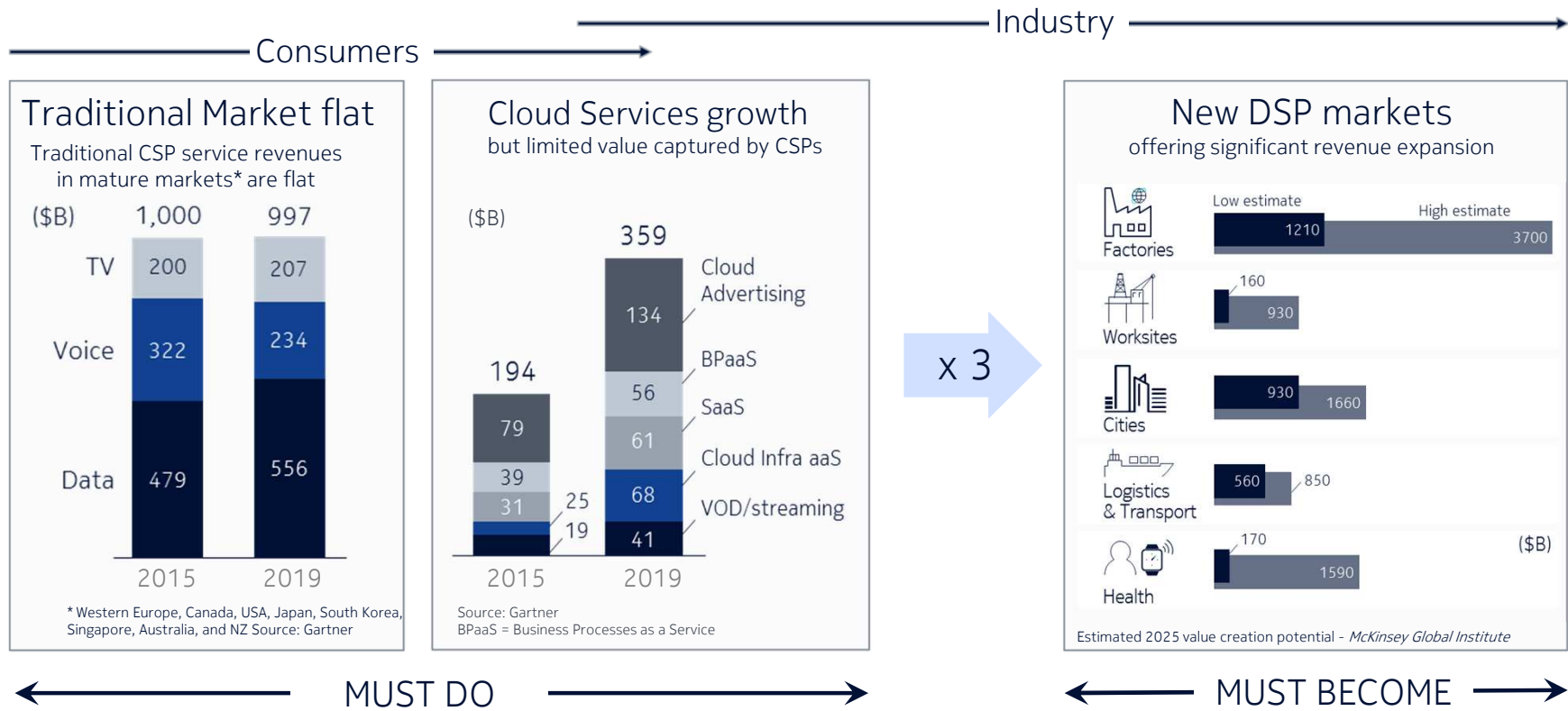


5G Update

NOKIA

Kai Sahala, Head of 5G E2E Sales APJ
May 2018

Telco market opportunity and new value creation



Mobile data traffic growth must be managed

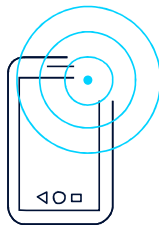
2001

Global internet traffic
6000 TB/day



2010

Global mobile traffic
8000 TB/day



2018

Finland mobile traffic
8000 TB/day

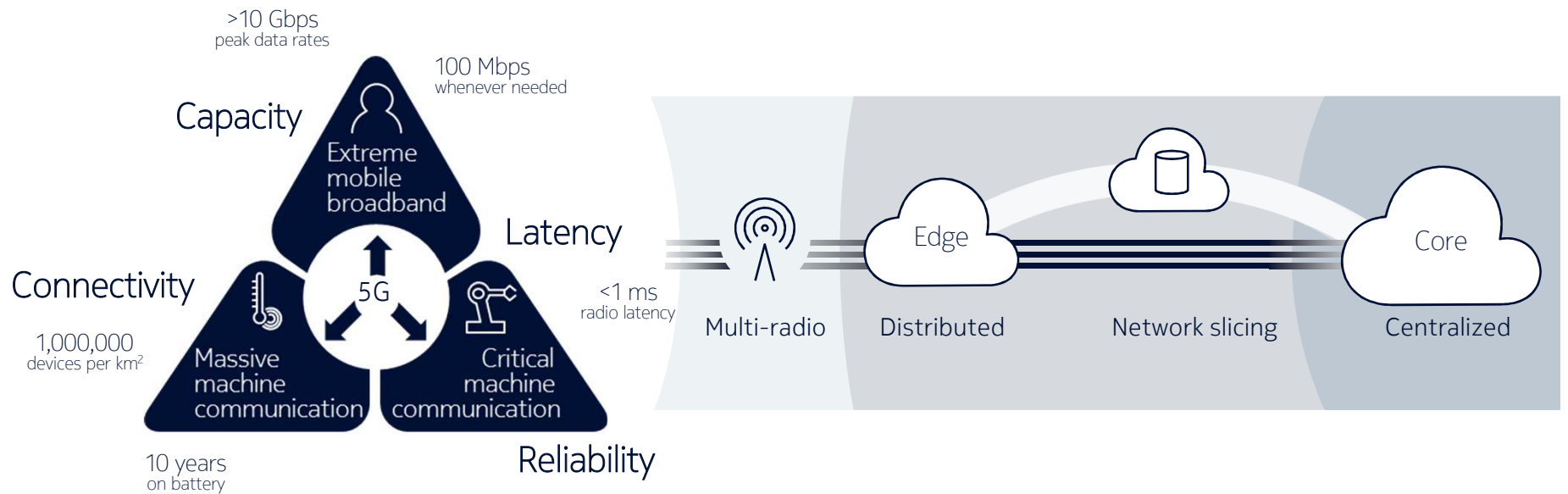


5G target

Sports stadium single game
4000 TB/game

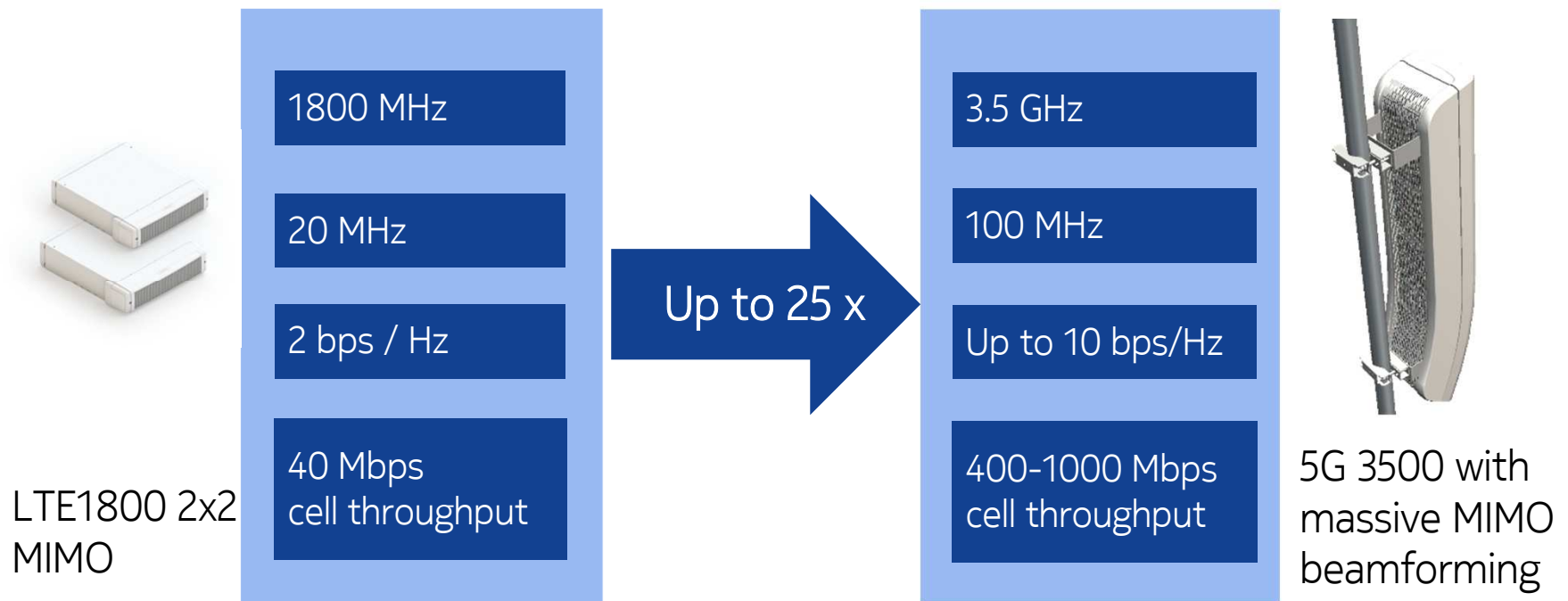


5G fulfils the future network requirements



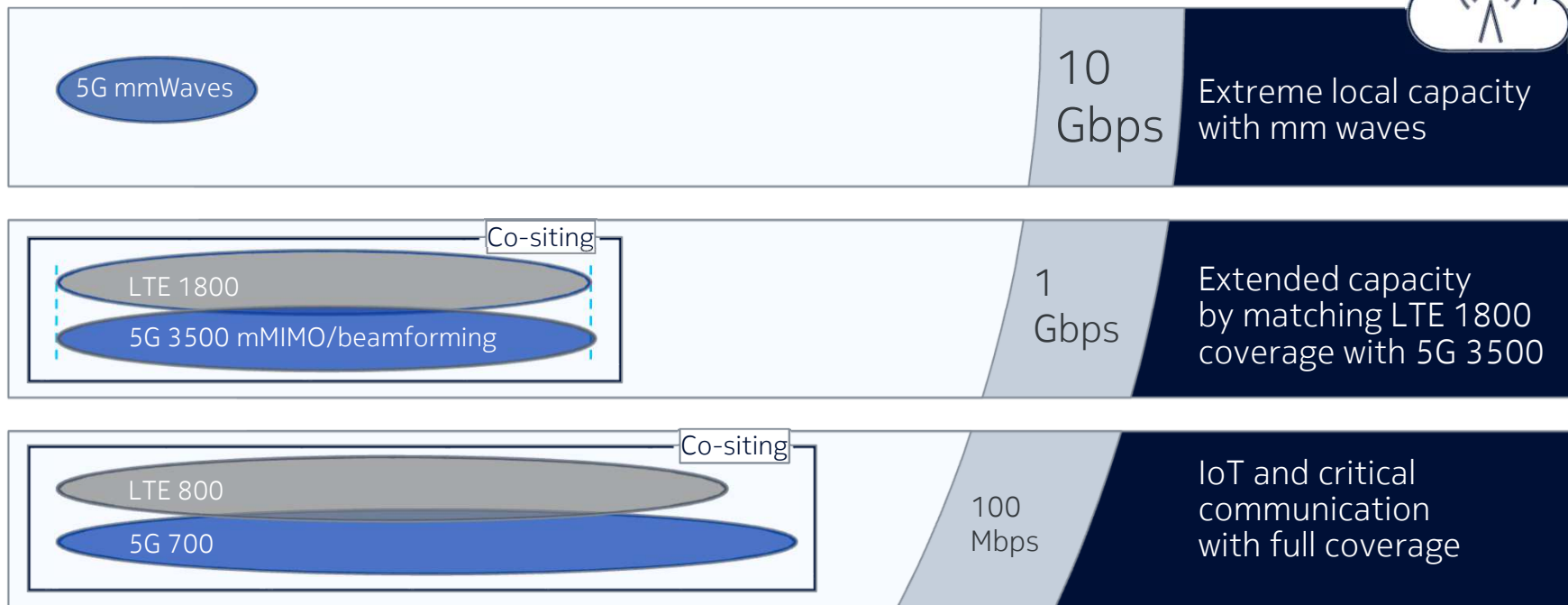
5G Enables up to 25x Capacity per Cell

5x More Spectrum and Up to 5x More Efficiency



5G coverage footprint

Combination of low and high bands



5G NR Frequency Bands

NR frequency range 1, below 6 GHz

Band	Uplink	Downlink	Duplex
n1	1920 – 1980 MHz	2110 – 2170 MHz	FDD
n2	1850 – 1910 MHz	1930 – 1990 MHz	FDD
n3	1710 – 1785 MHz	1805 – 1880 MHz	FDD
n5	824 – 849 MHz	869 – 894MHz	FDD
n7	2500 – 2570 MHz	2620 – 2690 MHz	FDD
n8	880 – 915 MHz	925 – 960 MHz	FDD
n20	832 – 862 MHz	791– 821MHz	FDD
n28	703 – 748 MHz	758 – 803 MHz	FDD
n38	2570 – 2620 MHz	2570 – 2620 MHz	TDD
n41	2496 – 2690 MHz	2496 – 2690 MHz	TDD
n50	1432 – 1517 MHz	1432 – 1517 MHz	TDD
n51	1427 – 1432 MHz	1427 – 1432 MHz	TDD
n66	1710 – 1780 MHz	2110 – 2200 MHz	FDD
n70	1695 – 1710 MHz	1995– 2020 MHz	FDD
n71	663 – 698 MHz	617 – 652 MHz	FDD
n74	1427 –1470 MHz	1475 – 1518 MHz	FDD
n75	N/A	1432 – 1517 MHz	SDL
n76	N/A	1427 – 1432 MHz	SDL
n77	3.3 – 4.2 GHz	3.3 – 4.2 GHz	TDD
n78	3.3 – 3.8 GHz	3.3 – 3.8 GHz	TDD
n79	4.4 – 5.0 GHz	4.4 – 5.0 GHz	TDD
n80	1710 – 1785 MHz	N/A	SUL
n81	880 – 915 MHz	N/A	SUL
n82	832 – 862 MHz	N/A	SUL
n83	703 – 748 MHz	N/A	SUL
n84	1920 – 1980 MHz	N/A	SUL

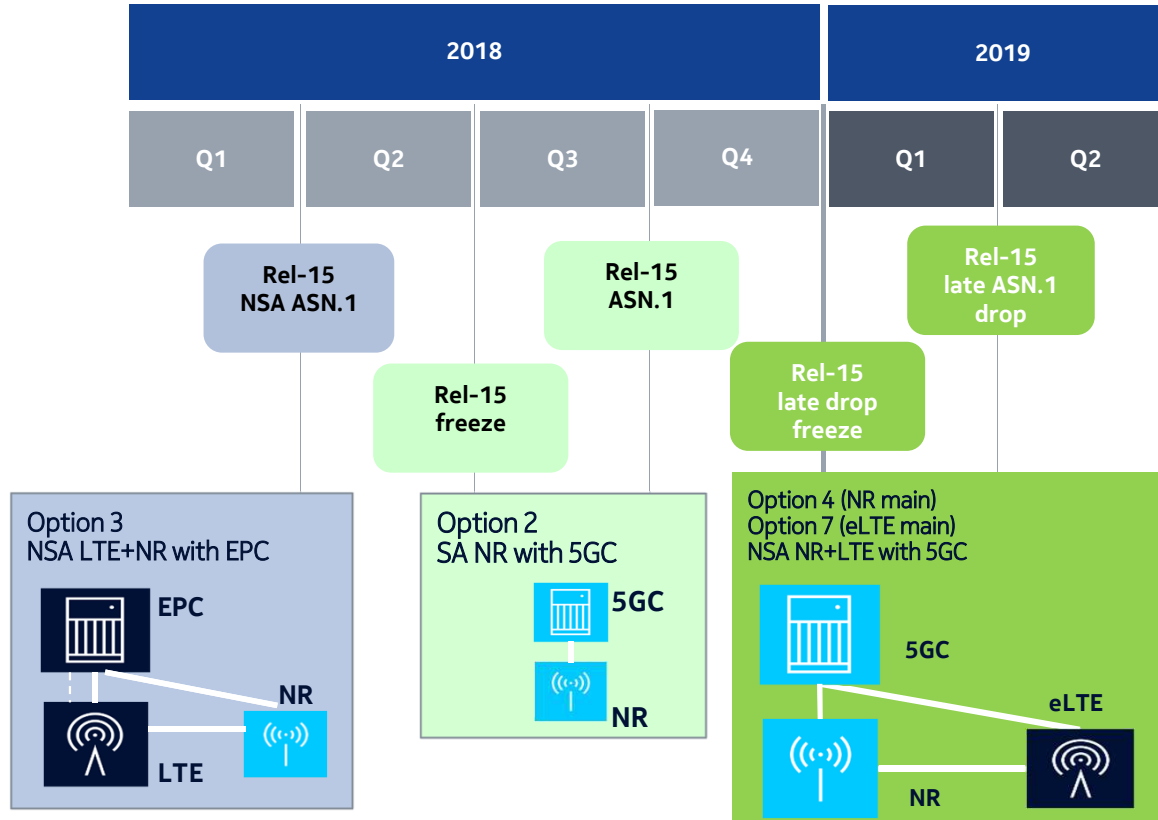
NR frequency range 2, above 24.25 GHz

Band	Uplink	Downlink	Duplex
n257	26.5 –29.5 GHz	26.5 –29.5 GHz	TDD
n258	24.25 – 27.5 GHz	24.25 – 27.5 GHz	TDD
n260	37–40 GHz	37–40 GHz	TDD

Additional bands still expected to be added to the specifications in June (bands 13, 25, 26, 34, 39, 40 ...)

Bands not completed in due time may be taken away from Release 15. Very large number of band combinations in addition to the bands being proposed

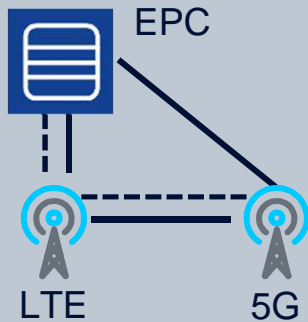
5G standardisation status



Motivations for Non-standalone (NSA) and Standalone (SA)

Why Dual Connectivity with NSA?

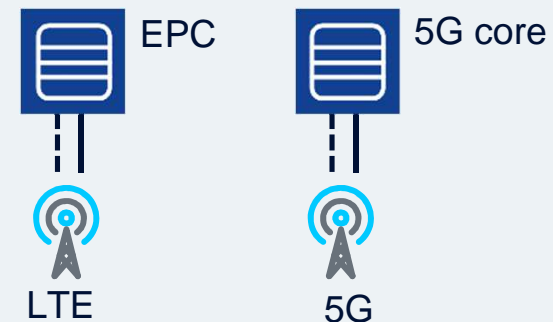
Option 3x | LTE+5G under EPC



- Available 6 months earlier than SA
- Existing EPC core used
- Existing LTE idle mode used
- Data rate aggregation LTE + 5G
- VoLTE in LTE

Why Standalone SA?

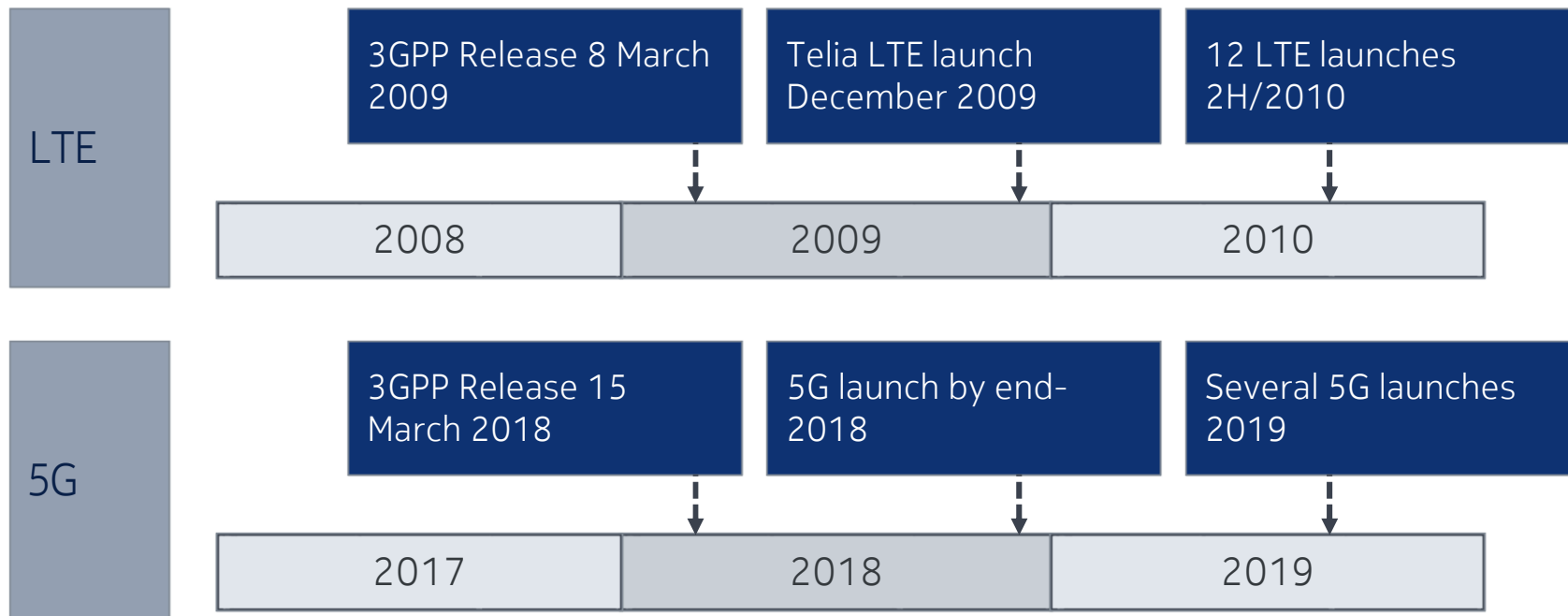
Option 2 | SA 5G under 5GC



- 5G end-to-end for new services
- Lower latency without LTE leg
- Lower setup time in 5G
- No need for LTE network upgrades

When can you buy 5G handset?

5G Schedule based on LTE History



5G early market use cases

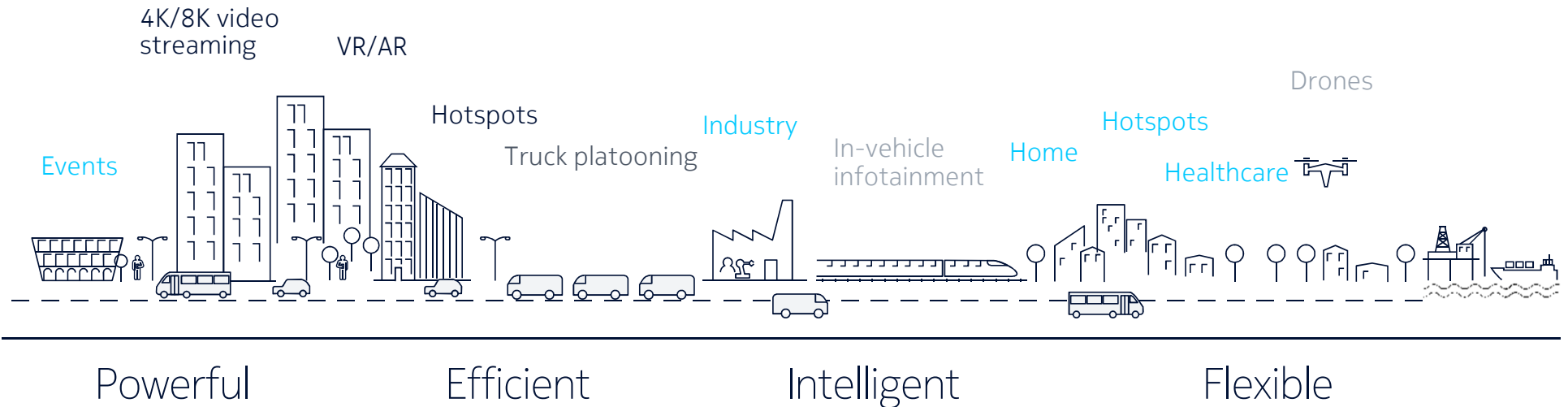
Dense city area
use cases

Highway
use cases

Public transport
use cases

Dedicated
use cases

Structural 5G
deployment
area



Nokia supporting KT 5G trial at Korea 2018 major sport event

KT 5G-driven visual demos supported by Nokia

- **Sync View** – 3D live performances from a bobsledder's viewpoint
- **Interactive Time Slice** – forward/backward time line review (user controlled « instant reply »)
- **360-degree VR** (virtual reality) live broadcasting
- **Omni-point view** – viewers to catch up with a certain athlete's performance



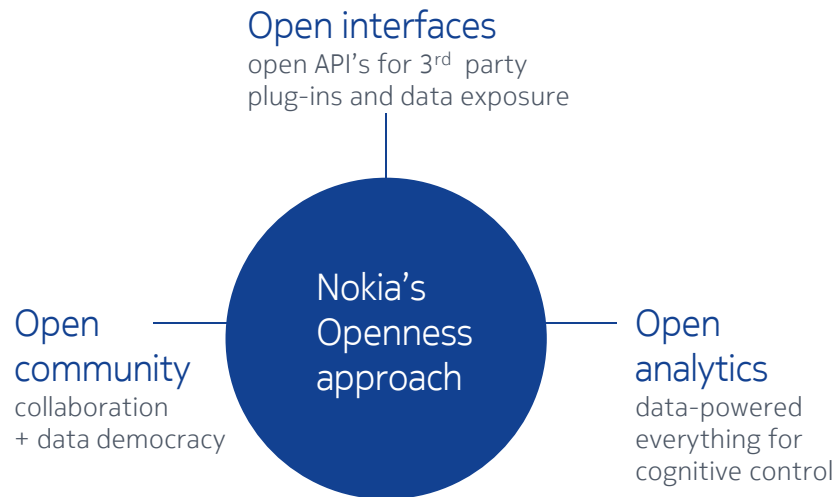
Time Slice

- 100 cameras, arranged in a 180-degree arc in the Ice Arena
- Footage combined to create 3D videos and freeze-frames of figure skaters
- Viewers can rotate around, like watching Neo dodge bullets in *The Matrix*



Always open

Build the flexibility required in 5G era



Open Ecosystem Network



Key take-aways

Standards
schedule
unchanged

Trials 2018,
handful of
launches by mid
2019

eMBB and Fixed
wireless use
cases first



MİKROSKOP