

5G Network Architecture

A healthy balance between Evolution and Revolution

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NGMN Vision

Serves as a baseline for 5G architecture discussion and definition



“5G is an end-to-end ecosystem to enable a fully mobile and connected society. It empowers value creation towards customers and partners, through existing and emerging use cases, delivered with consistent experience, and enabled by sustainable business models.”

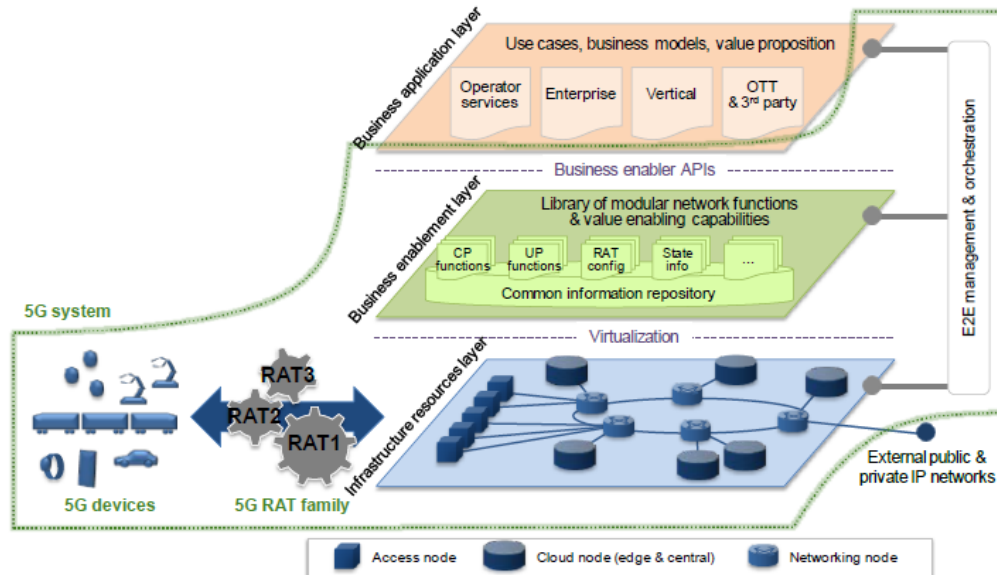


Figure 8: 5G Architecture

The NGMN White Paper has been endorsed by the following NGMN Board Members:

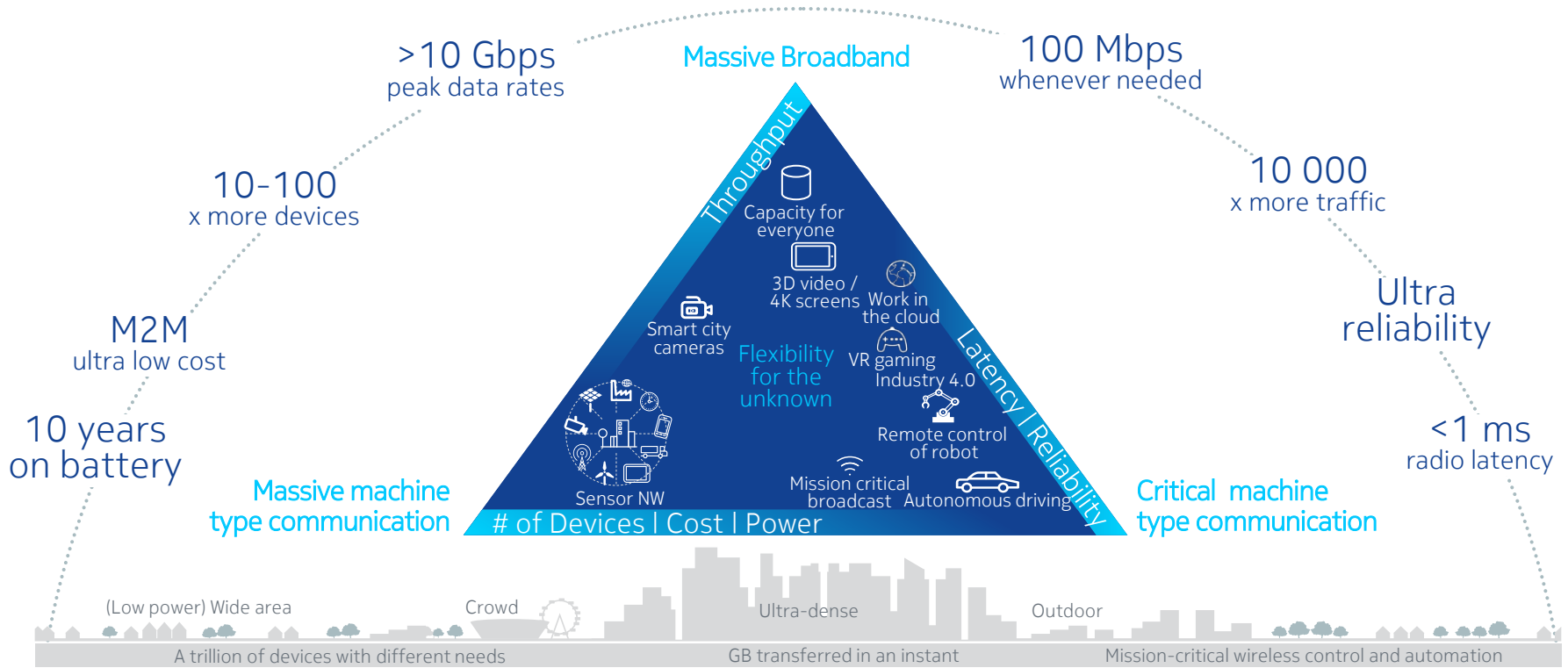
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A Deliverable by the NGMN Alliance

NGMN 5G WHITE PAPER

5G will enable very diverse use cases with extreme range of requirements

Requiring a scalable, flexible and programmable network architecture



The range of diverse use cases results in various requirements for the architecture

Enabling benefits for the operators



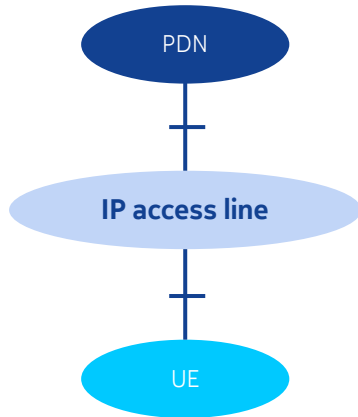
5G needs an enhanced connectivity model

To enable new use cases



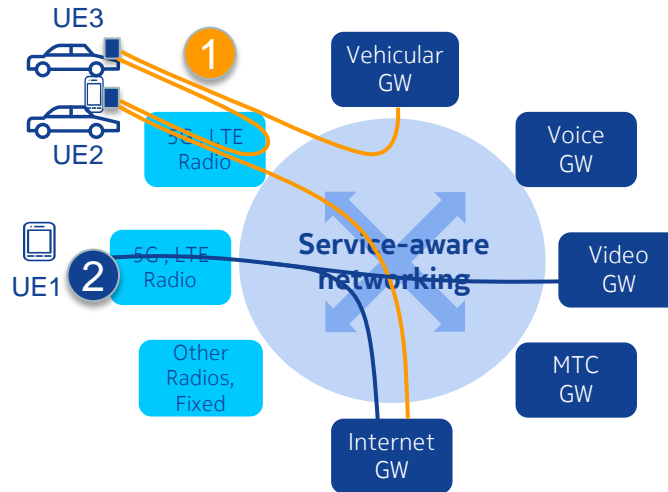
Connectivity in LTE

- Transparent pt-pt IP access line
- U-plane and c-plane are designed for pt-pt model



Enhanced 5G any to any connectivity

- Service-aware u-plane packet forwarding with full support for mobility, charging, lawful intercept
- New c-plane optimized for highly distributed service-aware networking functions



Some use cases require enhanced connectivity options for e.g.

- 1 local switching (for 5G low latency) and simultaneous access to Internet or other services
- 2 simultaneous connection to multiple GWs (e.g. for internet and optimized video delivery (MEC))

Reliability

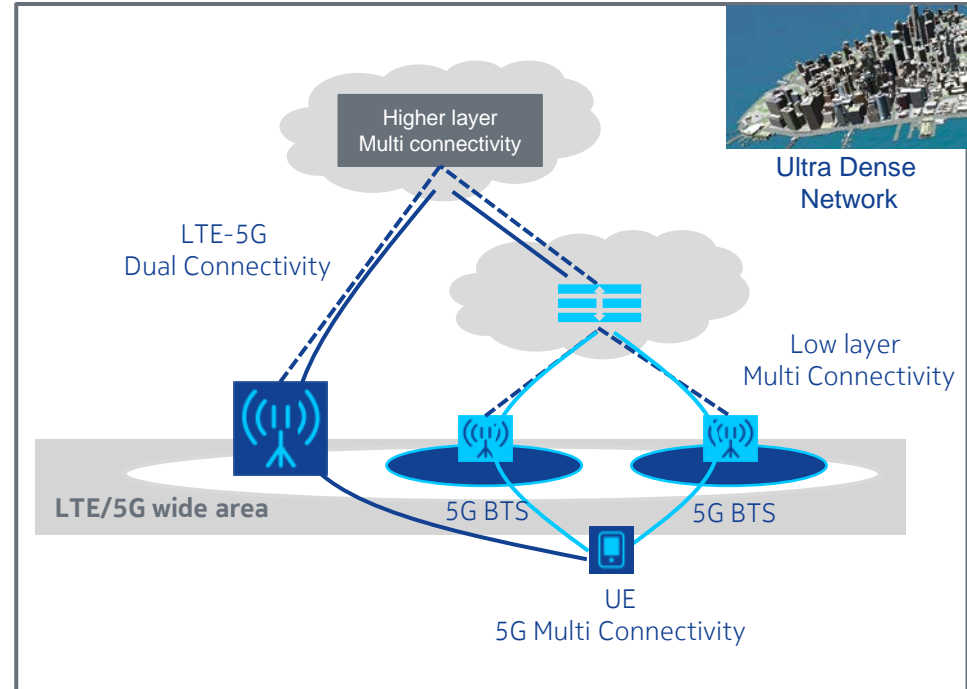
Simultaneous and native Het Net & multi-connectivity



- LTE↔5G dual connectivity ensures smooth introduction of 5G
- 5G multi-connectivity improves robustness and data throughput
- Multi or Single connectivity selected depending on the type of service

Benefits:

- Highest data throughput and consistent end user experience
- Enabler for the growing market of mission-critical services, e.g. health and safety, industry automation



Low Latency

Example: autonomous vehicles transforming urban space

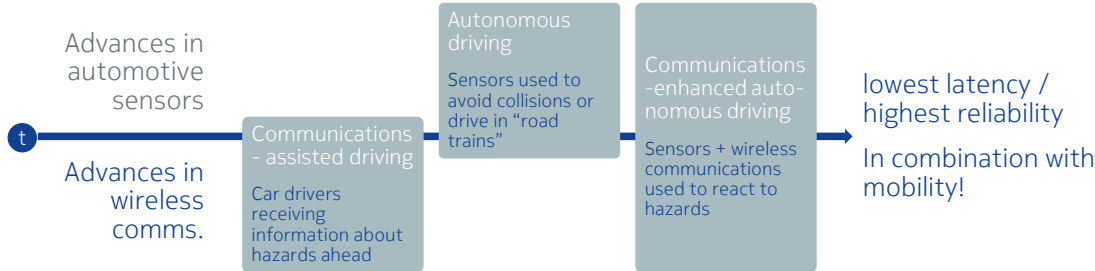
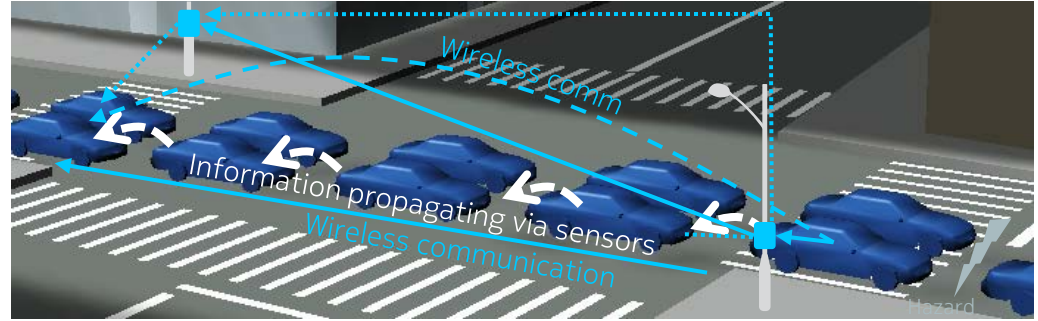


Dynamic geo-networking of vehicles:

- In a certain geographic location or area (e.g. an intersection, a road hazard)
- Forming a moving platoon of cars in close proximity with full mobility support

Related connectivity requirements:

- Lowest latency packet forwarding among UEs forming a virtual network
- Full mobility of UEs and virtual networks
- Seamless connectivity to additional services (e.g. Internet, traffic control)



Mobility on demand

Mobility and service continuity offered on demand

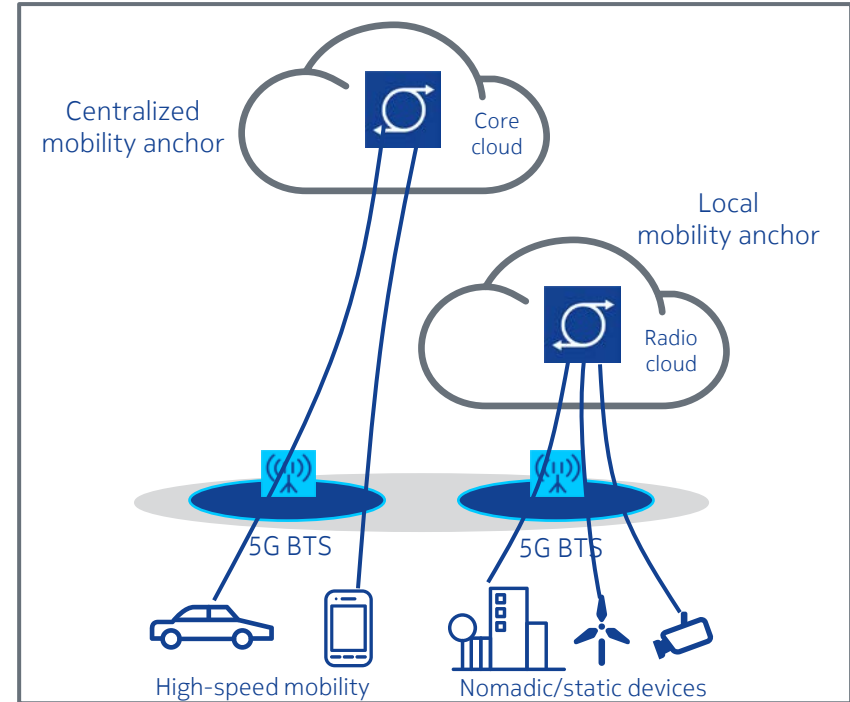


Wide range of mobility options

- No mobility (stationary meters, CPE) to high-speed trains running at 500km/h
- Various levels of service continuity: seamless mobility, nomadic mobility, sporadic senders
- Some MNOs observed that only 30% of subscribers are actually mobile

Benefits

- Optimize traffic flows and network resources
- TCO optimization:
 - Not all devices need full mobility support
 - Reduce core network resources and avoid traffic backhauling to centralized cloud



Quality and user experience

5G QoE architecture



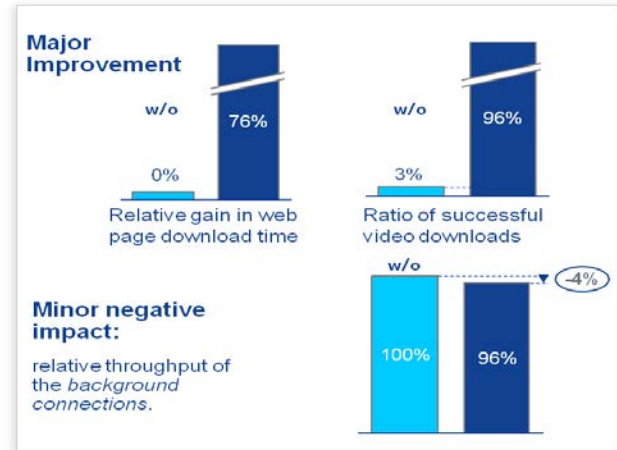
Drivers for a new QoE architecture

- Network enforces Quality of Experience rather than QoS
- Dynamic application-based QoS for known and future OTT applications
- Not achievable with LTE where same QoS is applied for all traffic in a bearer

Benefits

- Monetize quality of experience (B2B , B2C)
- Efficiently serve different business models, verticals (IoT and mission critical) as well as consumers
- Ensure superior user experience (web pages loading 76% faster, 96% of videos stream successfully)
- Good QoE in nearly 100% of the cases even in congested networks

Dynamic app-based QoE during congestion periods



Session on demand

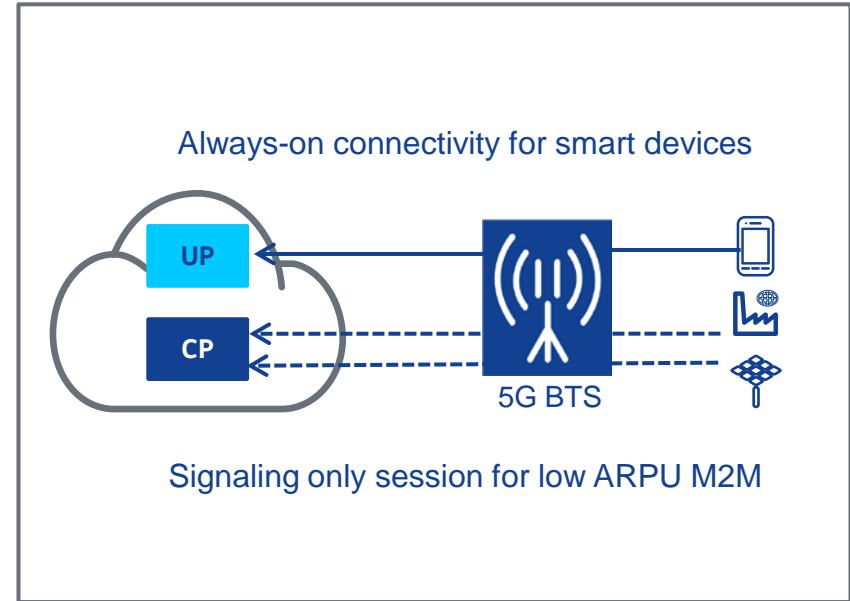
For improved network resource efficiency



- Resource efficiency for sporadic data transmission of low-cost and low ARPU devices can be significantly improved
- Session on demand eliminates signalling overhead for user-plane management → signalling only session

Benefits

- Efficient use of network resources
- Extended UE battery life

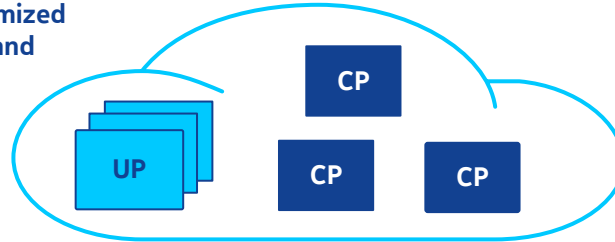


Network as a Service enables flexibility and Scalability

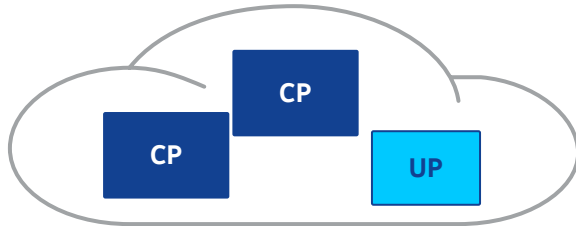
RAN selects the proper network slice based on UE type, class of service



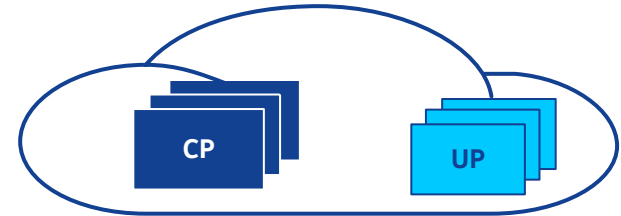
Network instance optimized for massive broadband (smart devices)



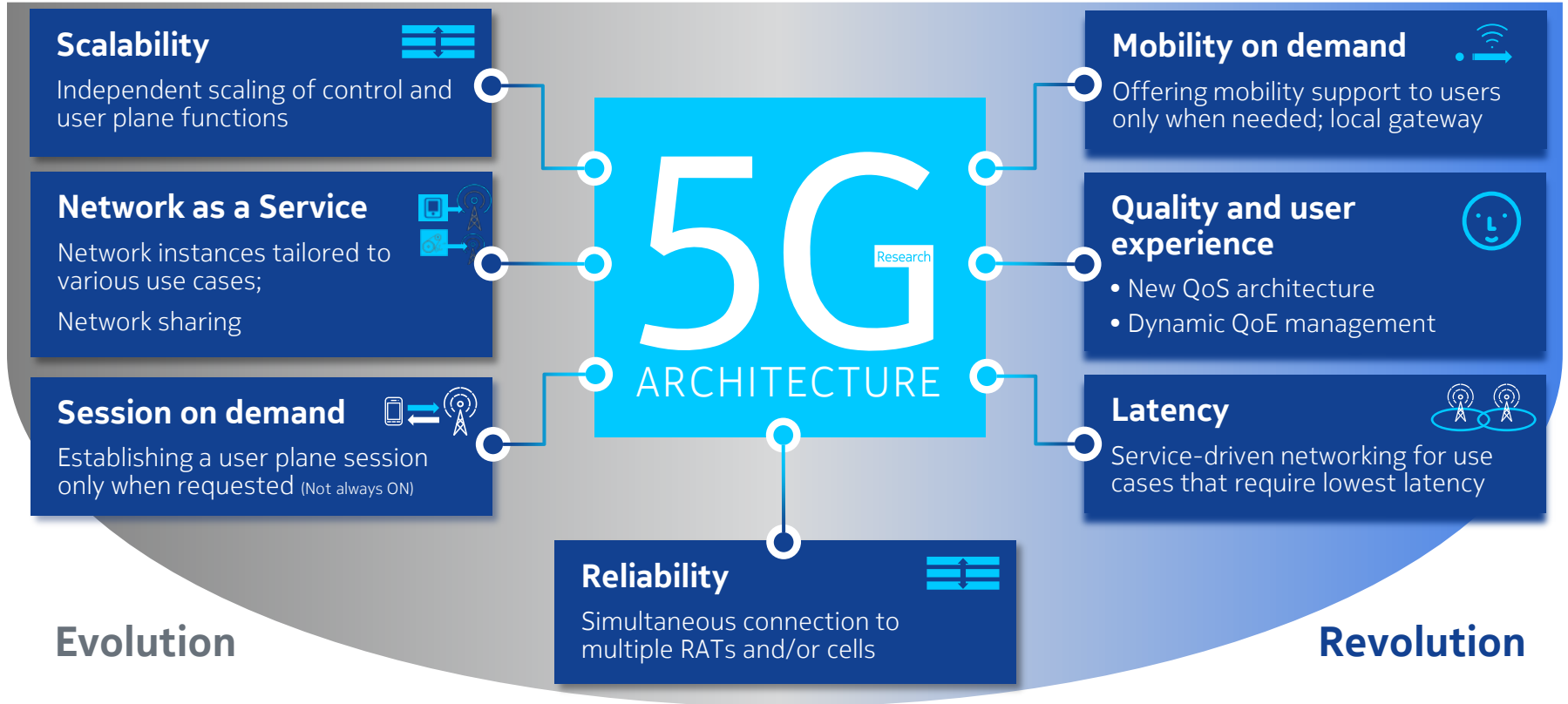
Network instance optimized for Massive MTC



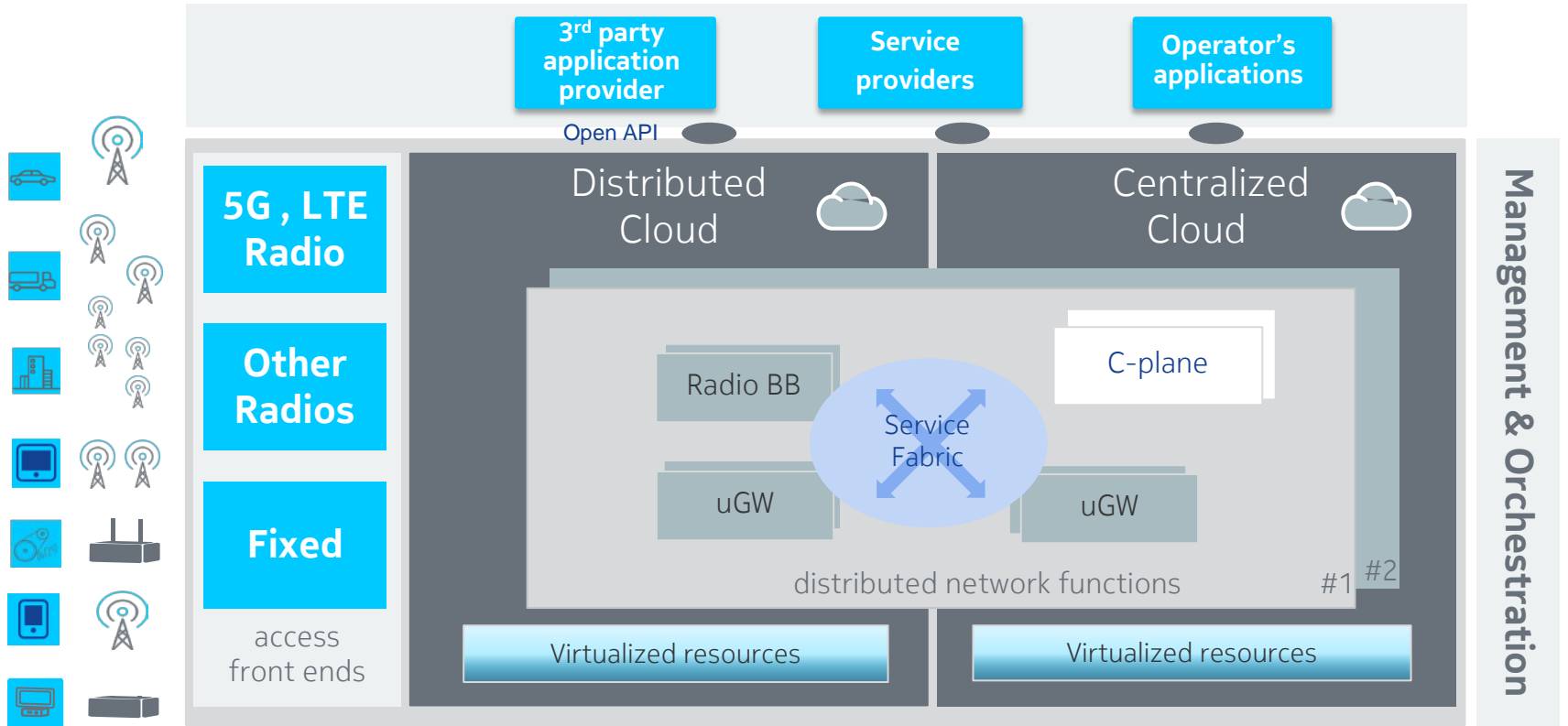
Network instance optimized to offer low latency, high reliability (critical MTC)



Translate into the need of a healthy balance of evolutionary & revolutionary concepts



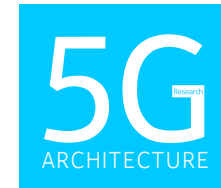
End to end 5G network architecture



Key to success

Call for action

- 1** NGMN needs to provide clear/strict prioritization of use cases and requirements in order to progress
- 2** Research on networking concepts/architecture needs to deliver innovative ideas and feed standardization
- 3** 3GPP needs to time and phase 5G radio and system architecture properly, ensuring forward compatibility!
- 4** A healthy balance of evolution and revolution will ensure investment protection while innovative technologies will enable a future-proof 5G network



NOKIA