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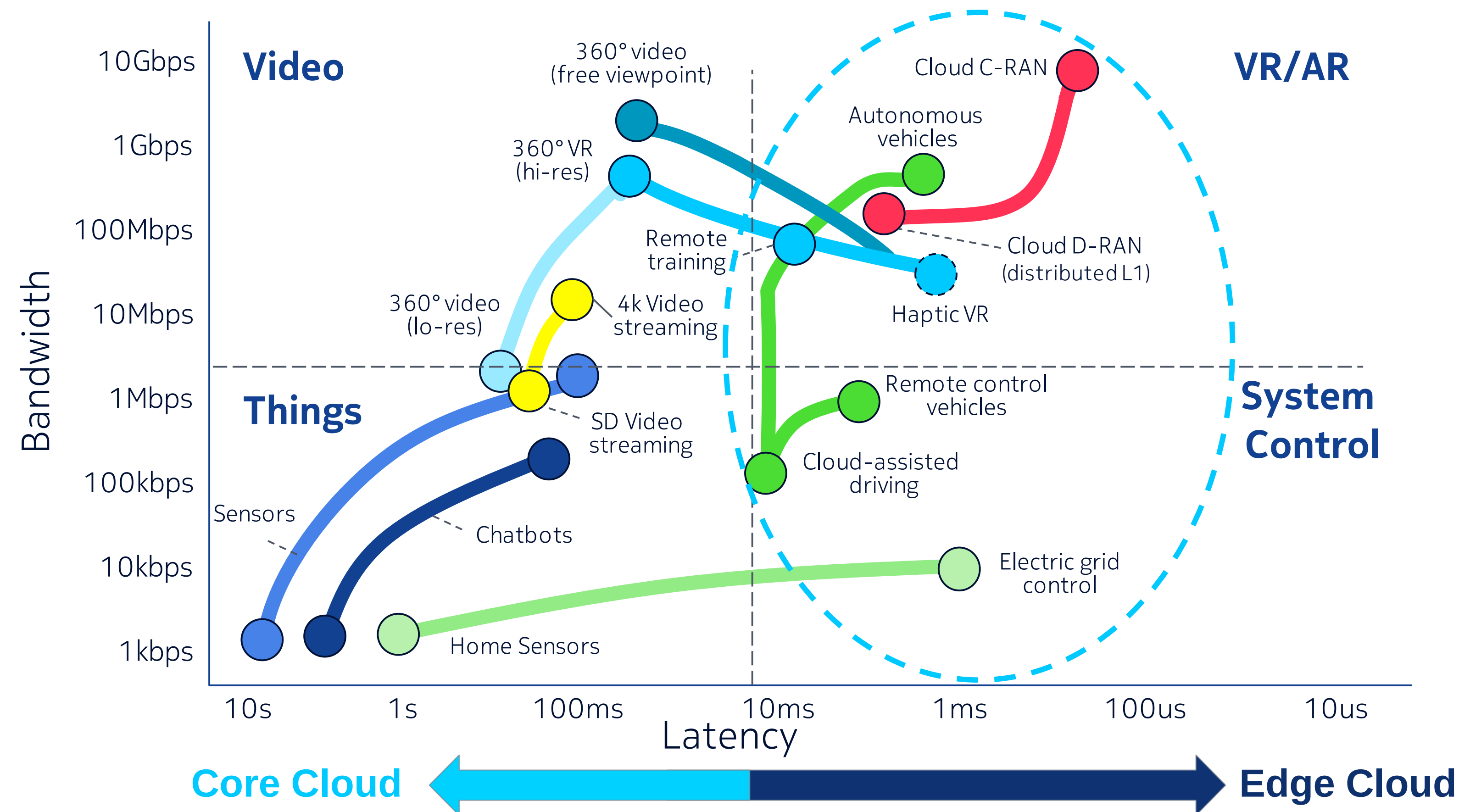
EDGE DATACENTER SOLUTION – THE NEED AND THE PROMISE

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New applications redefine network requirements



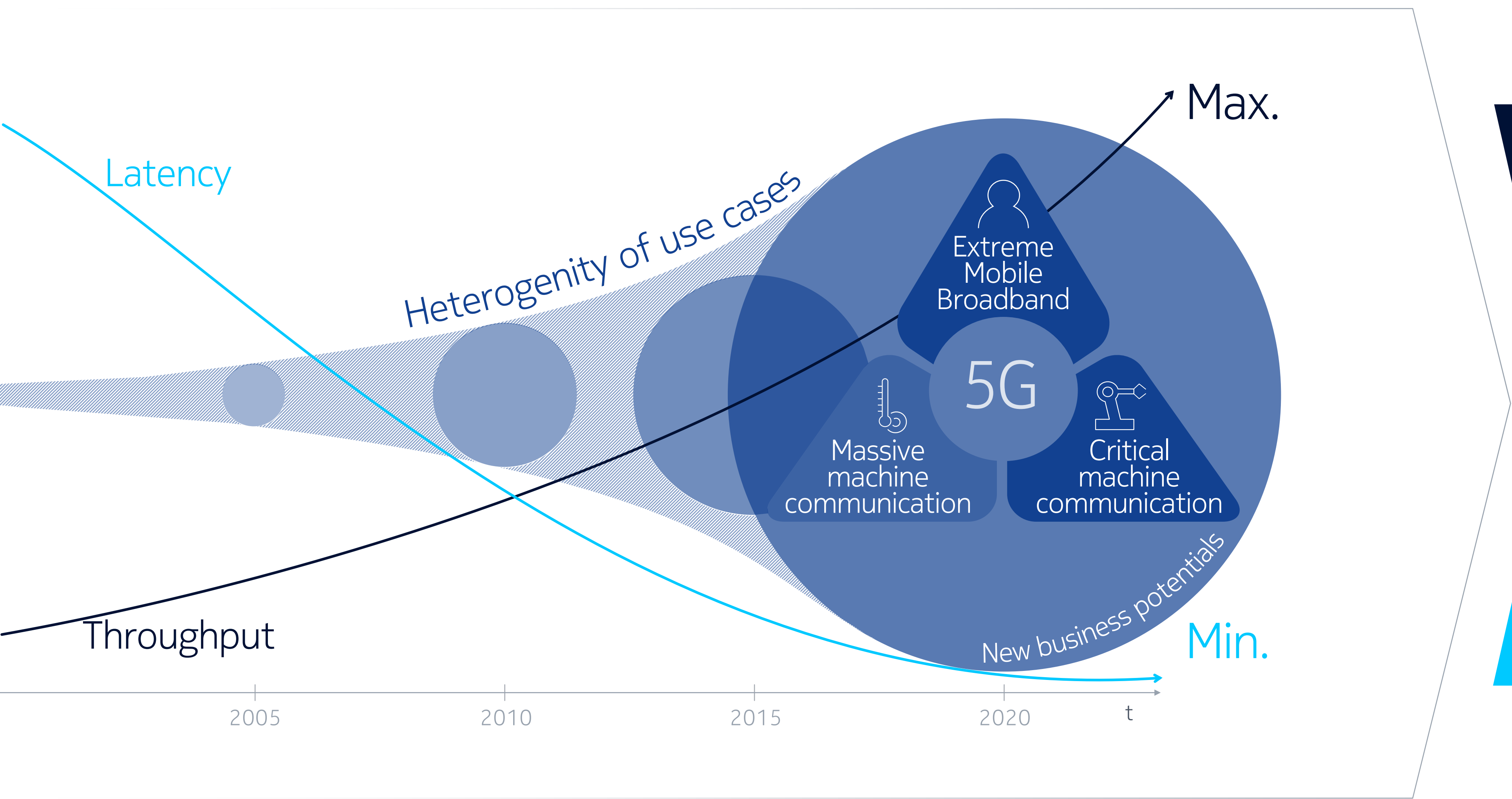
Low latency drivers

- Virtualized cloud access
- Interactively-intense AR/VR applications
 - virtual remote control
 - real time cloud rendering
 - haptic interaction
- Critical control systems
 - industrial/utility
 - vehicular automation

Similar to speed, latency becomes a point of differentiation

Pushing the limits to reach the next level

Addressing capacity demand while driving down latency



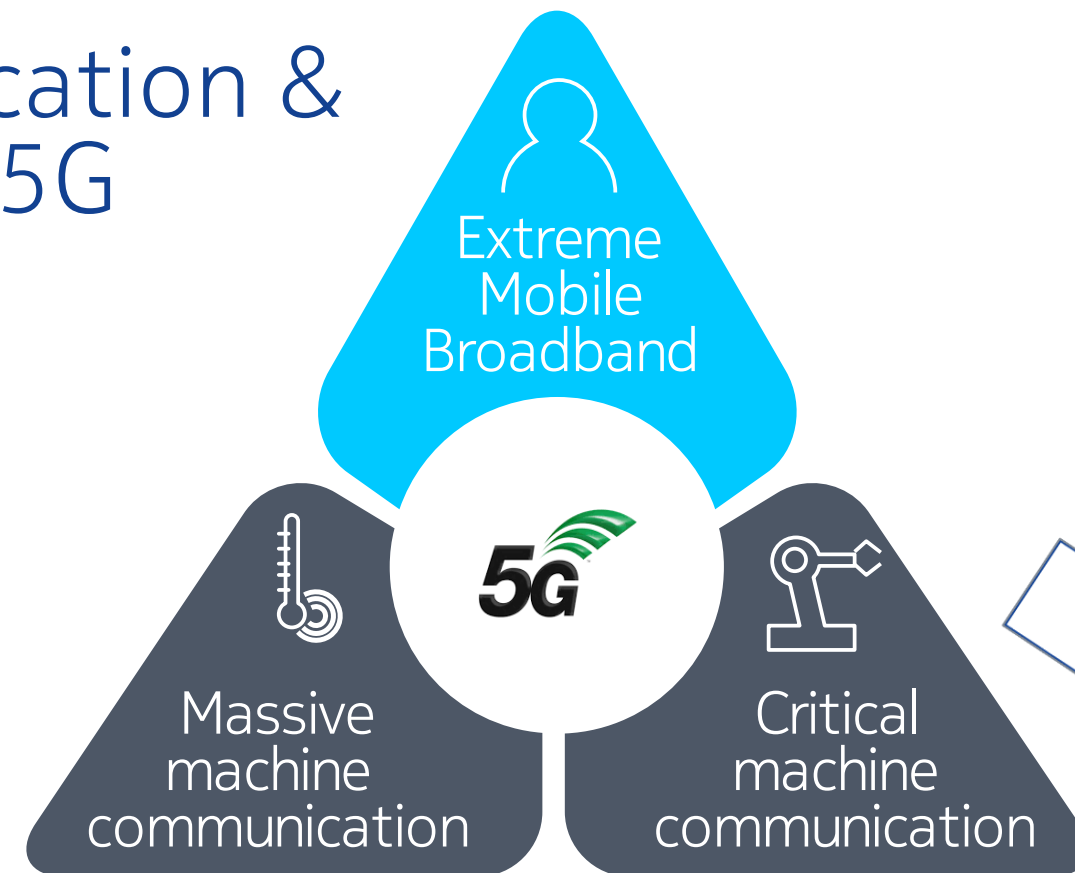
Efficient capacity
CENTRALIZED
DATA CENTERS



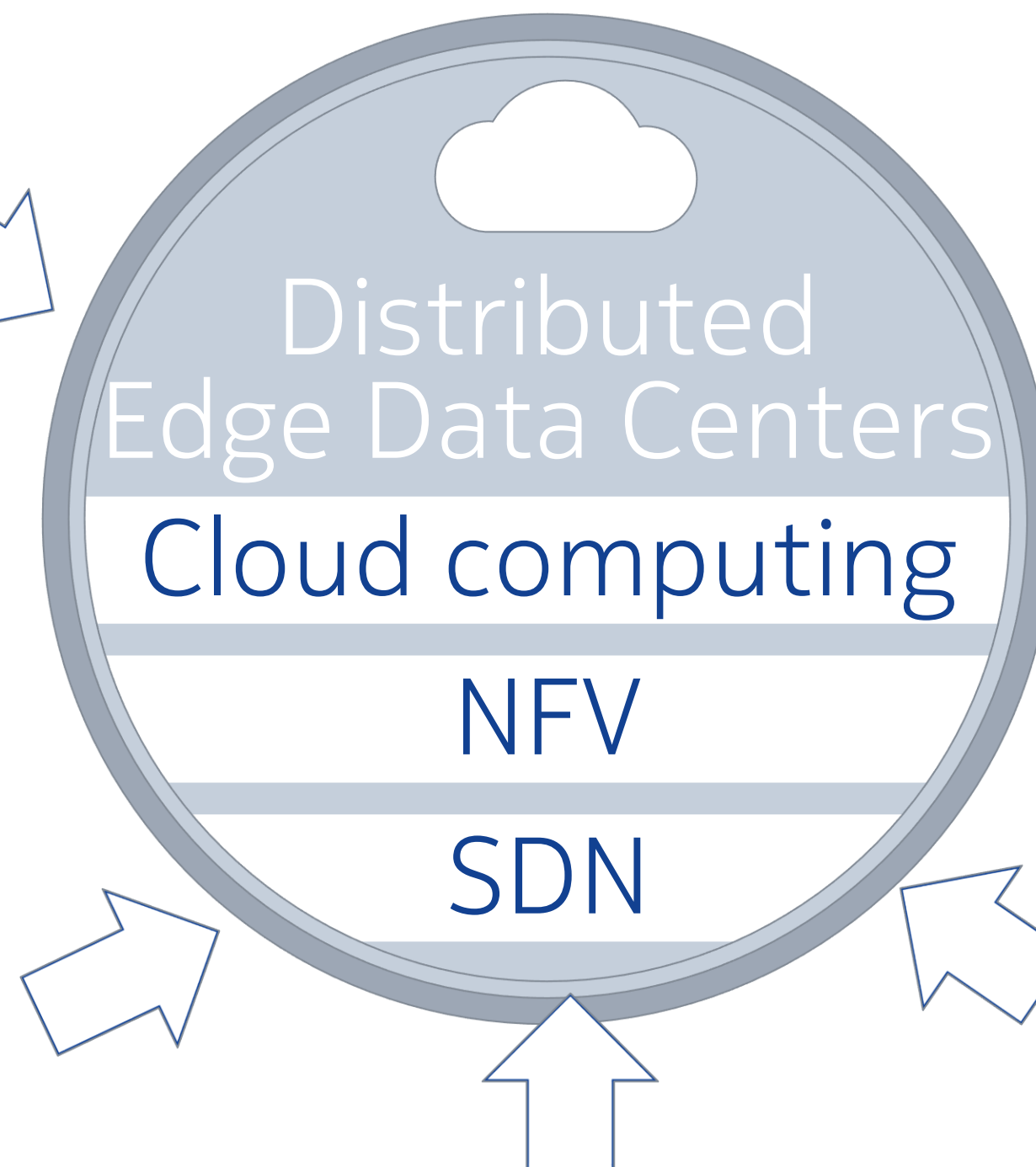
Low latency &
efficient transport
EDGE DATA CENTERS

The business opportunity from transforming towards the Edge Cloud

RAN Cloudification & Evolution to 5G



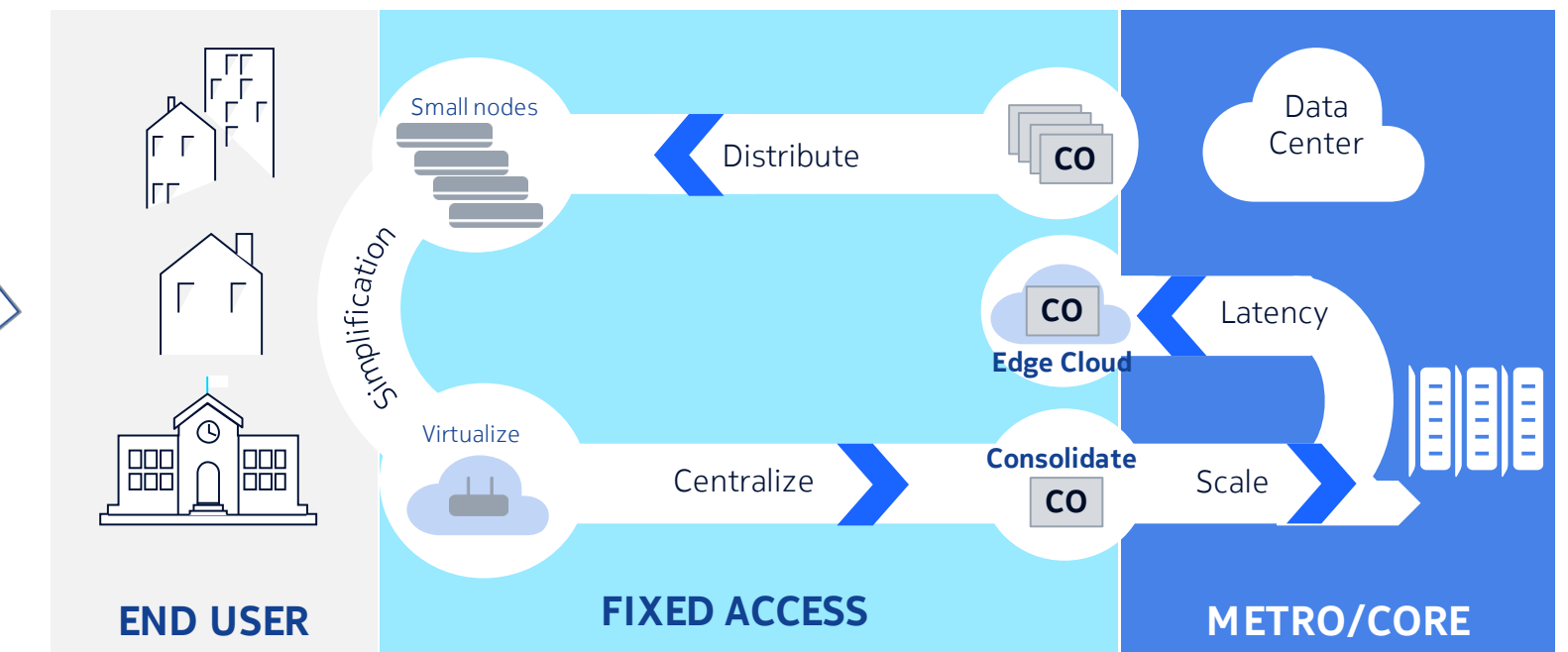
Platform for latency, bandwidth, and security critical use cases (IoT, MEC)



IP network transformation

- Distribution of BNG
- Virtualization IP Edge/VAS

Fixed Access Network Transformation

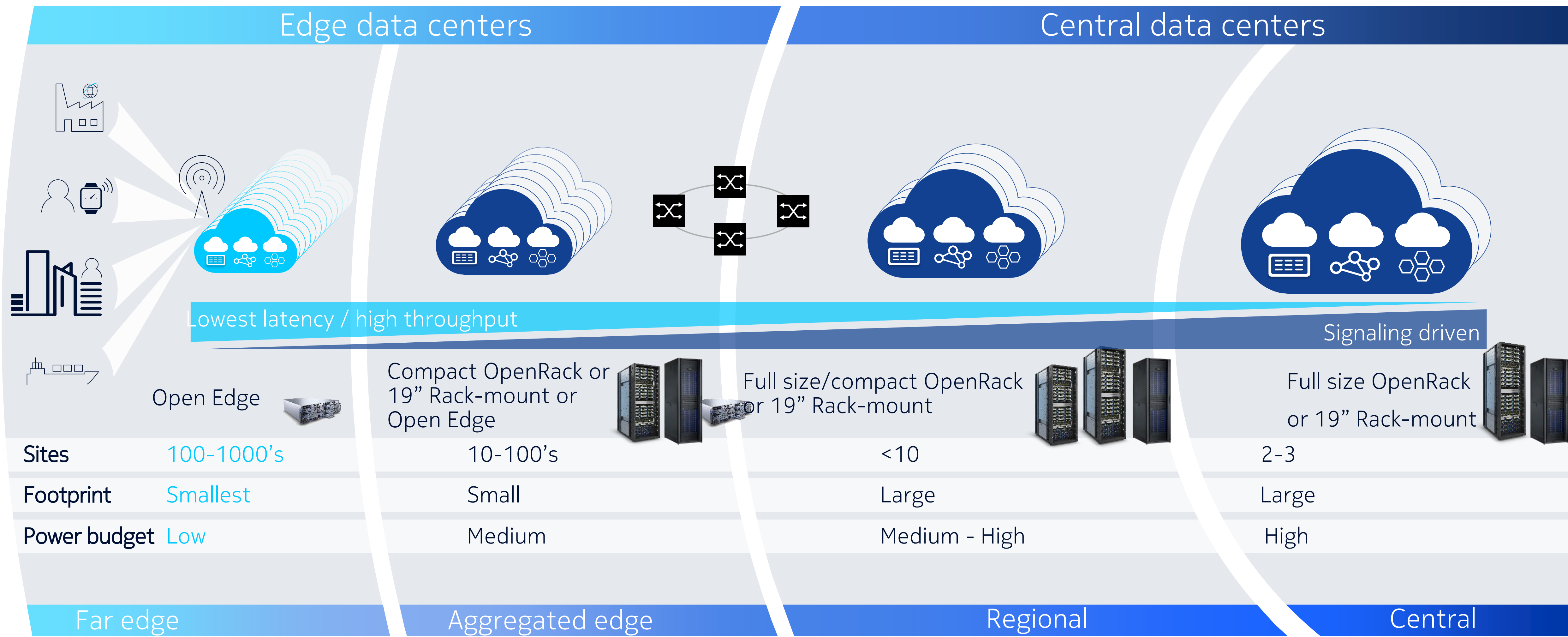


Public/Private Cloud and open ecosystem for innovation moving to Edge



Managing the lowest latency/cost trade off with a layered architecture

Datacenter portfolio for all deployments from Far Edge to HyperScale



Challenges in bringing the data center to the edge

Managing the trade offs

Efficient capacity

CENTRALIZED
DATA CENTERS

Cost efficiency

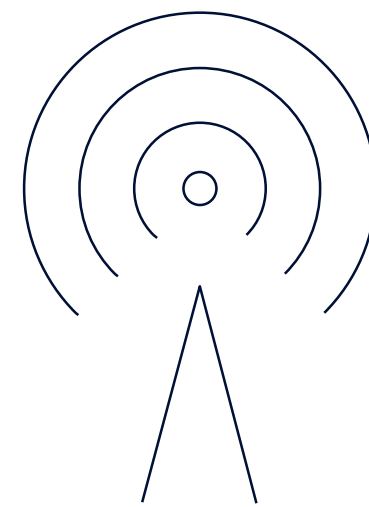


New business potentials

Low latency &
efficient transport

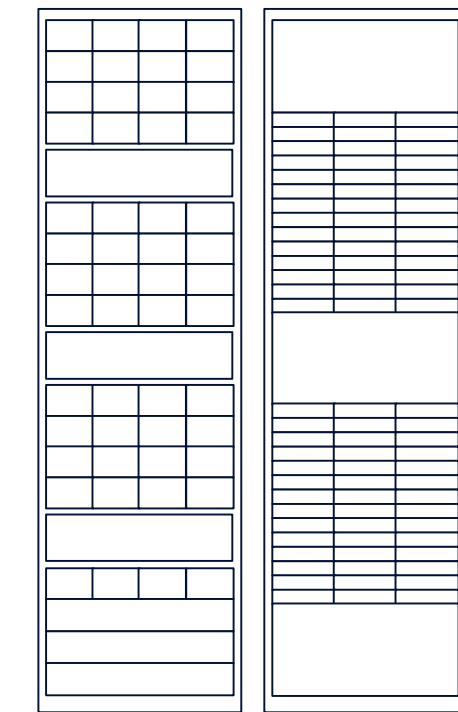
EDGE DATA CENTERS

Challenges in addressing new opportunities today



Radio sites

... no space for traditional
data center HW

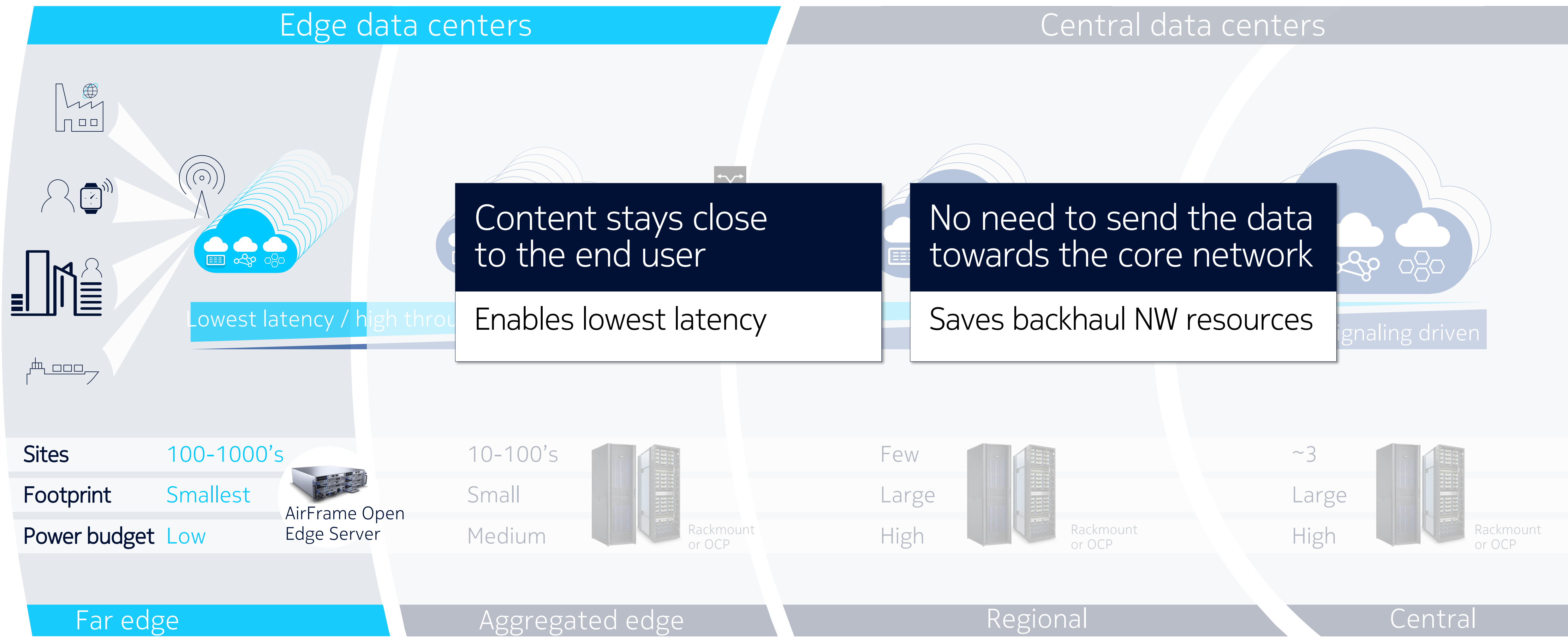


Classical data center HW

... not designed for
edge use

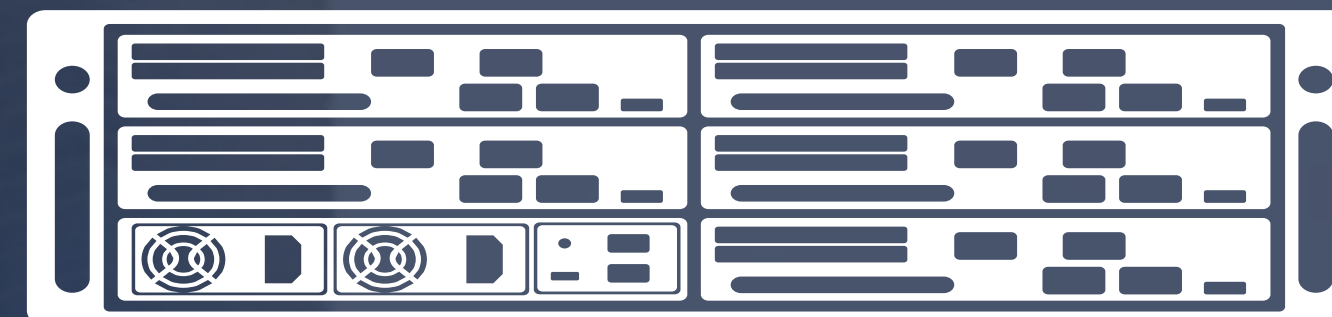
Managing the lowest latency/cost trade off with a layered architecture

First data center solution designed for the edge

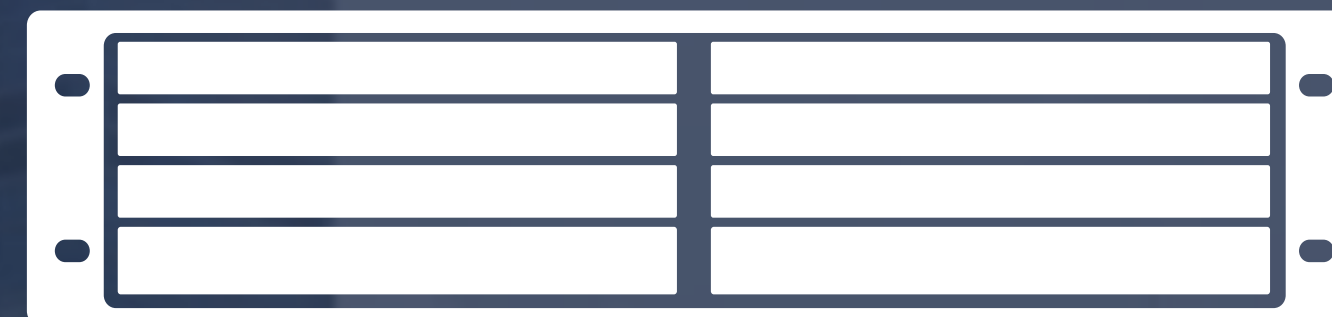


A compact data center with a base station form factor
No need for additional radio sites for edge data center HW

Open Edge server



Adding compute capabilities to a base station site



Reuse existing site solutions

AirScale base station

Hardware acceleration secures performance under space and power constraints

Cloud RAN

- 4G/5G L1/L2 real-time acceleration
- 100% better performance

Machine Learning/Artificial Intelligence

- Video analytics
- Image recognition
- 10x faster

Content acceleration

- Encoding, enriching, transcoding
- 30x faster

More data center capacity per m²



Automation of data center deployment and management is required with 1000's of distributed clouds

Open data center management solution

1. Vendor-agnostic hardware management
2. Open south-bound and north-bound APIs (Redfish, IPMI, RESTful etc.)



- Single view and operation over data centers
- Real-time data for automated operations
- Increase utilization of servers and improve power efficiency
- Analytics for smart capacity planning for future workloads
- Automated datacenter deployment using Ansible

Customer trial in Europe: OpenRack automated deployment with AirFrame Data center Management



- With parallelism, in less than 30 minutes, rack is ready for cloud installation
- Mostly automated, few manual steps, less errors
- Manual deployment would easily be a full-day task

Edge use case: Cloud RAN



Cloud RAN is part of Nokia's next generation AirScale Radio Access Scales for the future

AirScale Radio Access – common software



AirScale Base Station



AirScale Cloud RAN



AirScale Antennas



AirScale Wi-Fi

5G



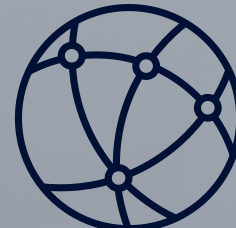
Capacity



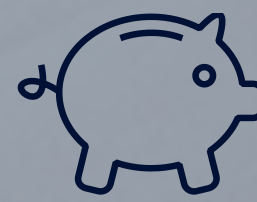
User
experience



New
revenues



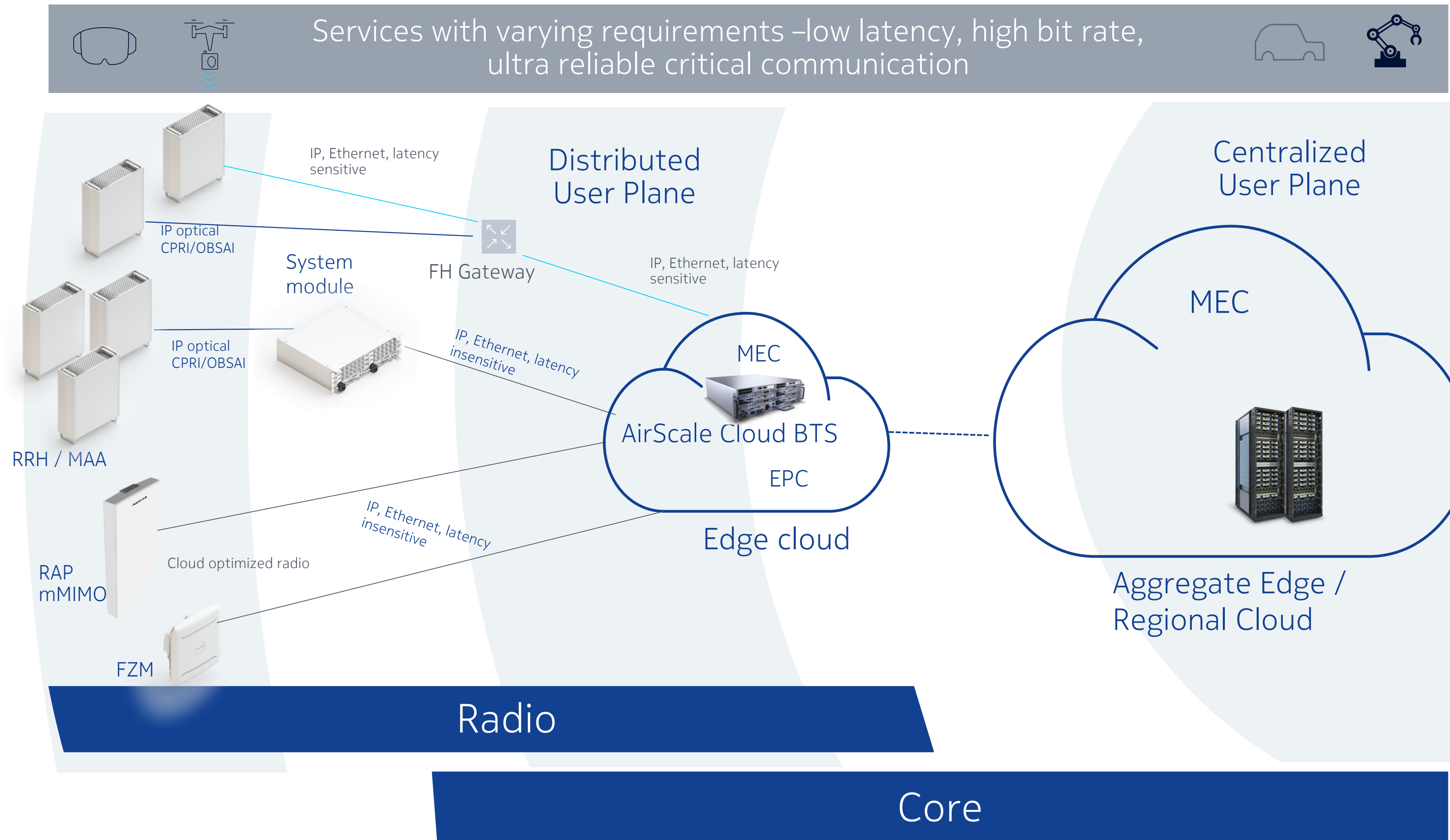
Architecture
evolution



Total cost
of ownership

Network topology evolution- cloud optimized architecture

Locate functions depending on application and latency needs



- Spectral and cell site efficiency drive centralization of radio functionality and simplification of cell site
- Cloud RAN, Distributed RAN and Centralized RAN answer to capacity requirements
- Low latency and high bit rates as drivers for distribution of functionalities
- Virtualization when optimal
- Radio and some core functions are migrating to the edge cloud

Edge use case:
VEPC

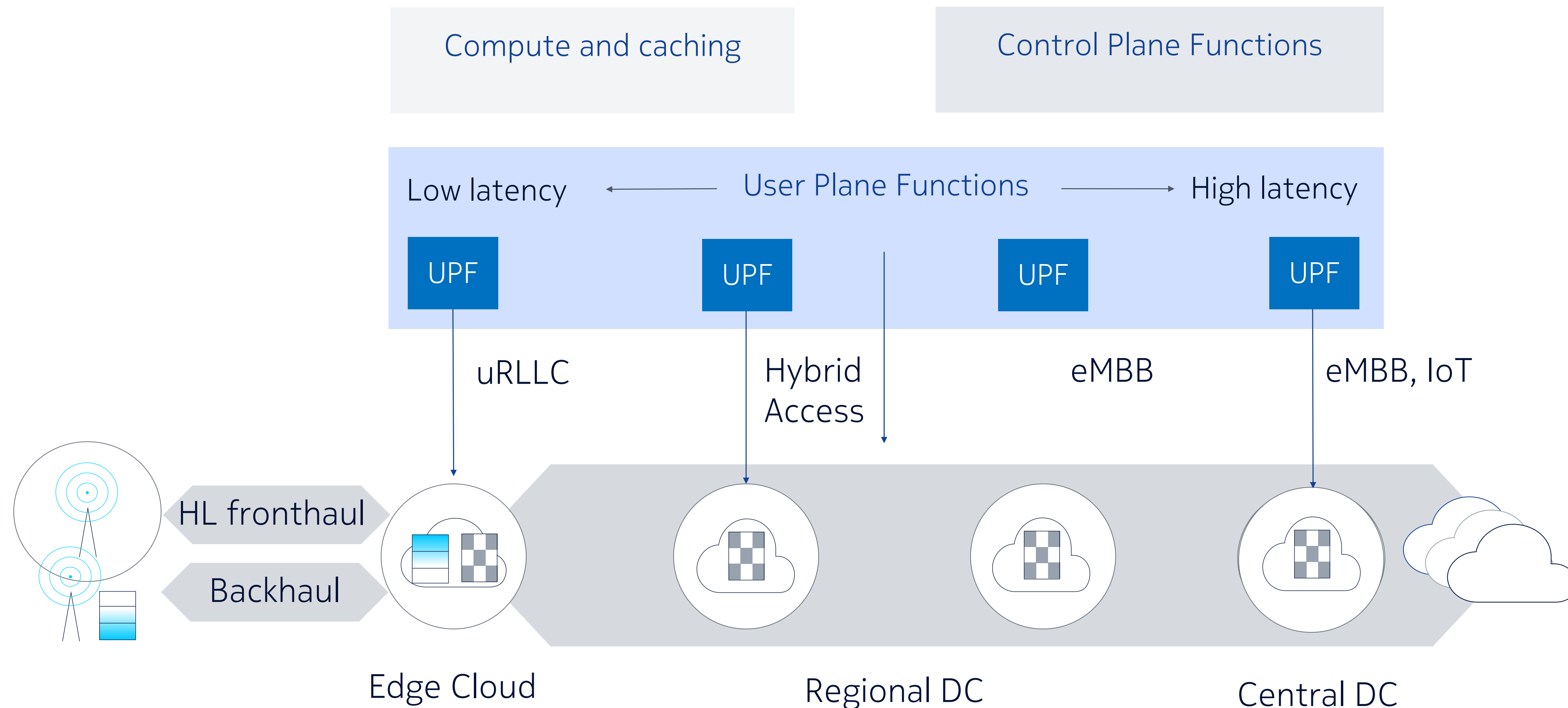


5G system architecture evolution

Cloud Native with Control and User Plane Separation

eMBB = enhanced Mobile Broadband

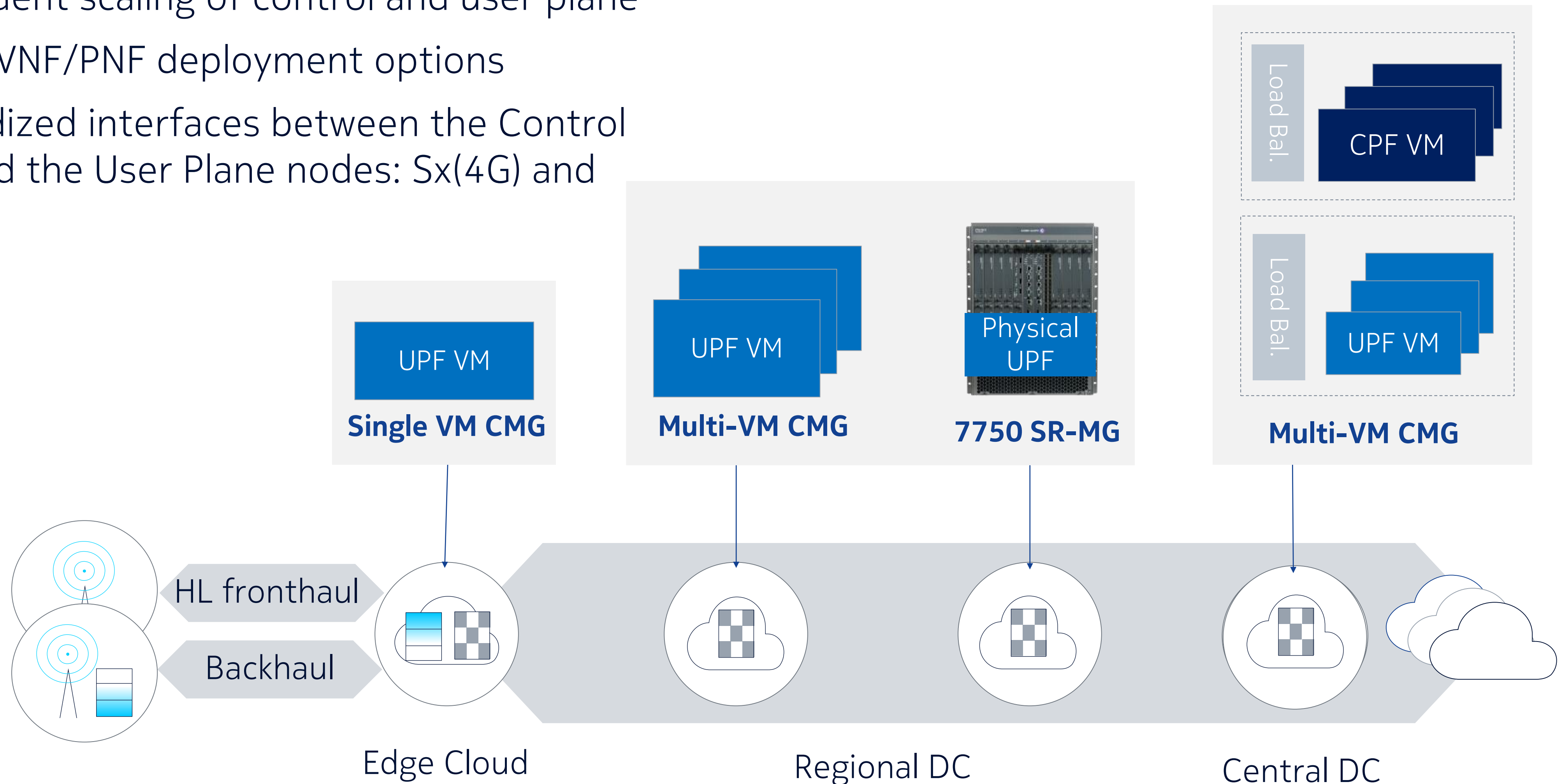
uRLLC = Ultra Reliable Low Latency Communications



5G system architecture evolution

Network Function Optimization

- Independent scaling of control and user plane
- Multiple VNF/PNF deployment options
- Standardized interfaces between the Control Plane and the User Plane nodes: Sx(4G) and N4(5G)



Open Edge Datacenter Solution

A fundamental step towards 5G

The edge cloud will play an essential role in the 5G architecture, enabling Cloud RAN and new vertical use cases

Full data center solution for the edge cloud

Compact size HW and real-time/low latency optimized infrastructure SW

Performance boost for demanding applications

Pluggable acceleration modules to secure performance within tight power and space constraints

Key enabler for AI and machine learning

Low latency and acceleration capabilities optimize the performance of machine learning and AI workloads



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