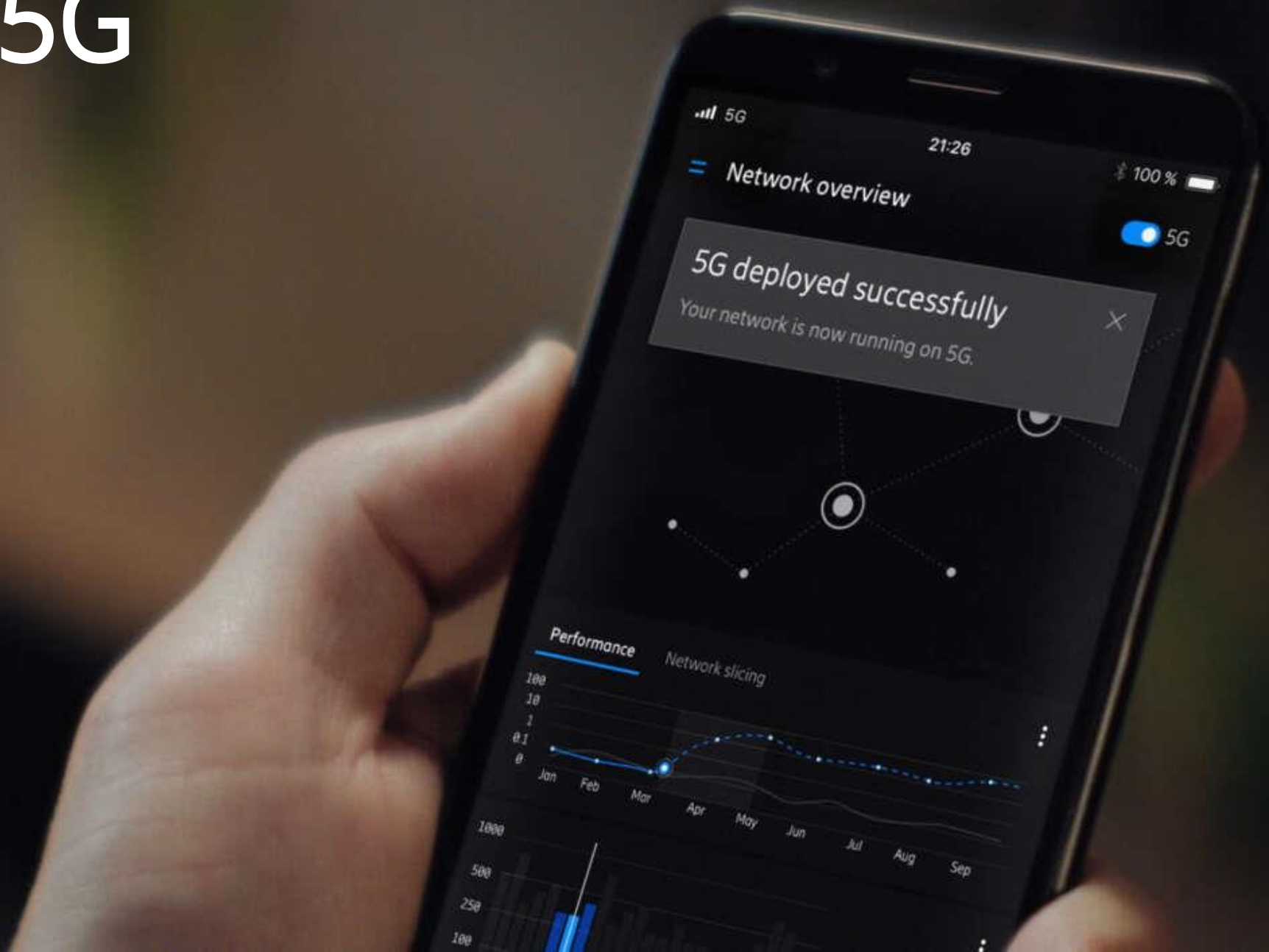# Indul az 5G

Novák Csaba
Ericsson Magyarország

Indul az 5G

First with commercial 5G live networks in 4 continents

22 Live networks

75 commercial 5G agreements

*As of Oct 2019

Live 5G networks with smartphones
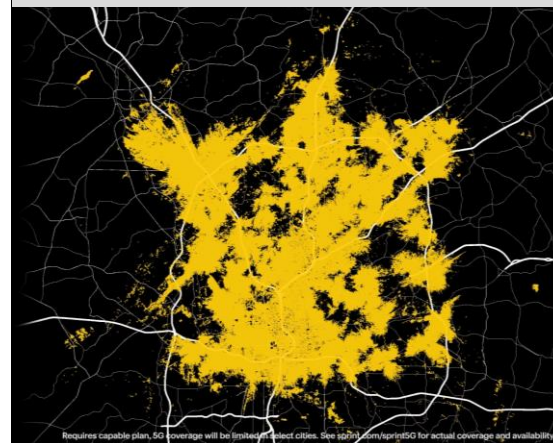## Both mmWave/mid-band spectrum

5G Speedtest 2 Gbps, Denver —Jun 27th

Sprint 5G coverage map of Atlanta -May 30th

AT&T achieves 1.3 Gbps; 5G Coverage

T-Mobile launched 5G Jun 28th

Verizon launches 5G in 2 markets

— Moto Z3, Z4 & S10 5G; LG V50 to follow
— Chicago , Minneapolis & Denver
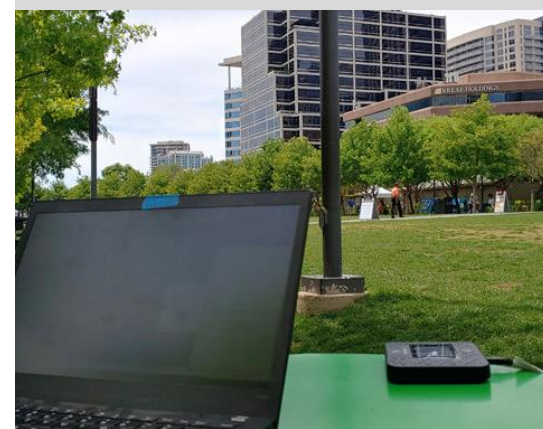— 19 more markets during 2019
— 450 Mbps DL typical

Sprint launches in 4 markets

— LG V50 & HTC 5G Hub
— Consistent 100Mbps with 700 Mbps peaks
— More than 1,115 sq miles of coverage in 4 cities
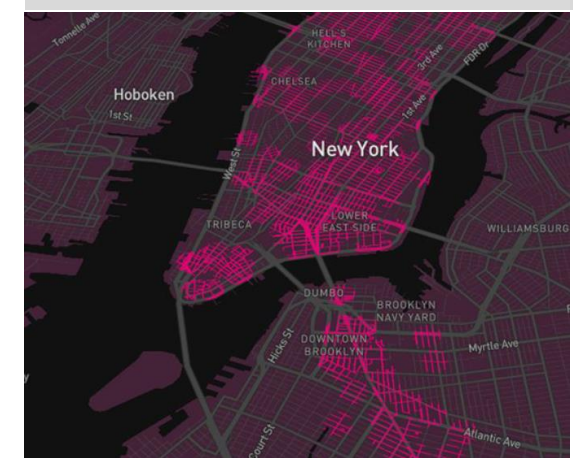— Using 2.5 GHz spectrum with 64T M-MIMO Ericsson radios

AT&T 5G Mobility live in 12 cities

— Launched Dec 2018 in 39 GHz
— Performance improved to 1 Gbps and then 2 Gbps
— Using NETGEAR® Nighthawk 5G Mobile Hotspot (pictured) & S10 5G

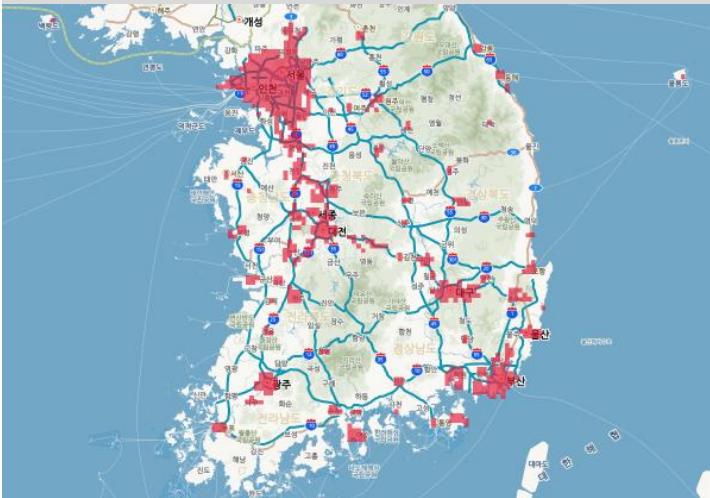### T-Mobile mmWave launch in 6 cities

— Samsung S10 5G
— Low band launch in 600 MHz by end of 2019
— Phone support for 600 MHz & mmWave expected by end of 2019

Live 5G networks with smartphones
Both mmWave/mid-band spectrum

SKT 5G coverage map —May 29th

5G Speedtest 711 Mbps, Bern — May1st

5G Speedtest 1.9 Gbps, Sydney —May28th

All Korean operators launch 5G

— Samsung S10 5G & LG V50
— More than 1M subscribers
— Large scale mid-band launch with Nationwide by H2 2020
— 64T, 32T and classic 4T radios in mix
— 5G traffic per user 3x LTE

Swisscom first 5G in Europe

— Oppo Reno 5G smartphone in Europe on 1st May,
— Initial deployment of 100 sites in 54 cities
— Mid-band 3.5GHz band (100 MHz)
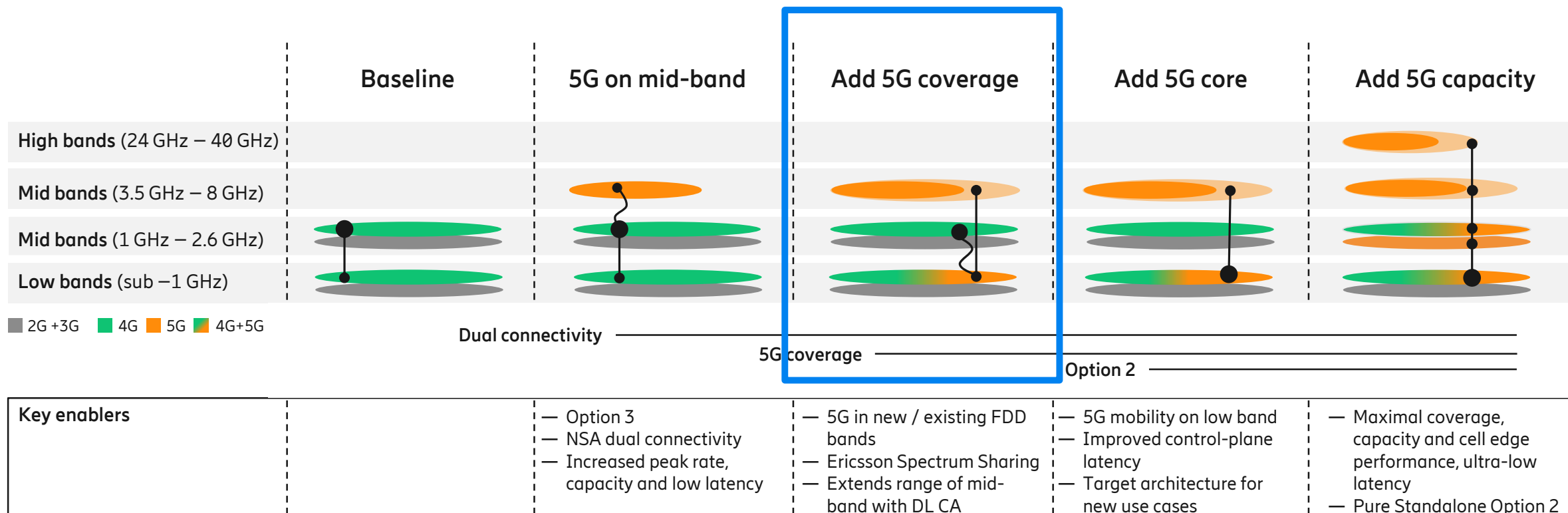— Nationwide coverge H2 2019 enabled by Ericsson Spectrum Sharing

Telstra launches in 10 cities

— Samsung S10 5G & HTC 5G Hub
— Using 3.5 GHz band
— 5G availalbe in premium price plan

5G network evolution strategy

	Baseline	5G on mid-band	Add 5G coverage	Add 5G core	Add 5G capacity
High bands (24 GHz − 40 GHz)					
Mid bands (3.5 GHz − 8 GHz)					
Mid bands (1 GHz − 2.6 GHz)					
Low bands (sub −1 GHz)					

■ 2G +3G ■ 4G ■ 5G ■ 4G+5G

Dual connectivity

5G coverage

Option 2

Key enablers					
		— Option 3 — NSA dual connectivity — Increased peak rate, capacity and low latency	— 5G in new / existing FDD bands — Ericsson Spectrum Sharing — Extends range of mid-band with DL CA	— 5G mobility on low band — Improved control-plane latency — Target architecture for new use cases	— Maximal coverage, capacity and cell edge performance, ultra-low latency — Pure Standalone Option 2

Multi-band 5G strategy

Add Band
Capacity

Mid band

High band

5G

Low band
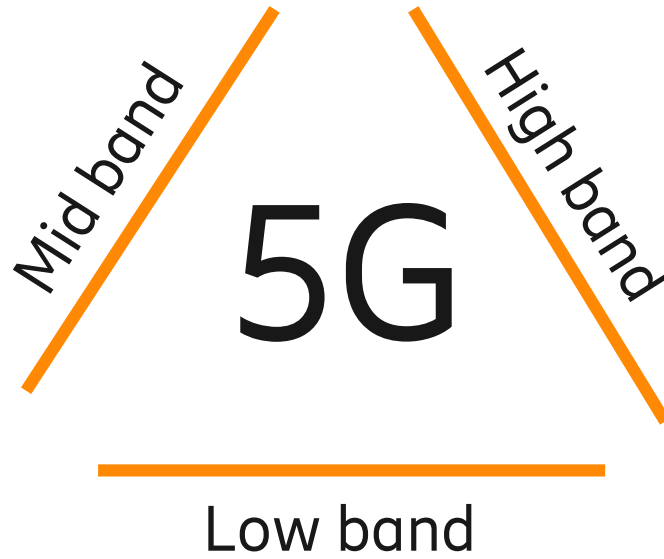
Turn on 5G
Coverage
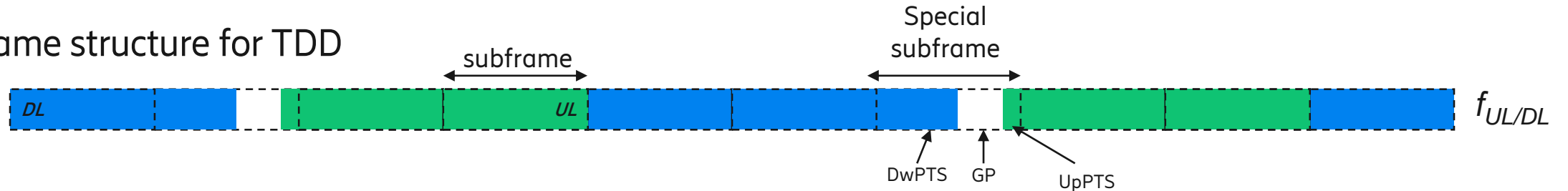
Add Band
Extreme Capacity
Exceptional latency

Fundamentals – FDD and TDD

— Frame structure for TDD

- NR TDD subframes in mid band (30kHz subcarrier spacing) are 0.5ms long
- LTE TDD and FDD and NR FDD subframes are 1ms long (15kHz subcarrier spacing)
- TDD Special subframe with three configurable fields
  › DwPTS: truncated downlink subframe for data/control, primary synch signal (PSS)
  › GP: guard period
  › UpPTS: Could be used for sounding reference signal or short PRACH. Not for data.

› Frame structure for FDD
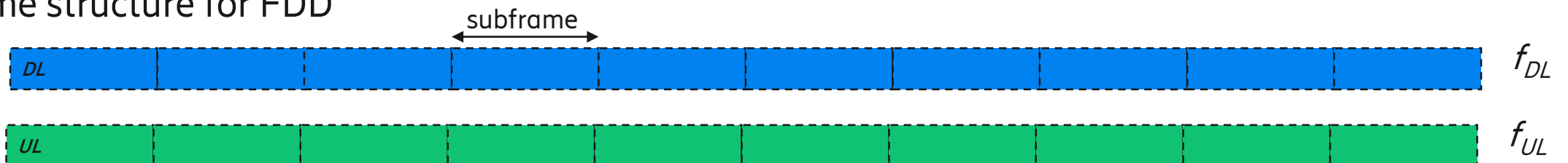
TDD-TDD Network co-existence


≈static

~stochastic

1

2
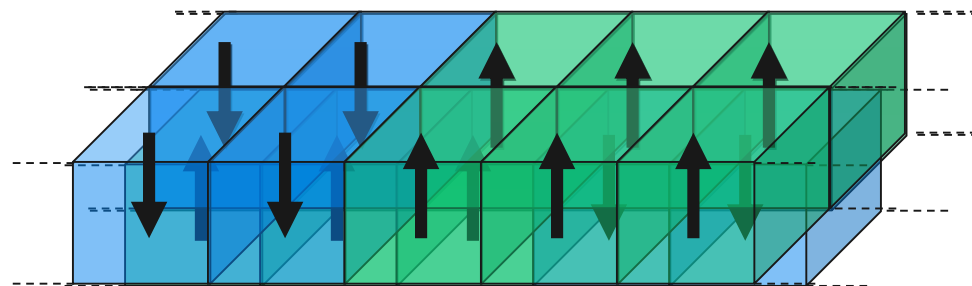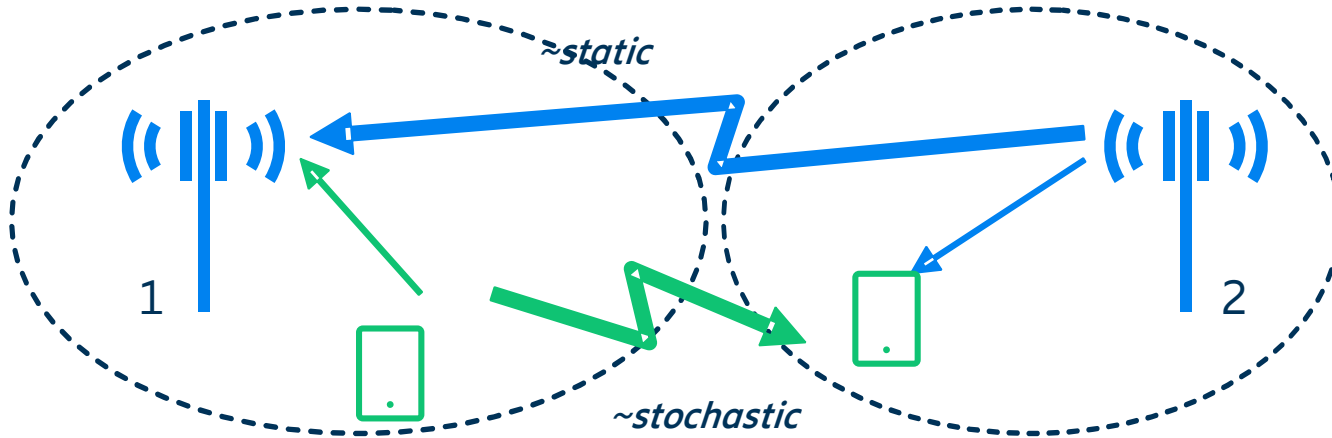
gNodeB 1

gNodeB 2

— Time domain co-ordination necessary for two TDD networks in same frequency band

— Throughput impact due to interference is dependent on

— Level of collision between UL and DL

— Site locations − near-far effects

— Solution: Operators to use same DL/UL ratio and synchronize source
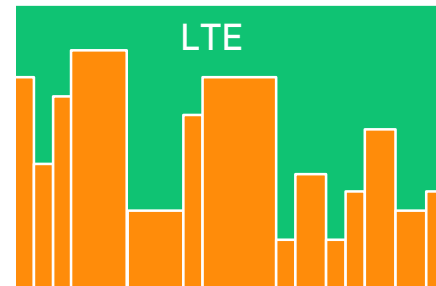
Key technology enablers for high performing 5G

Dual Connectivity
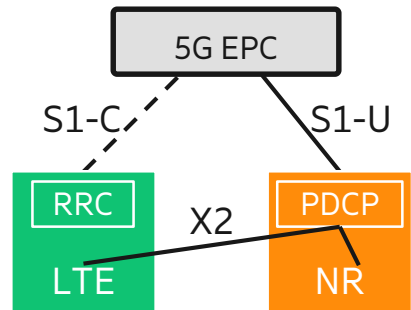
— Leverage 4G for:
  — UL coverage extension
  — DL bitrates
  — Time To Market
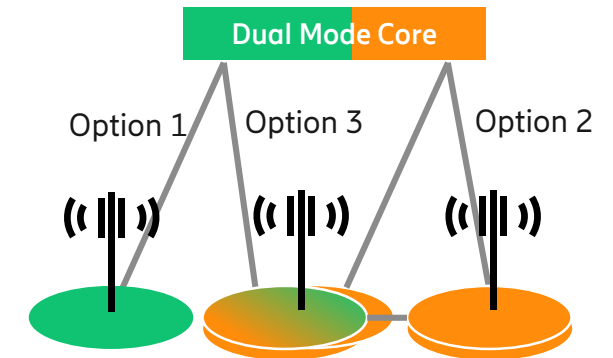
Spectrum sharing

— Smooth spectrum migration from 4G to 5G
— LTE and NR co-scheduled

Carrier Aggregation
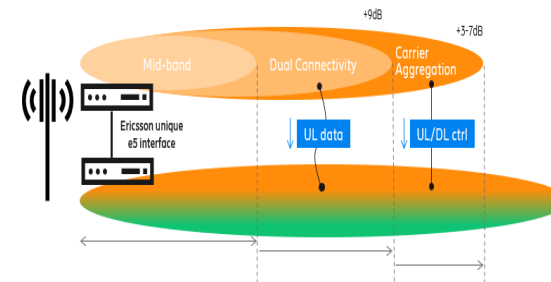
— Increased NR mid-band coverage by moving L1 control to lower NR carrier
— Supported by devices

Stand-Alone Option 2

— Target architecture for new use cases and innovation
— Enhanced Network Slicing support
— Improved MBB experience

Why Low Band NR?
Leveraging LB/MB FDD to extend TDD coverage

Mid-band

Dual Connectivity

Carrier Aggregation

Ericsson unique e5 interface

UL data

UL/DL ctrl

NR on mid-band TDD

NR/LTE on low-band FDD with Ericsson Spectrum Sharing

Standalone NR coverage baseline

Non-Standalone NR Dual Connectivity +9dB

Inter-band NR Carrier Aggregation +3-7dB
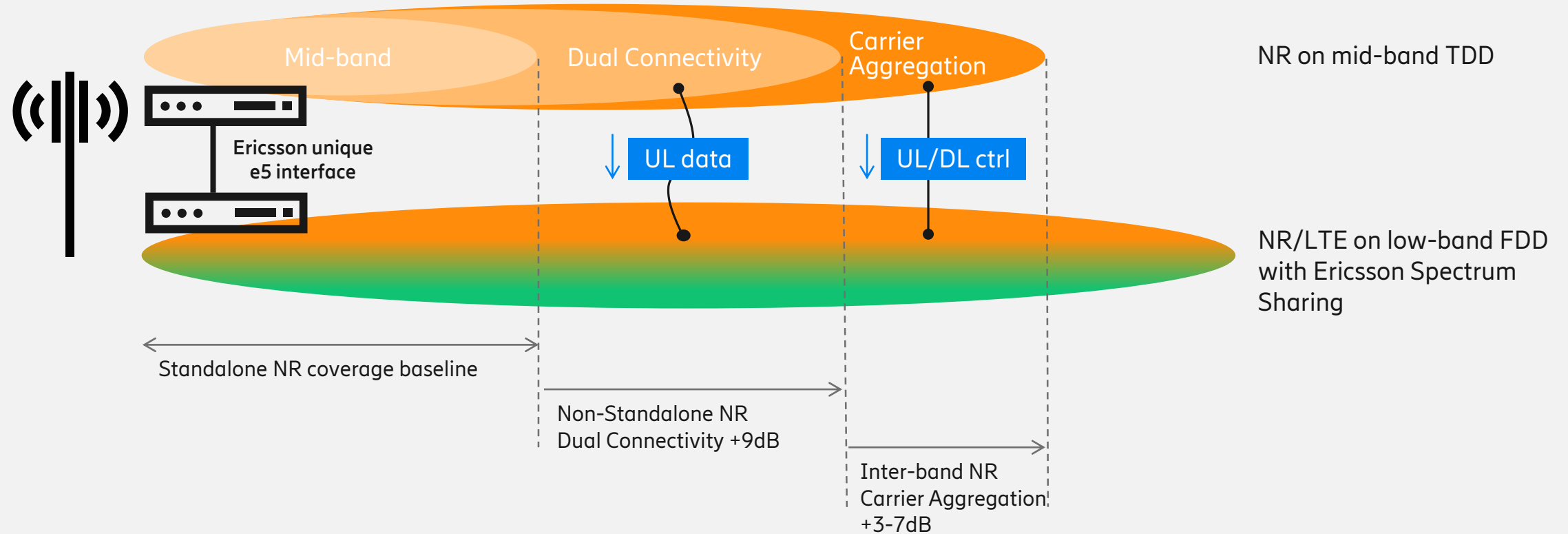
Latency benefit with SA NR vs NSA

NR: 1 Gbps

SA NR
from inactive
(option 2)

NSA NR
from idle
With B1 meas.
(option 3)

LTE: 300 Mbps

~30   ~90   ~140   ~340   ~450   ms

Assumption: Burst with 60 Mbit (7.5 MB)
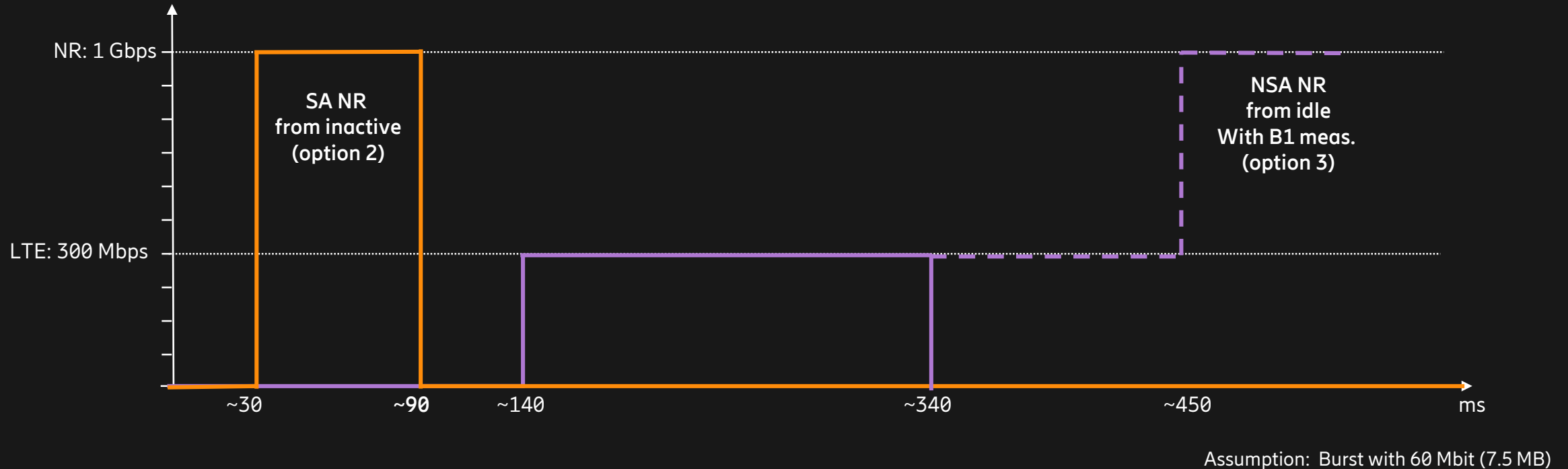
The SA session is finished before NSA has even started!

5G — one network for multiple use cases consumers and industries

10-100x	1000x	5x	100x
End-user data rates	Mobile data volumes	Lower latency	More devices

Low cost	5x	3x
Device cost reduction	NW energy efficiency	Spectral efficiency

Network slicing

Enhanced MBB · Massive IoT · Broadband IoT · Critical IoT · Industrial Automation IoT · Enterprise and Industry
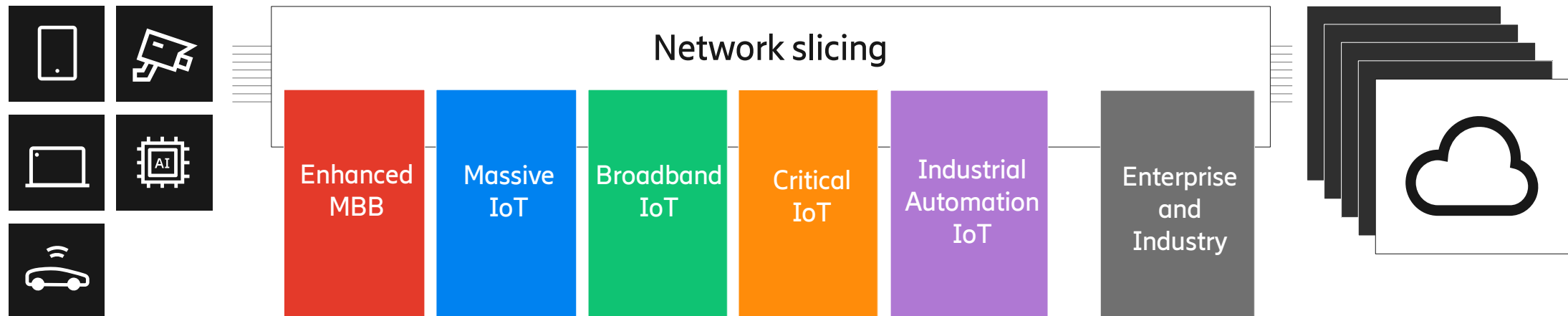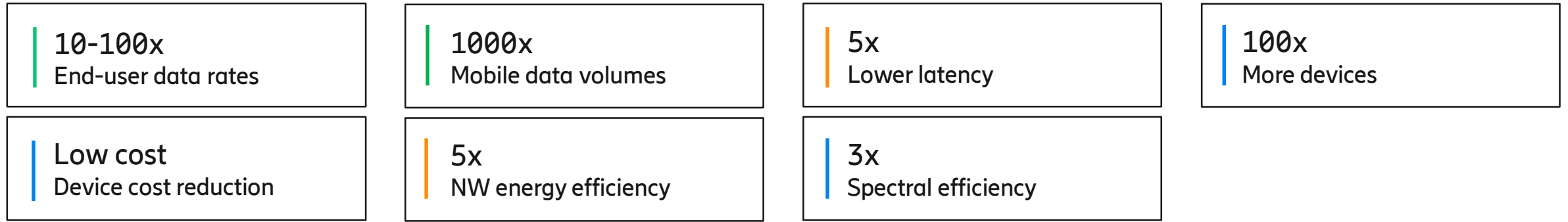
NFVI Evolution to Distributed Cloud Infrastructure

APP

Mobile Broadband

Enterprise

IoT

Media

Fixed Wireless Access

New Applications

Devices and Customers

APP | NEF

Deep Edge Solution
Deep edge system on NEBS HW

APP | NEF

Edge NFVI
| IaaS | CaaS |
| SDI /DC & CO/NEBS HW |

APP | NEF

NFVI
| IaaS | CaaS |
| SDI/ DC HW |

APP | NEF

Public Clouds

Deep Edge
<5 ms latency

Edge
5-20 ms latency

Central
20-50 ms latency

Internet

5G
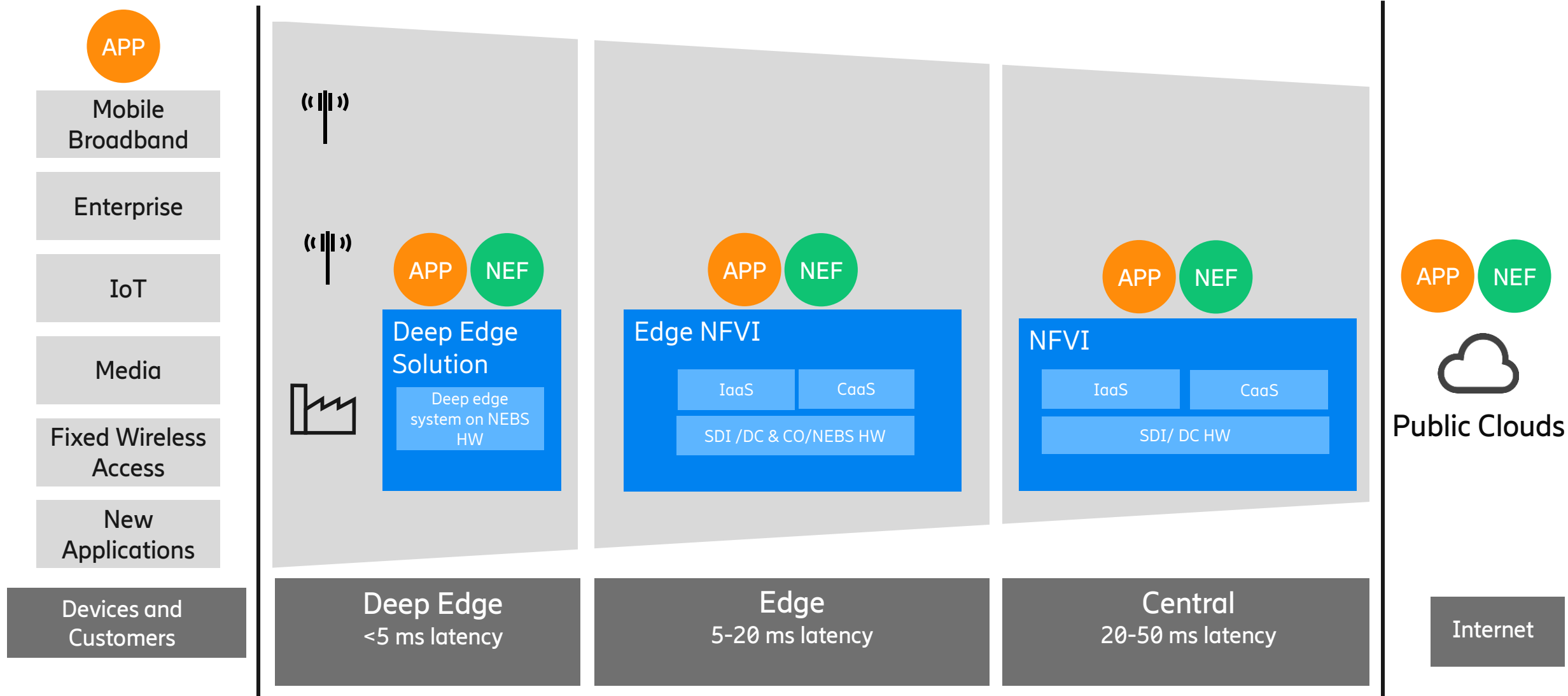
Implementation of a 5G System at the Audi Production Lab in Gaimersheim.

The laboratory will be equipped with Ericsson's Proof-of-Concept (PoC) network which is an open trial facility to enable early deployments of 5G technology.

1st phase: Steer Wirelessly connected production robots that are equipped with a gluing application.

In addition Audi and Ericsson are exploring whether 5G can be used in other Audi Group factories.

Audi and Ericsson to pioneer 5G for automotive manufacturing

Ericsson, Einride and Telia power sustainable, self-driving trucks with 5G

Ericsson, Einride and Telia are putting 5G into motion at a DB Schenker facility in Jönköping, Sweden.

The goal is to power an all-electric, autonomous transport ecosystem that takes fleet management to the next level.

Collaborative and immersive live entertainment experiences

— Ericsson is working alongside King's College London on **Connected Culture** project

— Aim is give people access to performances no matter where they are

— **Remote Music Demo** represents the potential for new performing arts experiences and collaboration over a distance

— **Holoportation** can provide performers access to new audiences

Ericsson MWC 2019