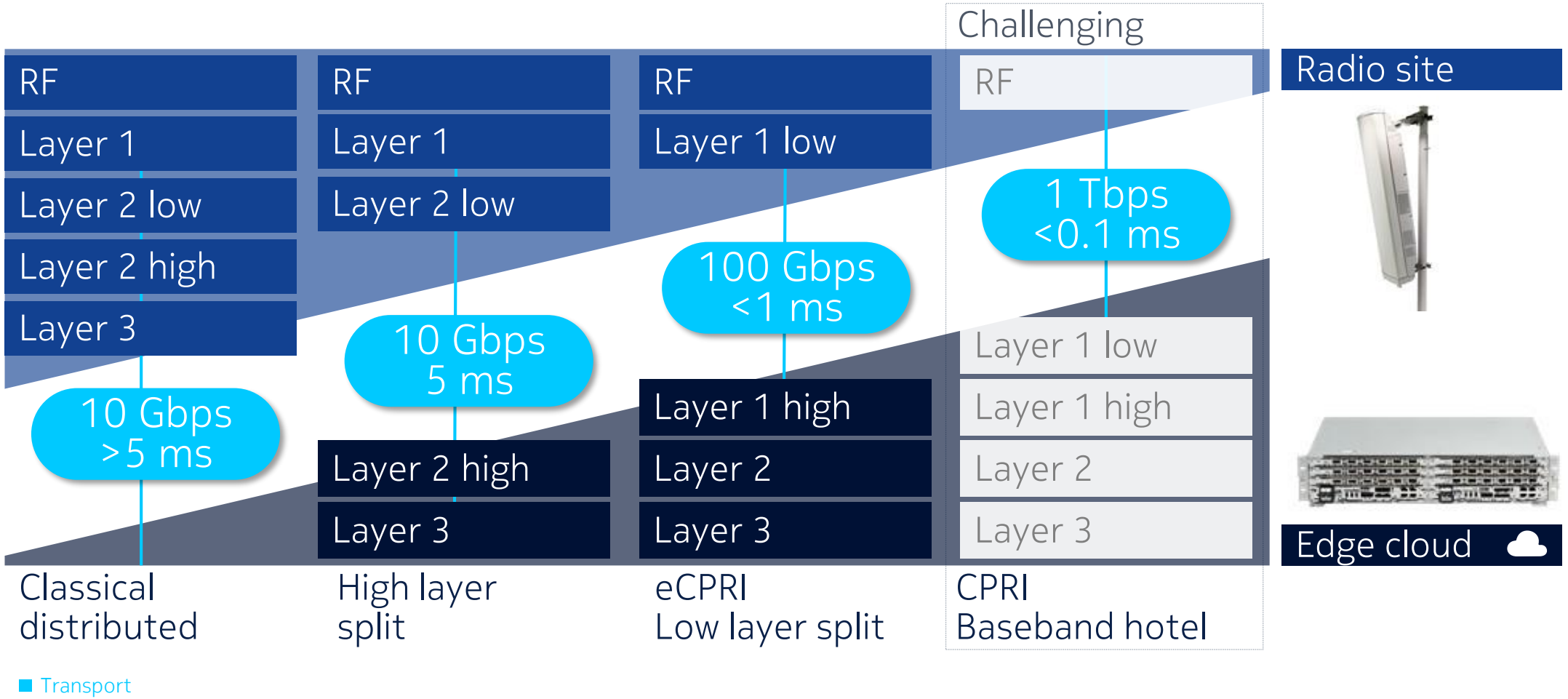
SUPPORT C-RAN EVOLUTION

2 out of 3 radio sites will have access to deep fiber networks by 2020

NOKIA Networks, T&I FutureWorks

5G radio architecture options

Trade off between latency reduction and growing transport requirements



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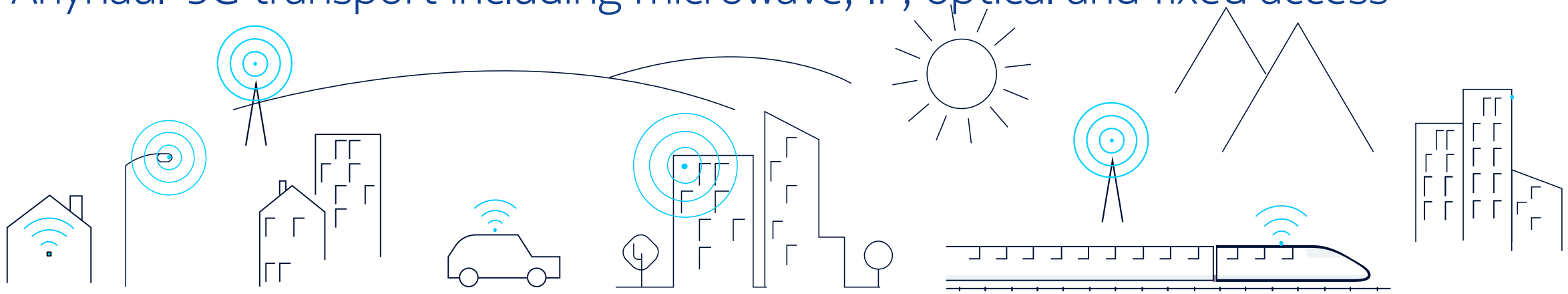
‘Anyhaul’ 5G transport including microwave, IP, optical and fixed access



Remote Radio Site-RU

Baseband Unit-DU

vRAN-CU

Cloud Packet Core

Data Center / Peering

Fronthaul

Midhaul

Backhaul

Backbone

eCPRI/CPRI

Optical C/DWDM

Latency Sensitive Ethernet

Future Specialized Variants of Fronthaul

Cell Site IP Router

Microwave

XGSPON

In-band mmWave

Metro Optical

Agg. Router

Head-End IP Router

Core IP Router

Microwave

Optical DWDM

*Anyhaul

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Thank you!