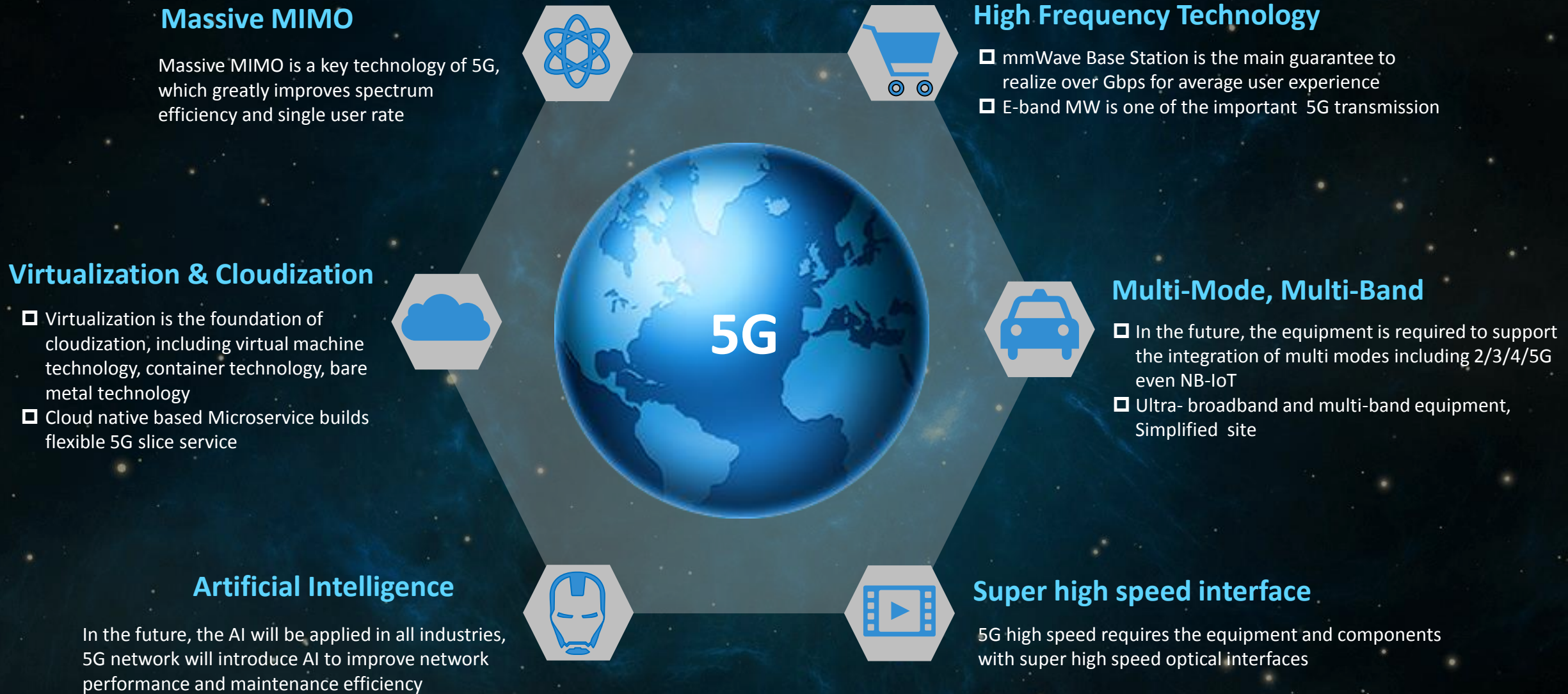


# Arithmetic Evolution – Telecoms Infrastructure Transforming Perspective

Tommy Bjorkberg – Director CTO Group  
Budapest 7 November 2019



# Technology Development Trend in 5G Era

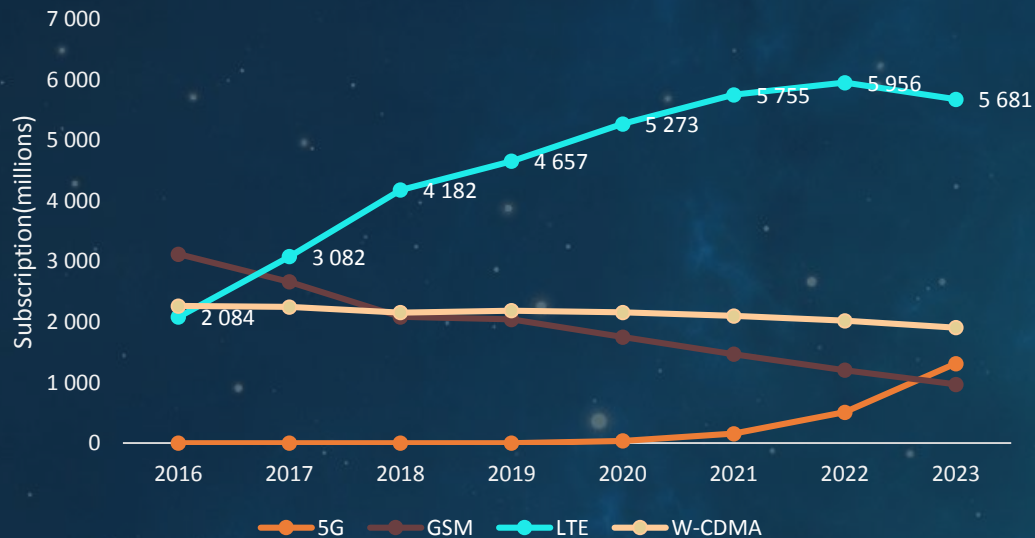




# LTE & 5G, Co-existing Side by Side for Years to Come

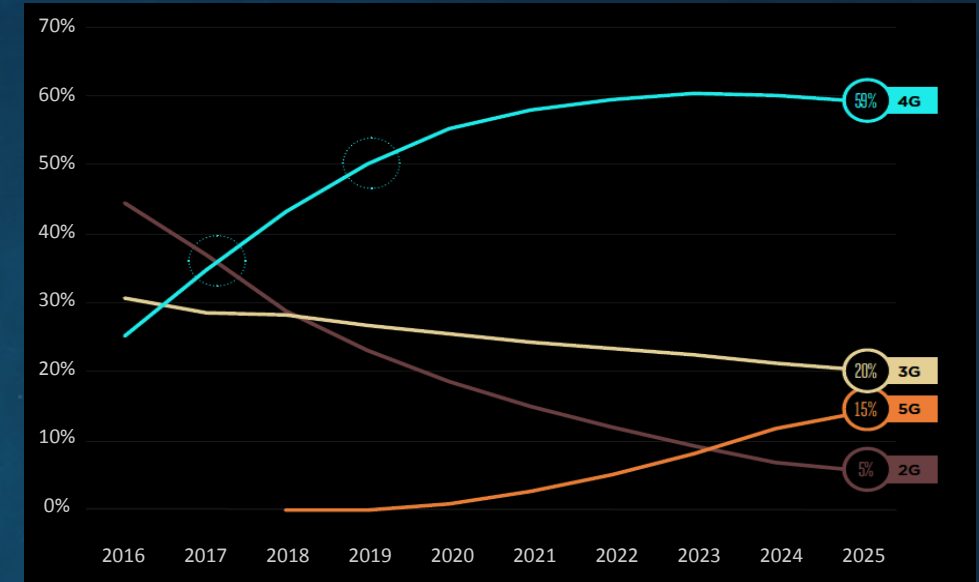
## Forecast on Global Mobile Connection

(OVUM, 2019.07)



## Global Mobile Connection Proportion Forecast

(GSMA, 2019.02)



- Technology hype and practical deployment are not synchronized due to various reasons, and 4G will dominate in the next 10 years.
- 4G and 5G will co-exist for a long time; 4G will be a key part of the underlying infrastructure network for CSPs in order to maintain steady and reliable revenue.

**4G took the lead in 2018 and will exceed half of connections in 2019, and will reach 59% in 2025.**

**- GSMA Intelligence**



# New Service Requirements Bring Even More Challenges to 4G

## Mobile Broadband



- 4G dominates the MBB traffic now (84% of global total traffic), and will keep strong growth in the next few years.

## Higher Throughput

## Latency-sensitive Services



- Latency-sensitive services are booming
- Short video applications & MOBA are popular
- Latency is the key to good user experience

## Lower Latency

## Internet of Things



- IoT will open up new opportunities to tap diverse enterprise demands
- 25 billion IoT connections @2025 forecast by GSMA

## Massive Connection

# 4G





# Arithmetic Evolution: Subtraction, Addition, Division, Multiplication



Subtraction:  
Simplify the  
Architecture



Addition:  
Enhance the  
Capability



Division:  
Differentiation  
and  
Multiplexing



Multiplication:  
Matrix  
Combination  
with Industry



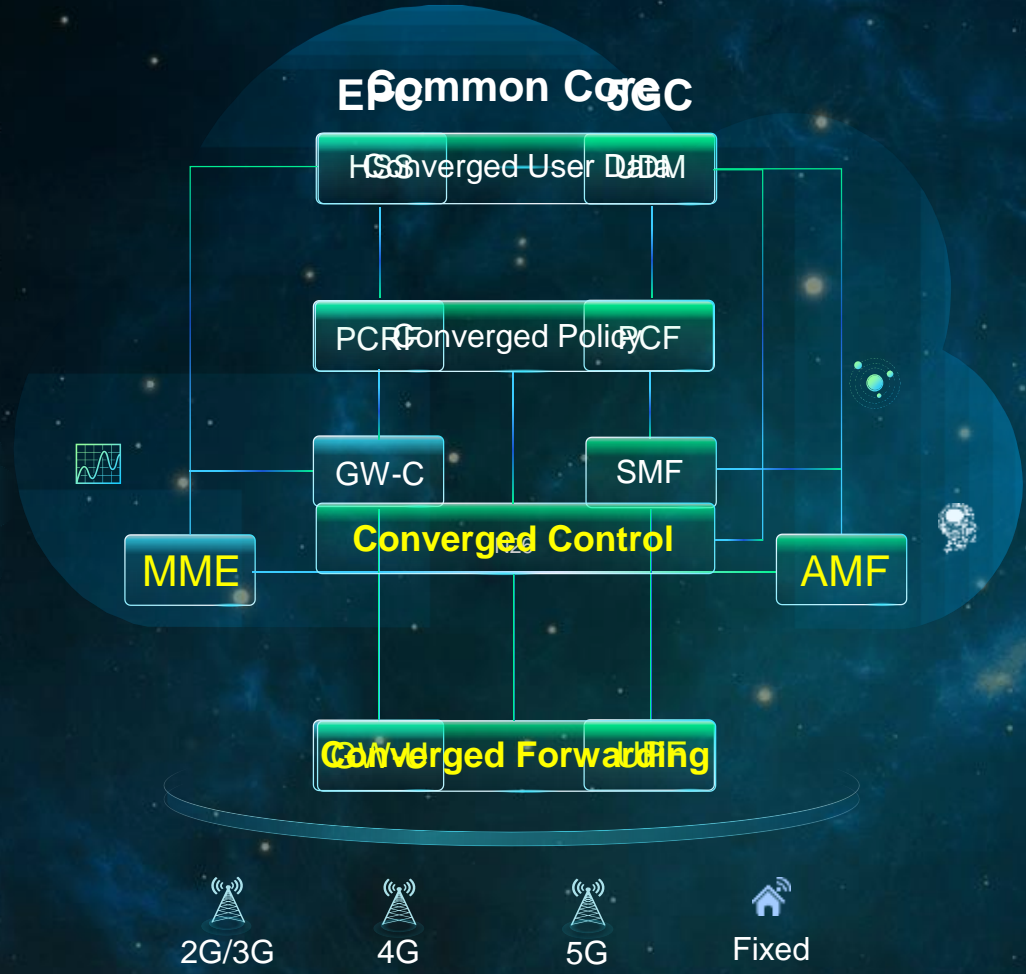
# Subtraction: One Core for All - Common Core

Challenges

Multiple Cores

EPC + 5GC  
Overlapping Investment

Complicated O&M



KPI  
**20%**

## One Core

2G/3G/4G/5G/Fixed full convergence  
Reduce signaling & latency

Investment  
**40%**

## Target Architecture

Support both SA and NSA, no repeated upgrade  
Reusable resource

Efficiency  
**2X**

## Simplified O&M

DevOps-based rapid service onboarding  
AI-based self-optimization & autonomy

**1st** 中国移动 China Mobile  
5G SA/4G Interworking

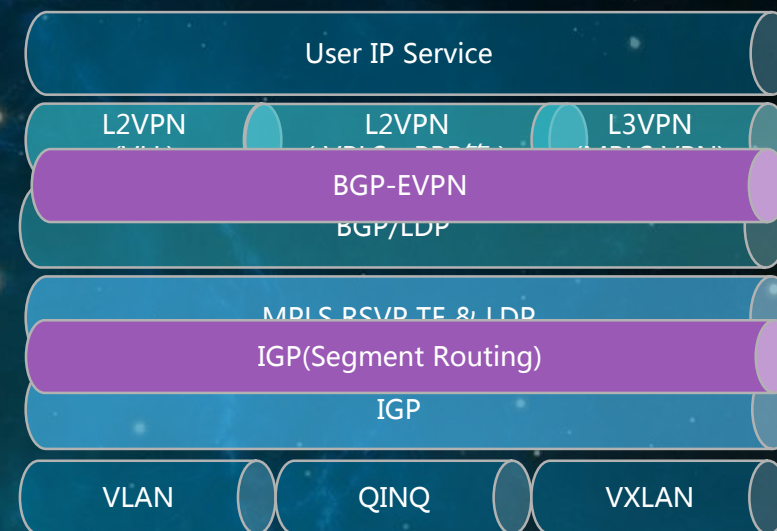
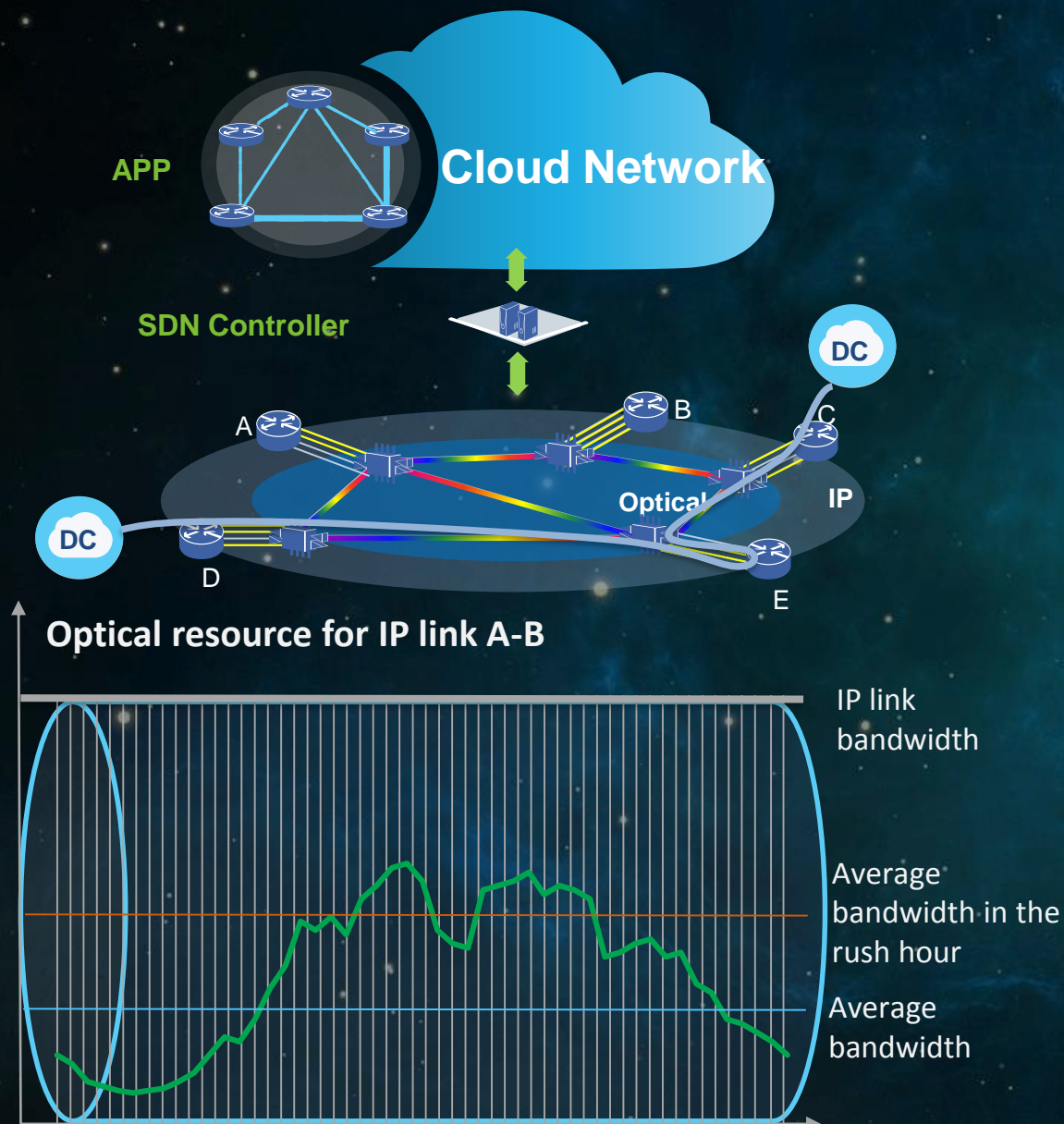
**1st** QUALCOMM  
@2.6 GHz  
5G SA Pre-Commercial IoT

**1st** orange  
5G SA Trail

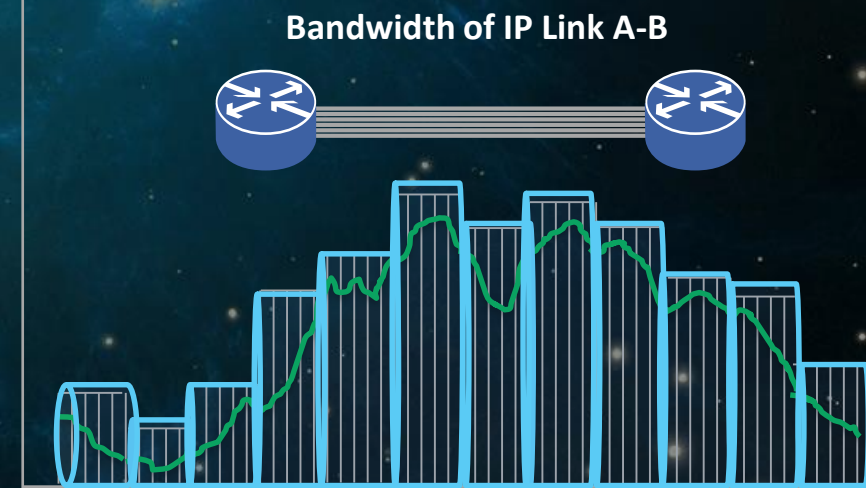
amazon  
vEPC on AWS Cloud



# Subtraction: SDN, Protocol Simplifying, Pipe Resource Pooling



Dynamic Optical Resource for IP Link A-B





# Subtraction: UniSite – Fewest RRUs & Antenna for All Scenarios



## UniSite benefits :

- Substantial decrease of required RRUs
- One antenna for all Sub3G
- Making enough space for 5G AAU

## Industry's most complete UBR portfolio

- 1800 + 2100
- 700 + 800 + 900
- 900 + 1800 + 2100

## The only vendor offering combiner-imbedded RRUs

- saving antenna ports / external combiners
- customization for specific spectrum demands

UniSite addresses the challenges in all deployment scenarios.



- 1 Hotspot coverage
- 2 Indoor coverage
- 3 Blind spot in city
- 4 High cost of site acquirement

## ◆ Differentiated Sites and HetNet



## Blind spot in narrow street



## Qcell

- 2T6S/4T6S
- X-antenna



# Addition: Service and Experience Enhancement

Network Enhancement	NB-IoT & eMTC	MEC		
<div> Quality</div> <div> Coverage</div> <div> Capacity</div> <div> Reliability</div>	<div> Home appliance Sharing China Telecom</div> <div> Smart metering China Telecom/Unicom</div> <div> Electi-bicycle mgmt. China Mobile</div> <div> Motorbike mgmt. Thailand AIS</div>	<div> Location-based Services</div> <div> Local Services</div> <div> Network Connection Acceleration</div>	<div>  Traffic Offload for CDN Latency 50%↓</div> <div>  Telenet Local Live Video Service &lt;600ms E2E latency</div> <div>  WindTre Connection Acceleration Latency 19%↓ initial throughput 40%↑</div>	



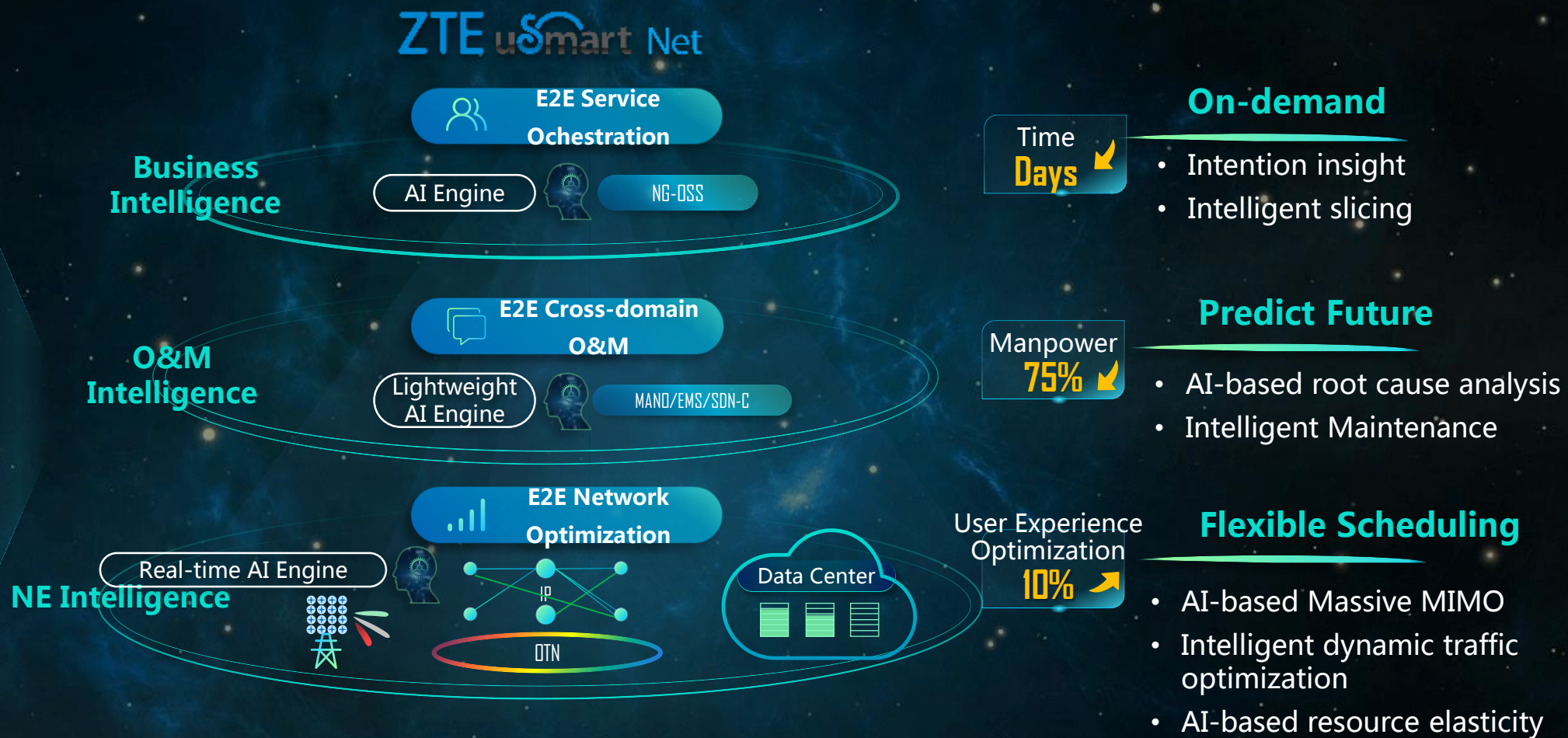
## Addition: E2E AI

## Challenges

  
Different Requirement

  
Complicated O&M

  
Low Efficiency



  
O-RAN Based Load Balance

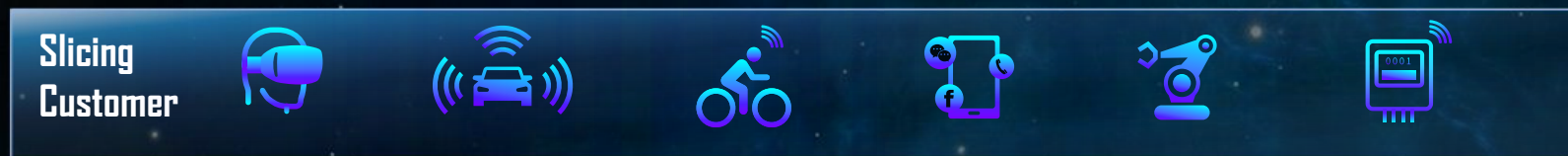
  
AI-based Massive MIMO

  
Wireless network Self-optimization

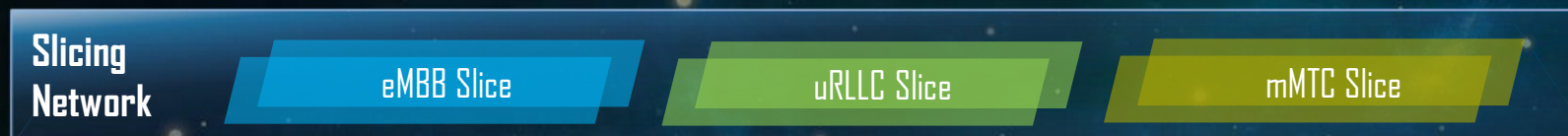
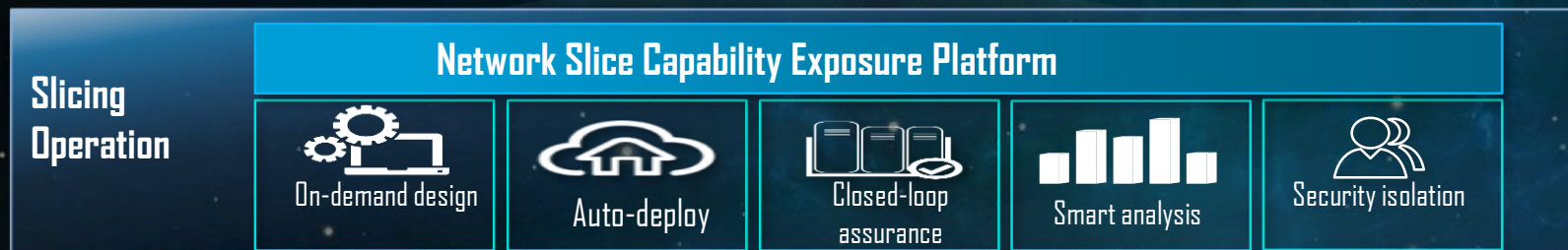
  
Network Intelligent O&M



# Division: E2E Slicing Helps Vertical Industry Development



## Network Slice as a Service (NSaaS)



## Slicing Operation

- Explore from 4G traffic operation to **5G slice operation**
- **SaaS**, to flexibly provide private network services for industry customers
- **In-depth combination of slice and service**, to be provided for end users



# Division: Spectrum Dynamic Multiplexing and Resource Differentiation

Spectrum

## All-scenario

Offering solutions to all spectrum-sharing challenges

## Smooth migration

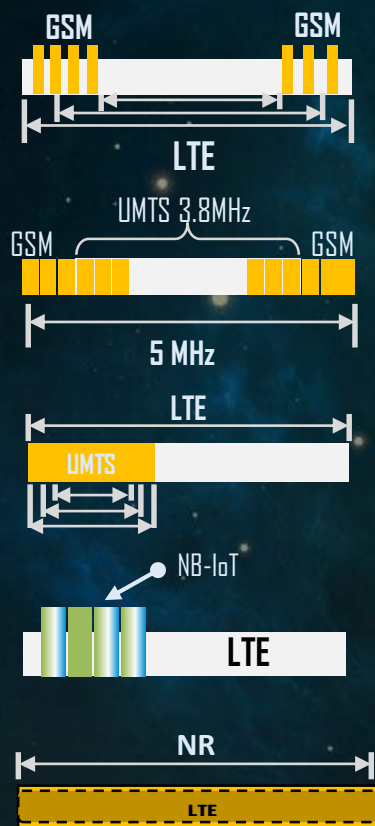
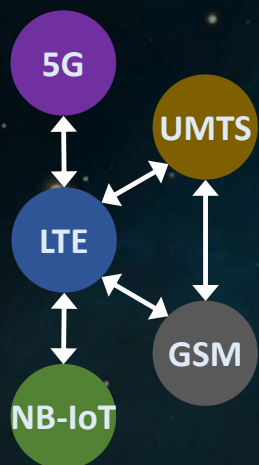
Painless phase-out & better user experience & new intro

User  
Revenue  
Increase



Service  
Experience  
Enhancement

**Magic Radio Pro**  
All-scenario spectrum  
dynamic sharing



50%

Average LTE throughput gain @  
2G/4G sharing

48%

Frequency band sharing ratio @  
2G/3G sharing

55%

U/L total throughput gain @  
3G/4G sharing

40%

NB-IoT connected users  
@ NB-IoT/LTE sharing

100%

User throughput gain @ 4G/5G  
sharing

**Differentiation**  
**Policy Definition**  
**Policy Enforcement**

User, Device



Traffic, Service

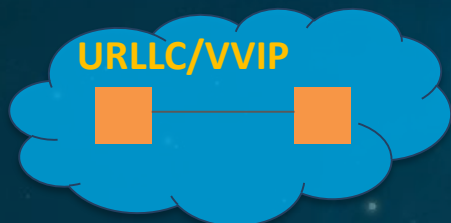




## Division: Bearer Slicing On-demand

### Critical Service

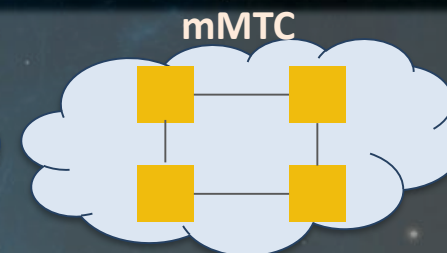
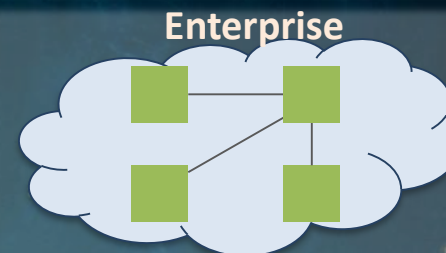
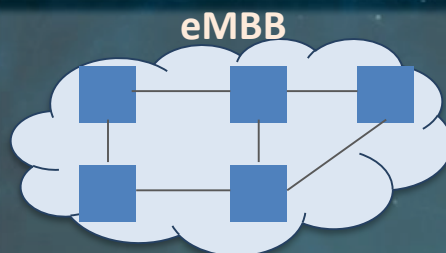
#### Physical Private Network



- Exclusive network resource
- Direct P2P route

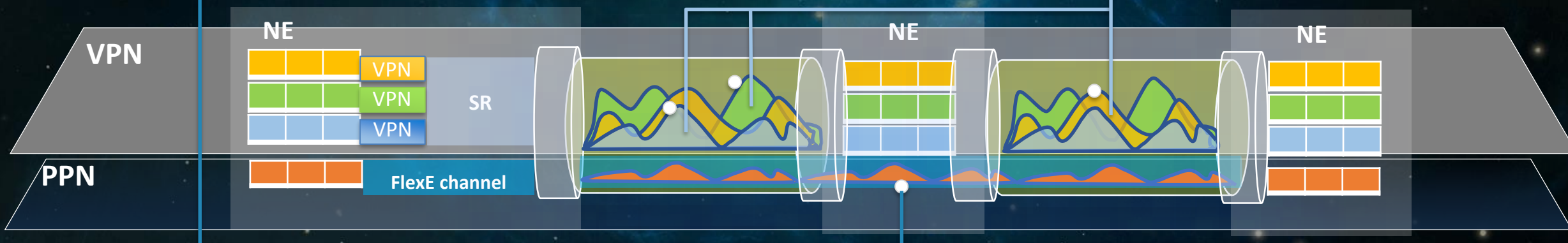
### Non-critical Service

#### Virtual Private Network



- Share bandwidth with other service
- Data processed in each node

*Dual experience generate extra revenue*

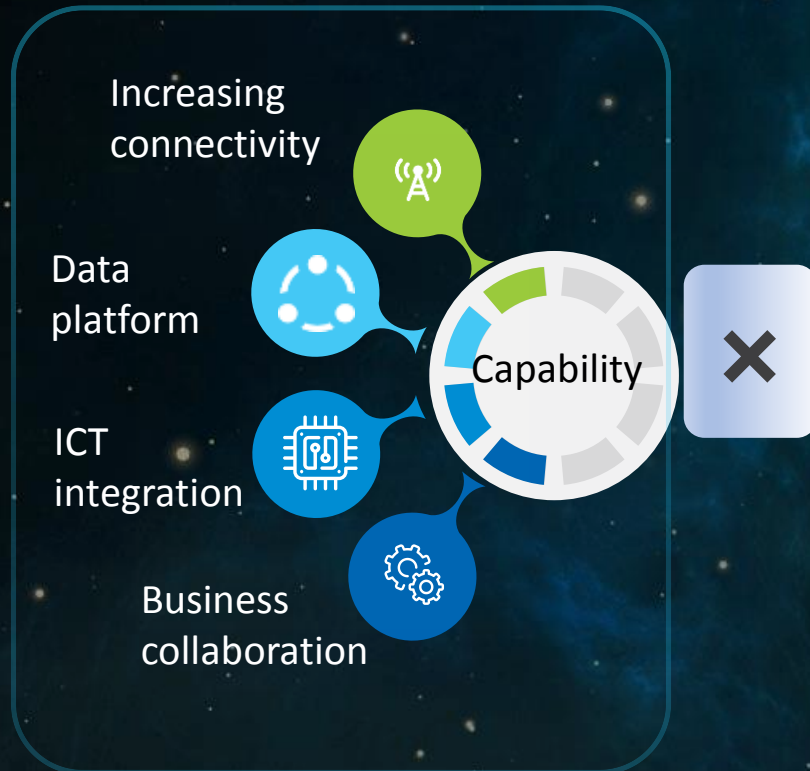


**Successful E2E Slicing in China Mobile and China Telecom**

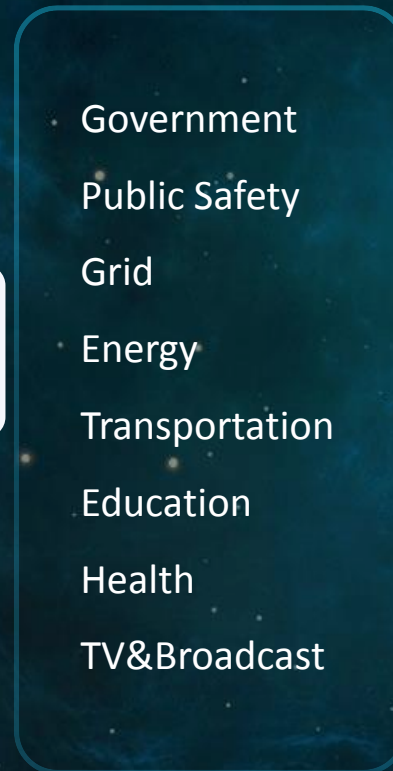


# Multiplication: Telecoms and Industry Interaction Matrix

## Operator's core competitiveness

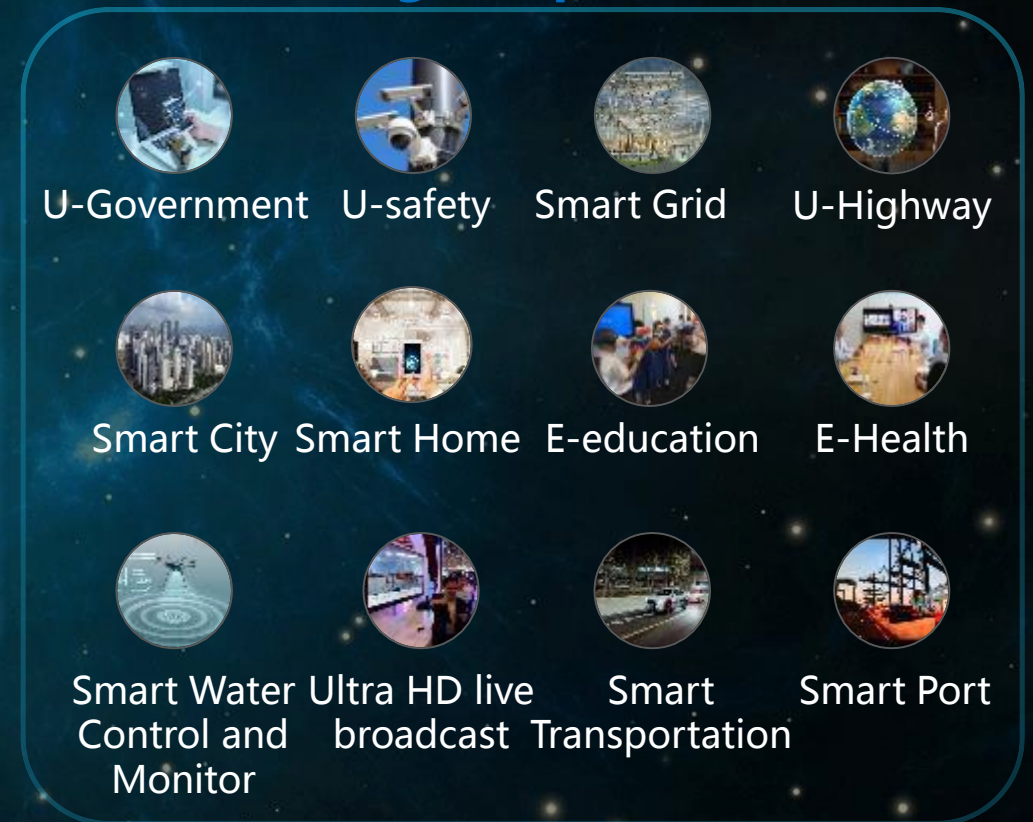


## Traditional industry



=

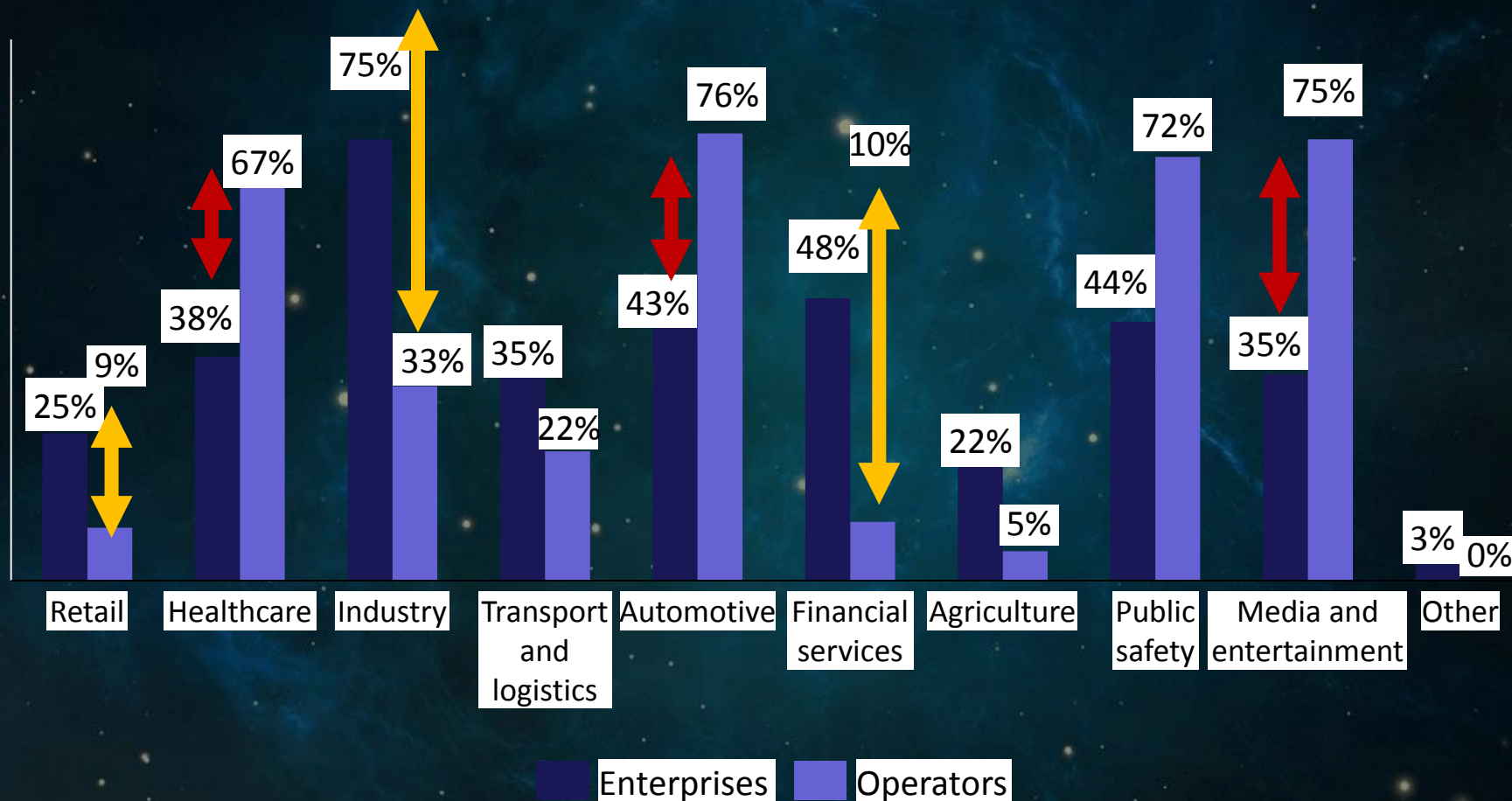
## Unlimited possibilities and great potential





But operators in developed markets have yet to prioritise industries with highest 5G demand

- MNO focus vs. enterprises expectations of 5G benefits' importance by sector





# Leading 5G Innovations