MYTHICAL 5G: WHAT TO EXPECT

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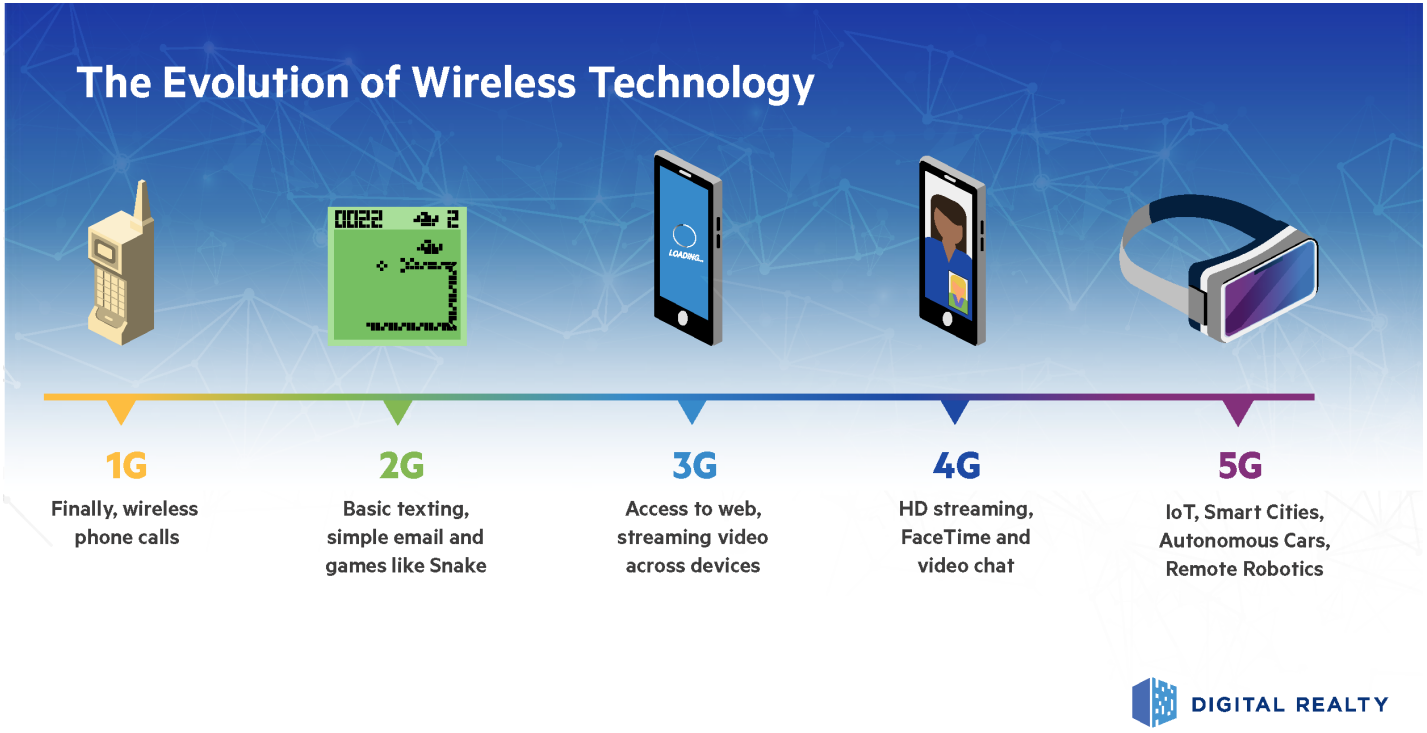
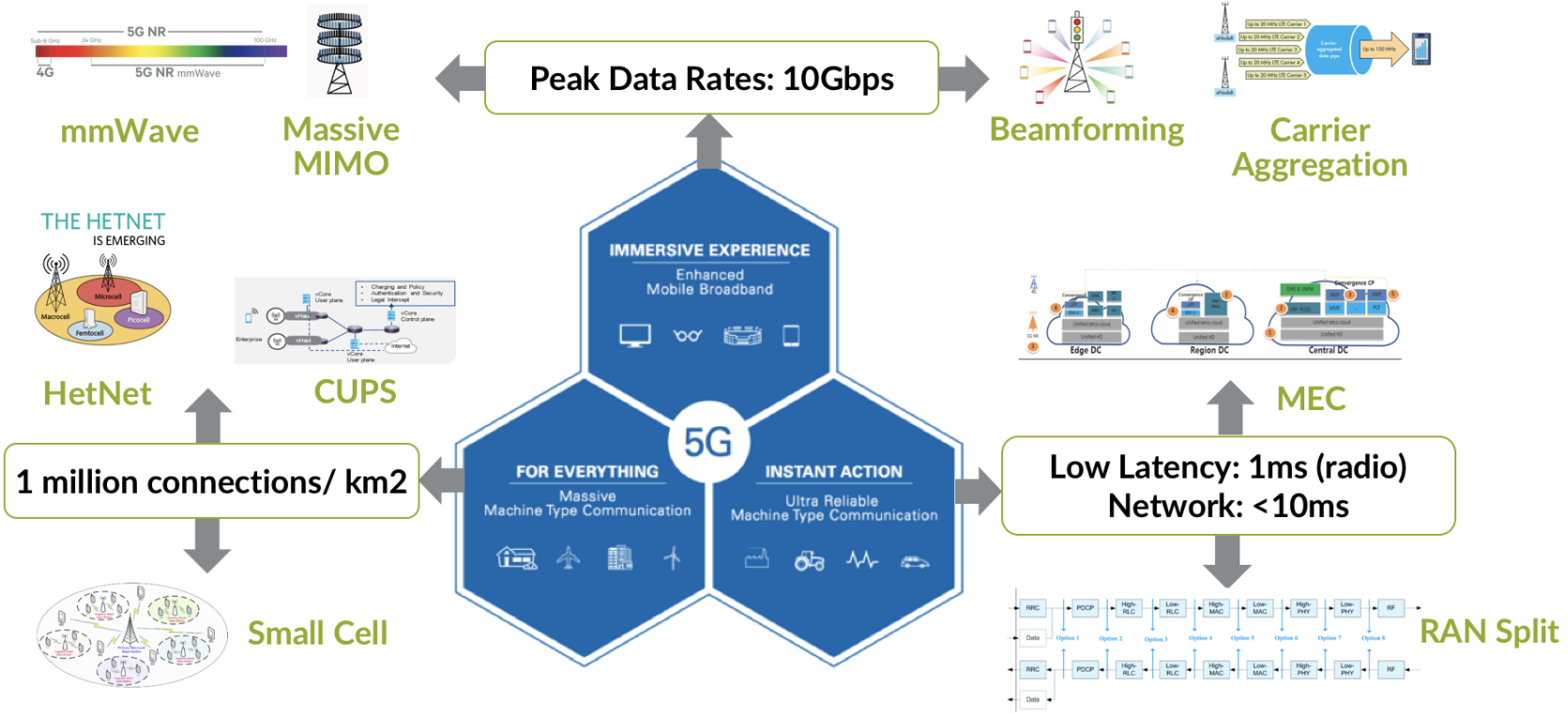
Juniper Networks | Engineering Simplicity

WHAT IS 5G?



DIGITAL REALTY

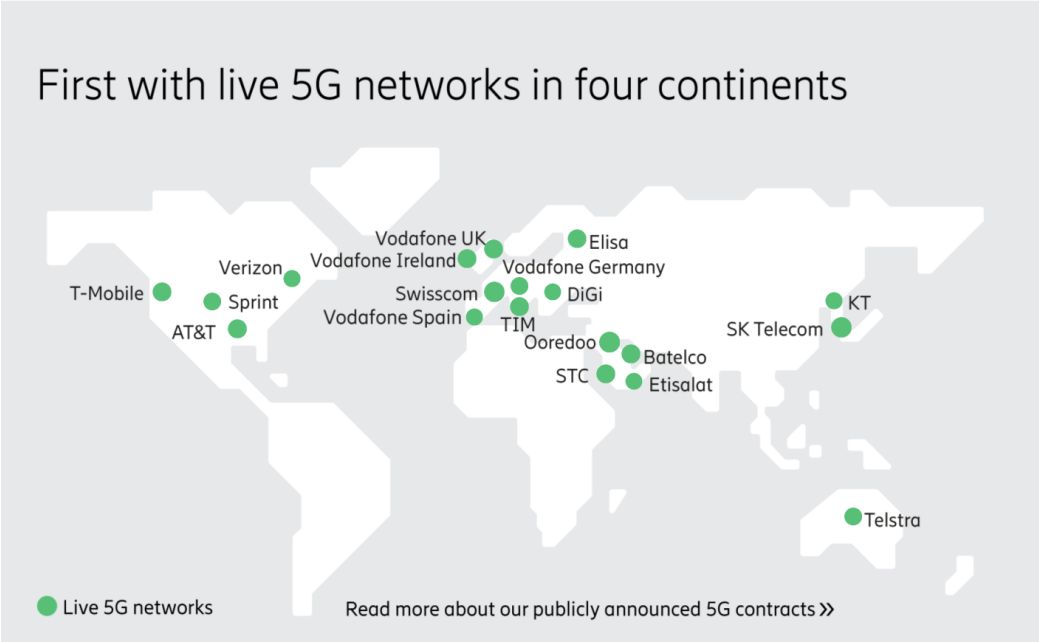
5G TECHNOLOGY DRIVERS



5G IS HERE!

First 5G networks now live across Americas, EMEA and APAC:

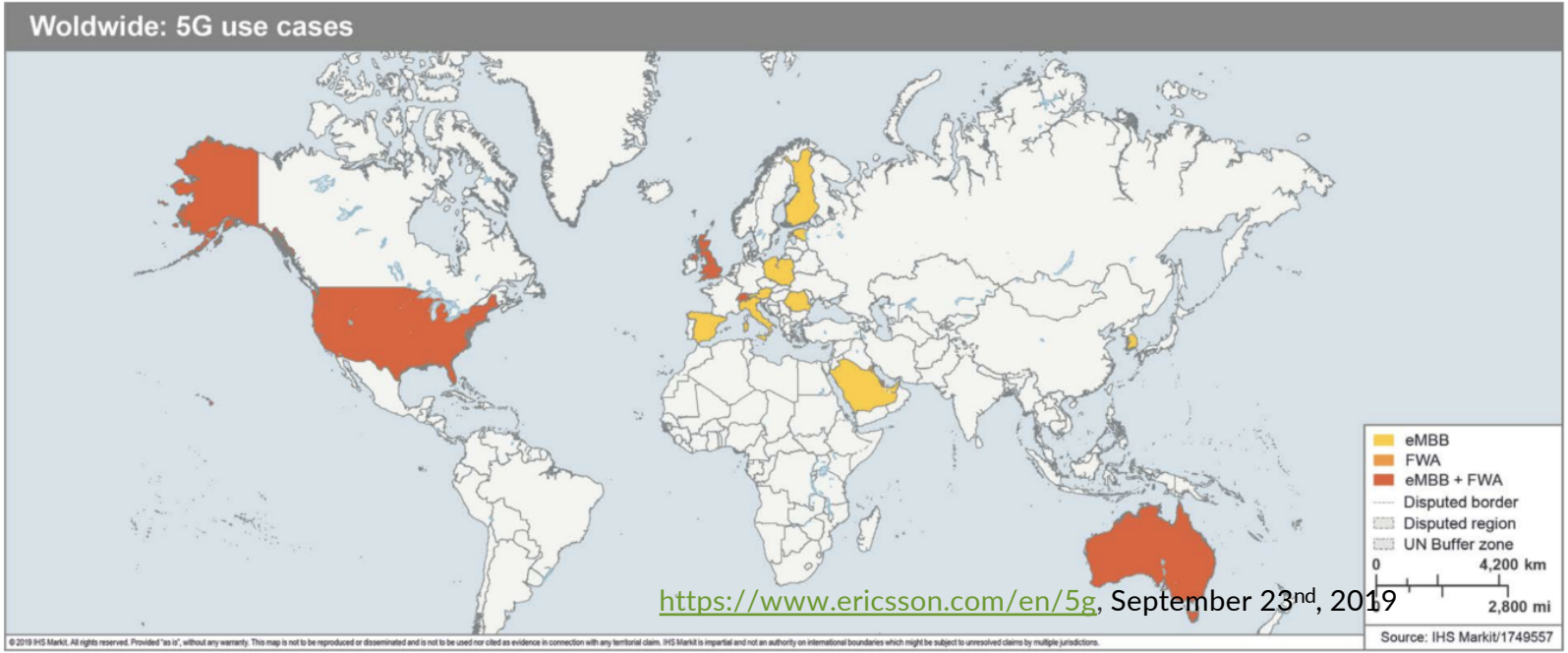
- Still early days, mass nationwide roll-outs will still take several years.
- Mainly Mid bands in EMEA and APAC, High bands in Americas
- Worldwide 45%~65% coverage expected by 2024.



https://www.ericsson.com/en/5g, September 23nd, 2019

BUT WAIT A SECOND…

Enhanced mobile broadband and fixed wireless access are the primary use cases applied by operators so far



https://www.ericsson.com/en/5g, September 23nd, 2019

5G STANDARTIZATION PROCESS

RELEASE 15 – 5G first phase (commercial deployments)

5G non-standalone (Dec 2017) and 5G standalone definitions (Jun 2018)

Mainly focused on enhanced Mobile Broadband (eMBB) and fixed wireless

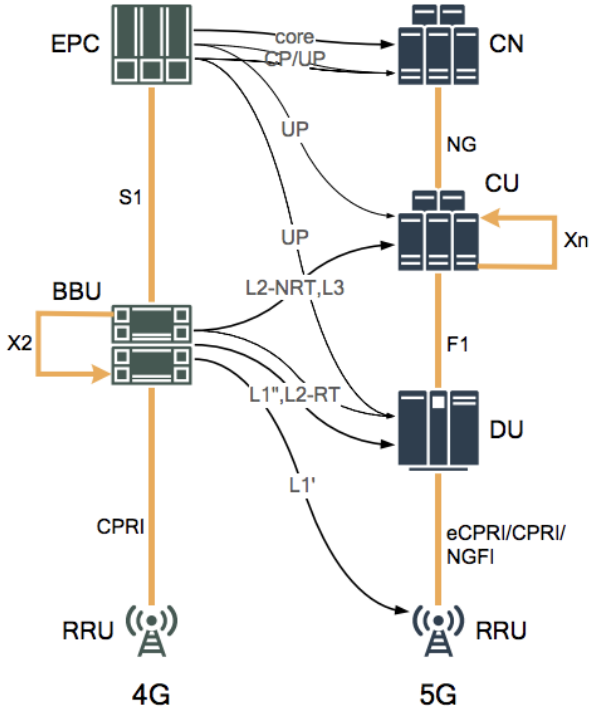
May perform on lower speed (on sub-6GHz bands) comparable to LTE Advanced Pro (LAA – Licensed Assisted Access, Rel 13) -> Gigabit Class LTE on 20MHZ of licensed spectrum + 5Ghz unlicensed part

RELEASE 16 – 5G second phase (further evolution)

To be completed by the end of 2019

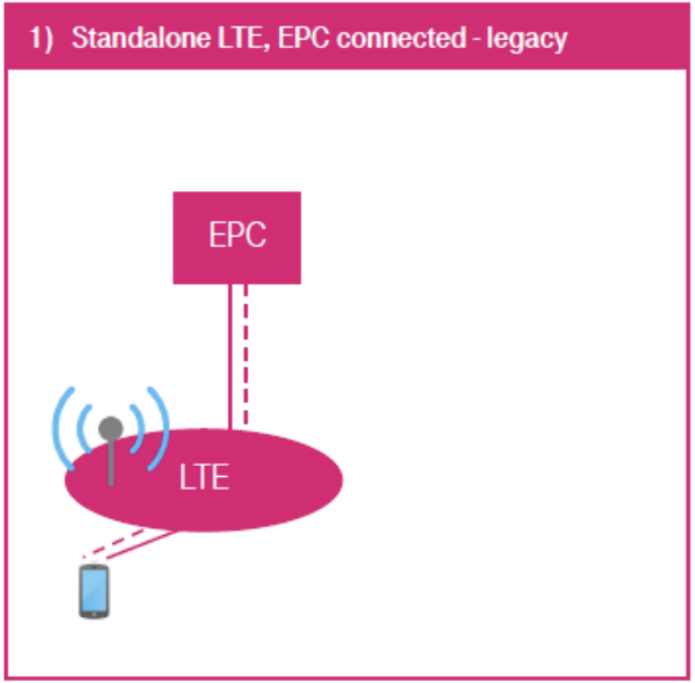
Focus on Ultra-Reliable Low-Latency Communications (URLLC, 1ms latency -> SD cars) and Massive Machine Type Communications (MMTC, 1m devices per km2 -> Industrial IOT)

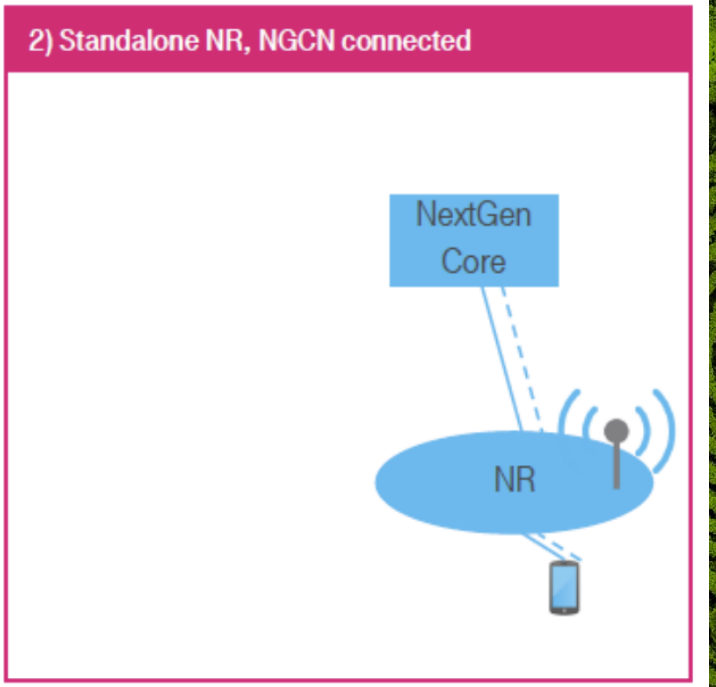
BASE STATIONS EVOLUTION



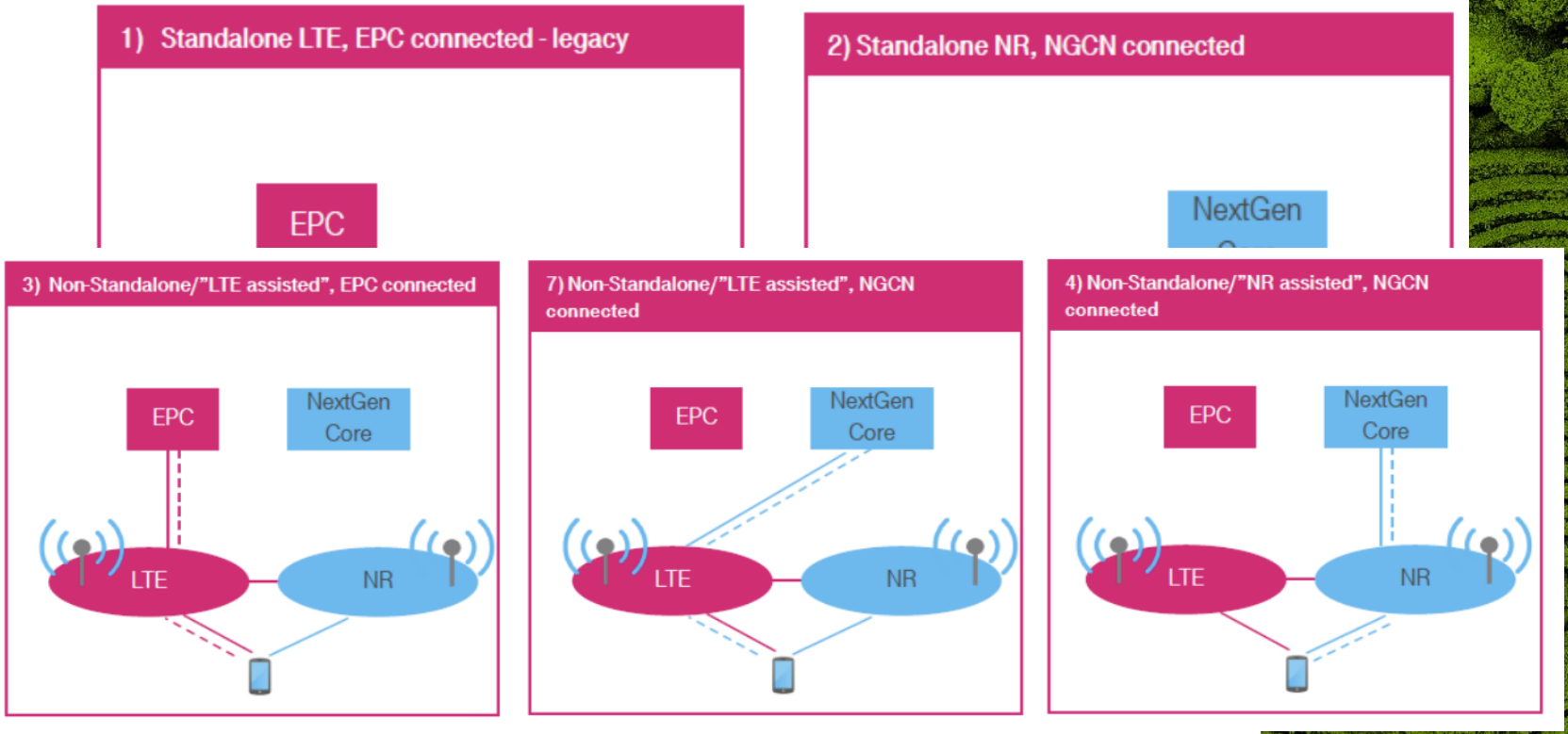
Evolving from single-node in 4G to split function architecture in 5G

TRANSITION TO 5G



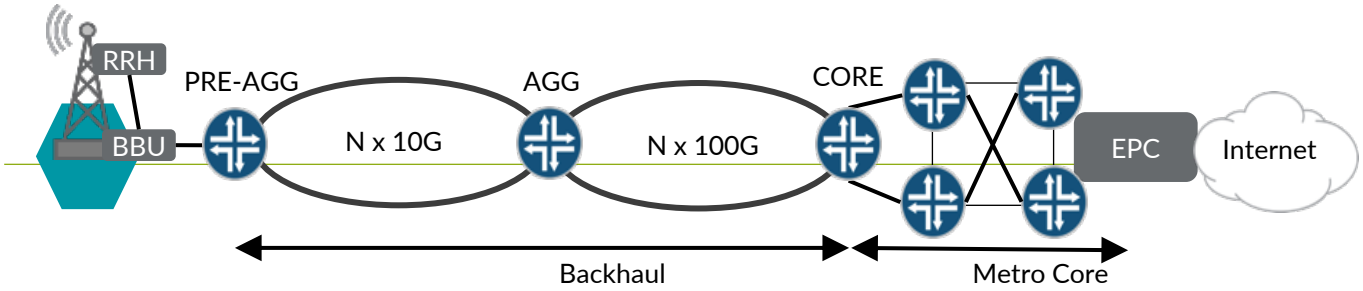


TRANSITION TO 5G



MBH ARCHITECTURE TODAY (4G / LTE-A)

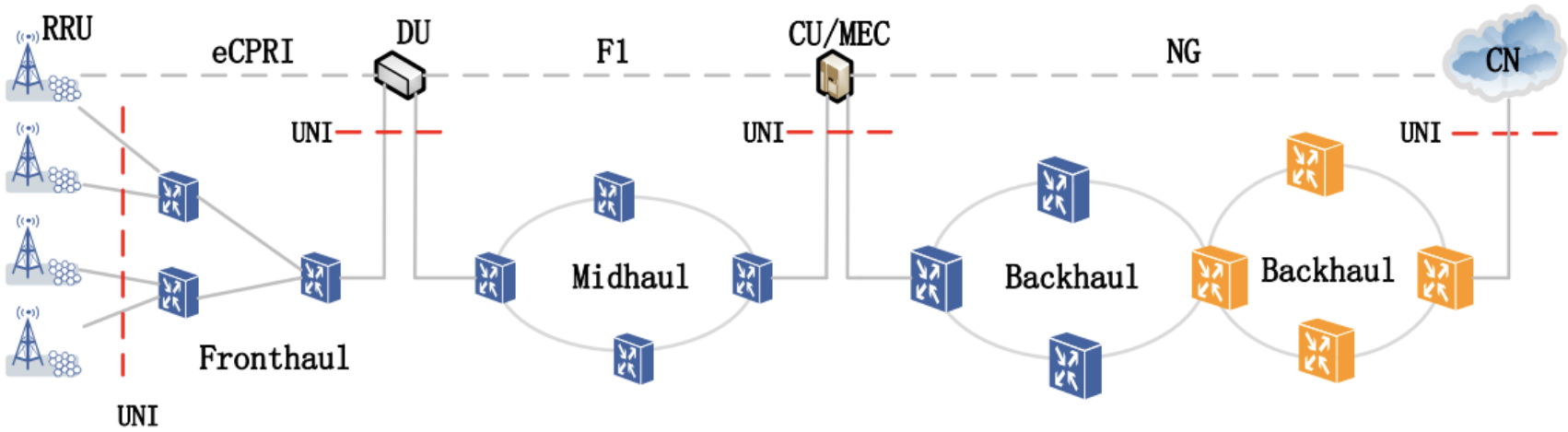
Massive MIMO
Carrier Aggregation



Most deployed CSR architecture for 4G / LTE-A today:

- Operators start to implement Massive MIMO and Carrier Aggregation for better spectrum efficiency to improve density and bandwidth. This requires CSR upgrades at Cell Sites from **1GE to 10GE**.
- **10GE CSR** typically deployed at single site or to aggregate multiple cell sites, depending on reach between sites.
- Requires hardened CSR with **3 … 8 x 10GE ports** (downlink & uplink).

MBH ARCHITECTURE EVOLUTION (5G)



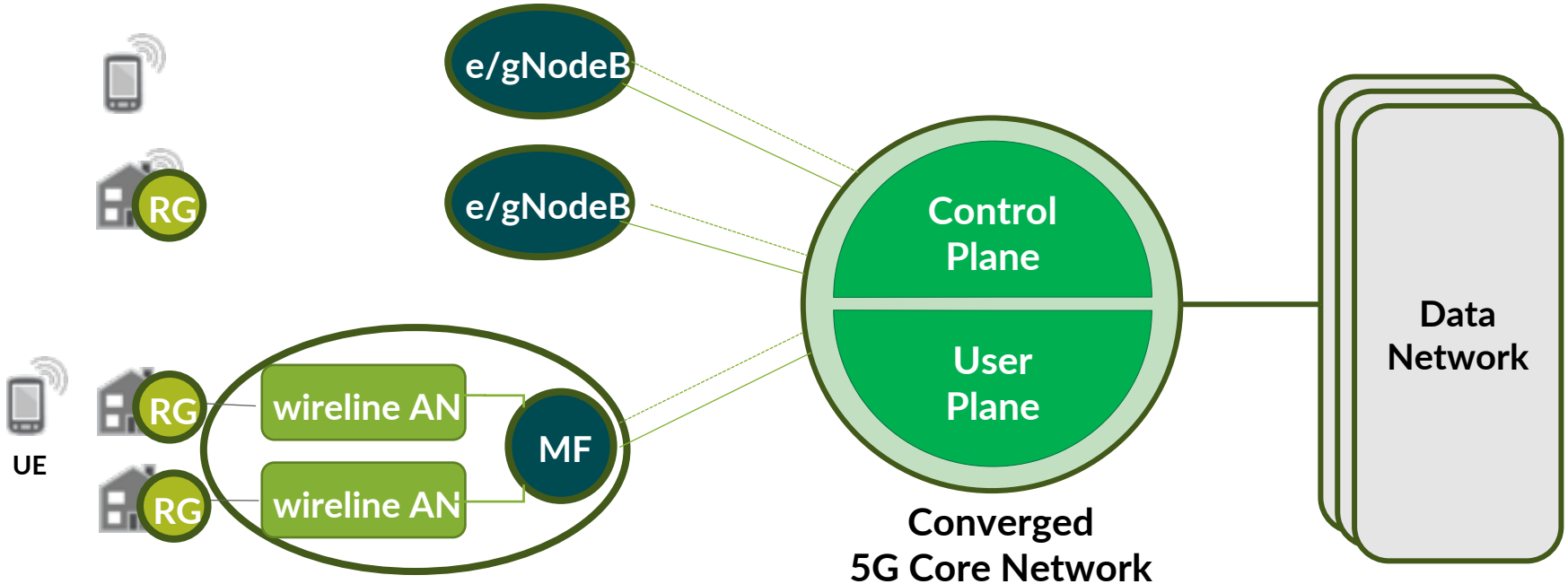
L2 fronthaul evolution with eCPRI

- Maximum 100 us (microsecond) latency and 65 ns delay variation
- Ethernet Switch with RoE and TSN: typically 6 x 10/25GE + 2 x 100GE

Table 7-3 Network reach requirements

Fronthaul	1~20km
Midhaul	20~40km
Backhaul	1~10km Aggregation: 5-80km Core: 20~300km

HIGH LEVEL CONVERGED ARCHITECTURE
WWC: WIRELINE WIRELESS CONVERGENCE



	24-28GHz	37-40GHz	64-71GHz
	24.25-24.45GHz 24.75-25.25GHz 27.5-28.35GHz	37-37.6GHz 37.6-40GHz 47.2-48.2GHz	64-71GHz
	26.5-27.5GHz 27.5-28.35GHz	37-37.6GHz 37.6-40GHz	64-71GHz
	24.5-27.5GHz		
	26GHz		
	26GHz		
	26GHz		
	26.5-27.5GHz		
	24.5-27.5GHz	37.5-42.5GHz	
	26.5-29.5GHz		
	27-29.5GHz		
	24.25-27.5GHz	39GHz	

Source: Qualcomm Technologies, Inc

COVERAGE RESTRICTIONS

Nieuws

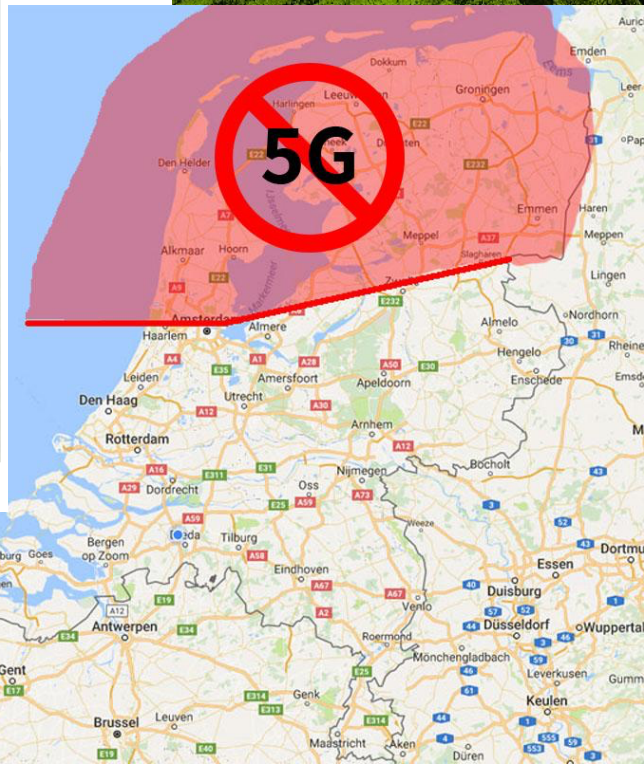
08 februari 2018 - Ron Smeets

Staatsveiligheid zit 5G uitrol in de weg

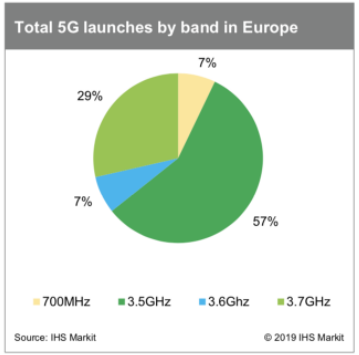
Providers vrezen een achterstand voor Nederland

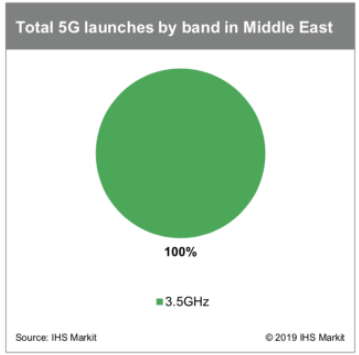
In 2020 moet het eerste commerciële 5G netwerk een feit zijn. Het is de bedoeling dat in en rond de Amsterdam Arena, een van de speelsteden van Euro 2020, een 5G netwerk actief is. De kans dat dat gebeurt wordt echter steeds kleiner vanwege enkele afluisterschotels in het Friese Burum. De providers, en KPN in het bijzonder, luiden nu de noodklok en vrezen dat Nederland een achterstand zal oplopen als deze kwestie niet snel opgelost wordt. Wat is het geval?

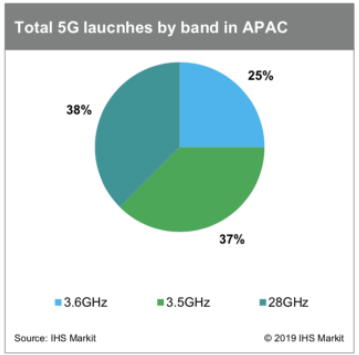
Ook interessant

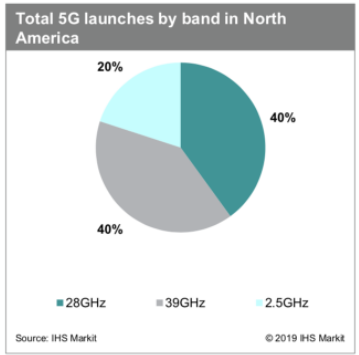


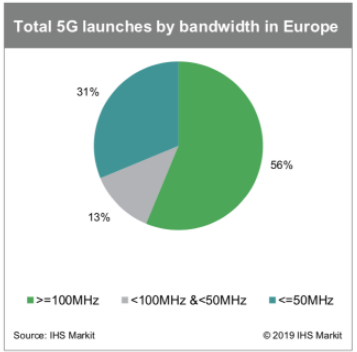
FREQUENCIES USED

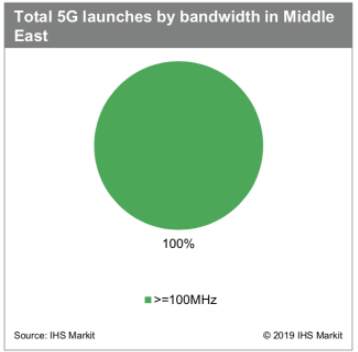


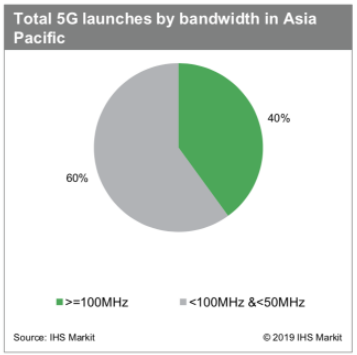


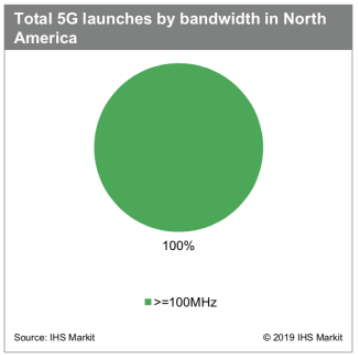




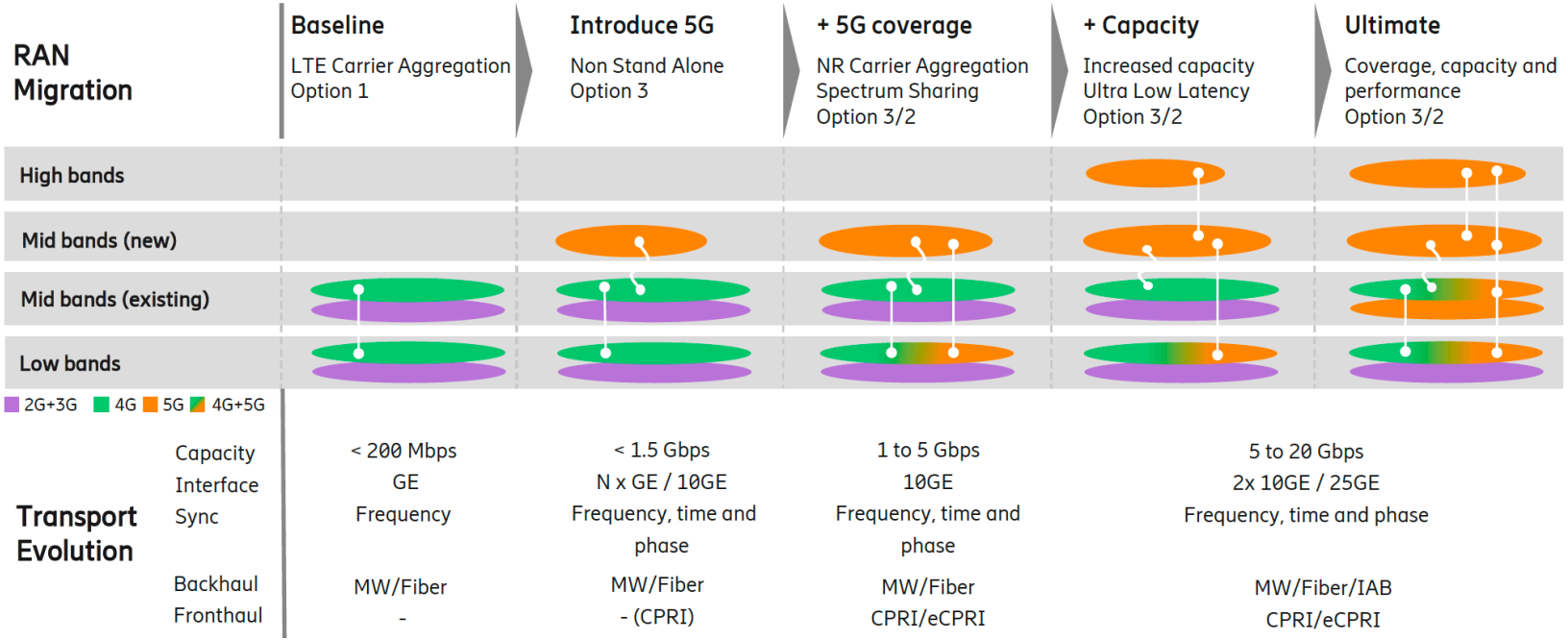








5G DEPLOYMENT SCENARIOS



5G deployments only increase spectral efficiency with ~20%, so more spectrum and denser site deployments are needed for capacity growth

ENHANCED MOBILE BROADBAND

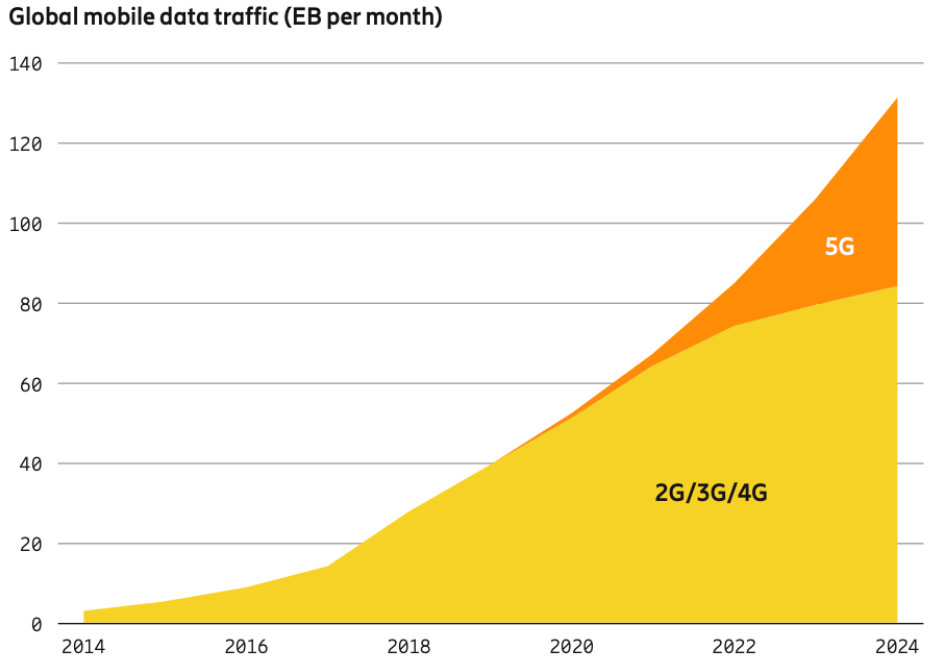
Initial growth on LTE/LTE-A before giving way to 5G

Mobile traffic is still growing rapidly:

- **Growth from 28 EB/month in 2018 to 131 EB/month in 2024, 30% CAGR (4.7x)**
- **Total fixed data traffic grows only with 22% CAGR (3.3x).**

5G starts to contribute in earnest to traffic volume by 2021-2022:

- **Main growth on LTE/LTE-A until 2022, then this will start to saturate.**
- **Needs much more spectrum to be available and deployed (especially mid- and high-bands).**
- **Needs much denser site deployments to deal with worse propagation of high-bands.**



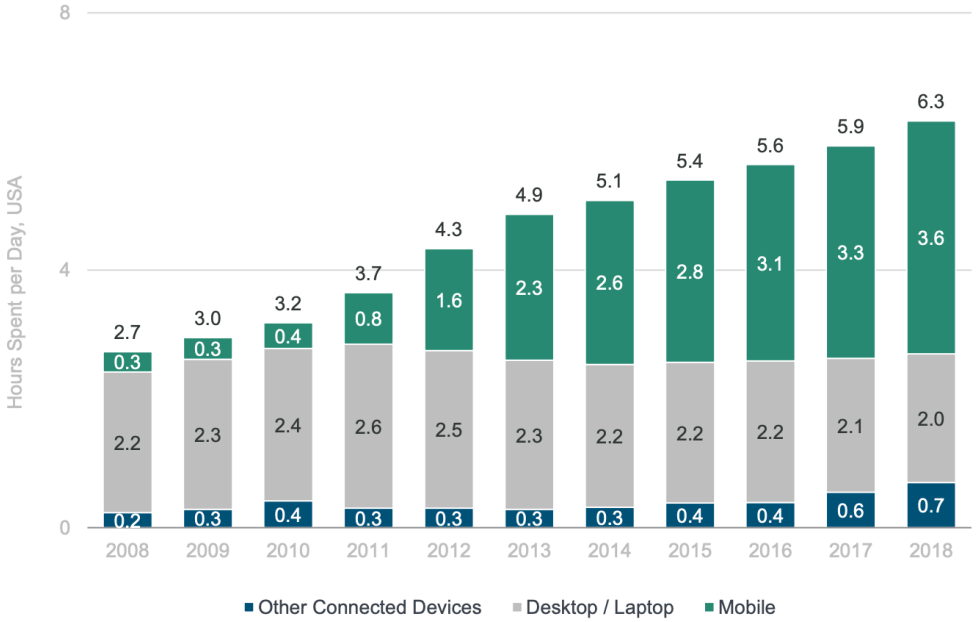
From: Ericsson Mobility Report, June 2019

ENHANCED MOBILE BROADBAND

What's driving the traffic growth?

We're getting addicting to the small screen…

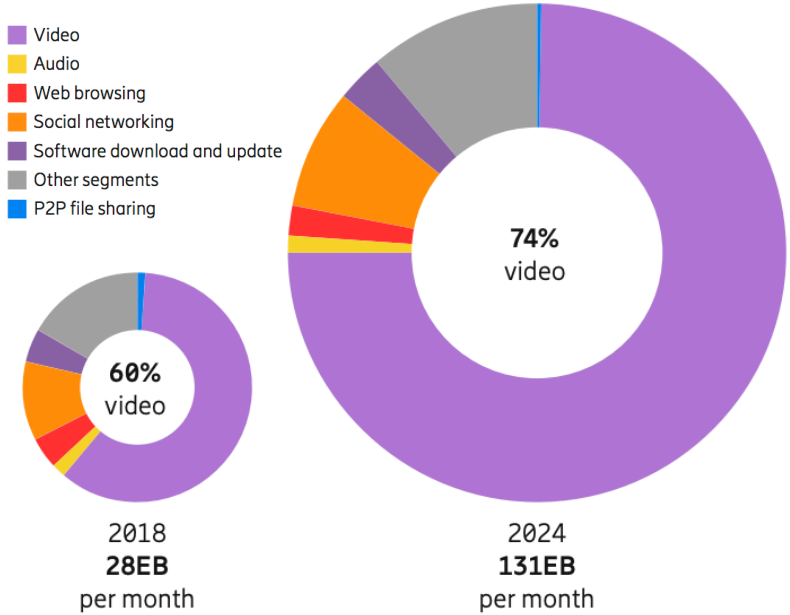
Daily hours spend with digital media per adult user



From: Mary Meeker, Internet trends 2019, June 2019

watching ever more (and higher definition) video

Mobile data traffic by application

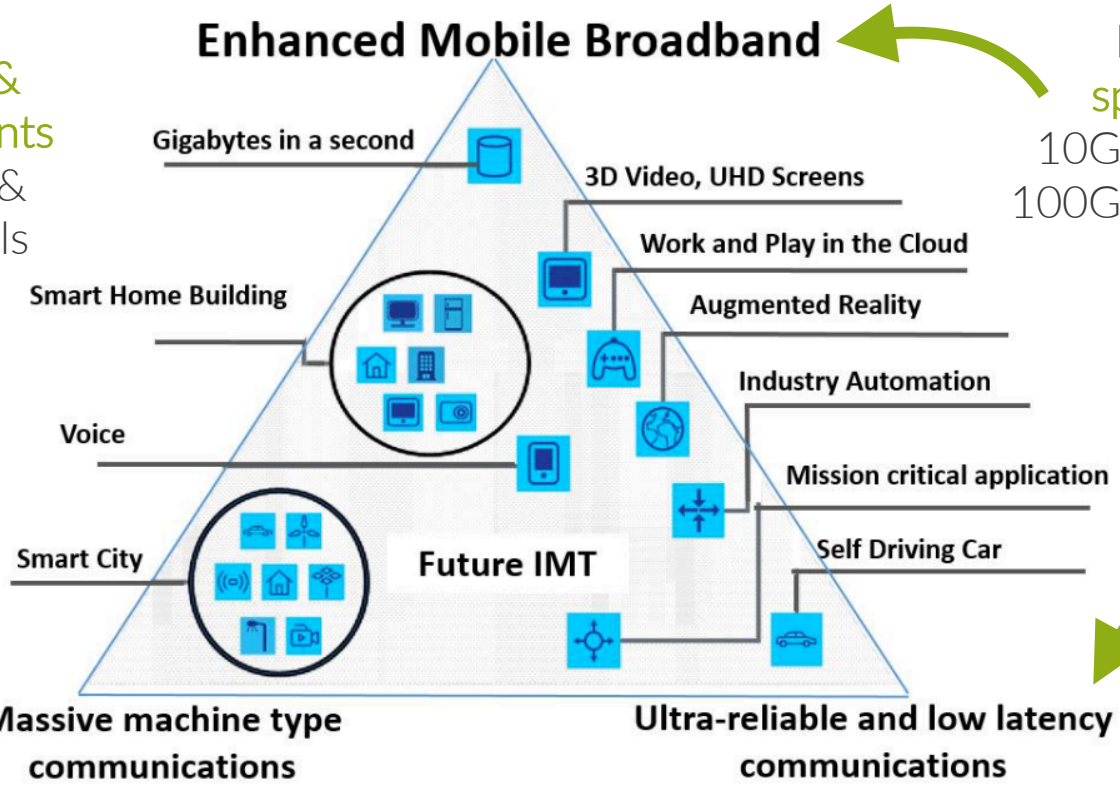


Adapted from: Ericsson Mobility Report, June 2019

5G USE CASES

More than just Enhanced Mobile Broadband

Large scale & many end-points
Automation & new protocols like SR



Ethernet port speed migration
10GE is the new 1GE
100GE is the new 10GE

Timing and synchronization becomes very critical

MAKING INDUSTRY SMARTER: PORTS & SHIPPING

enterprise iot insights

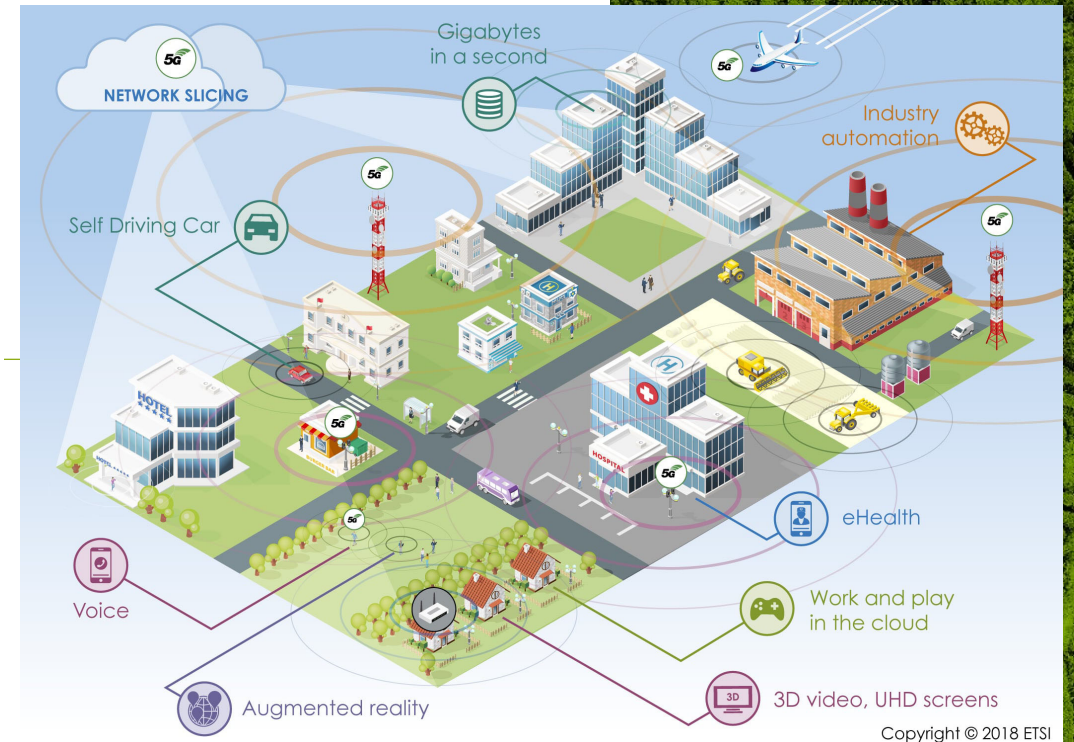
JULY 2019

SMART PORTS

Automation and intelligence with private LTE / 5G networks and public network slices

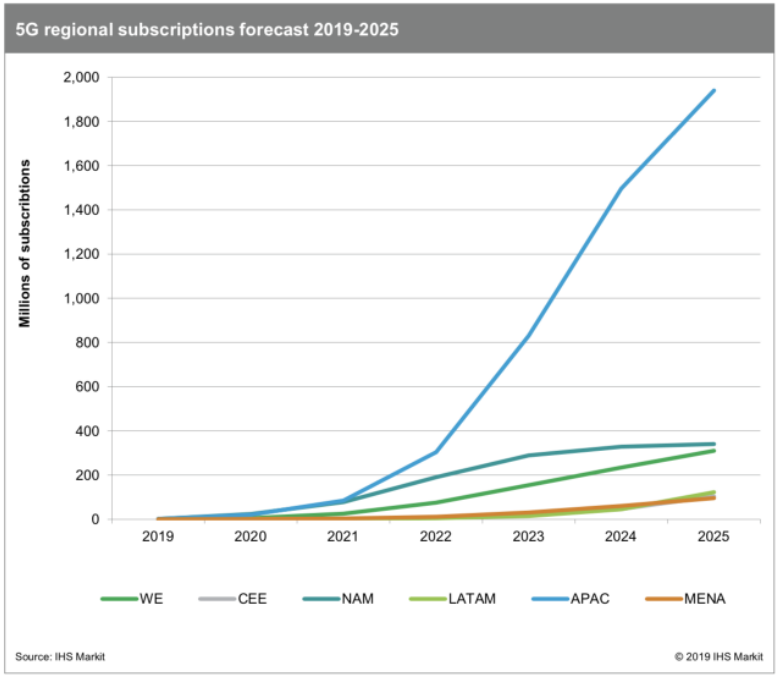
by James Blackman Editor, Enterprise IoT Insights

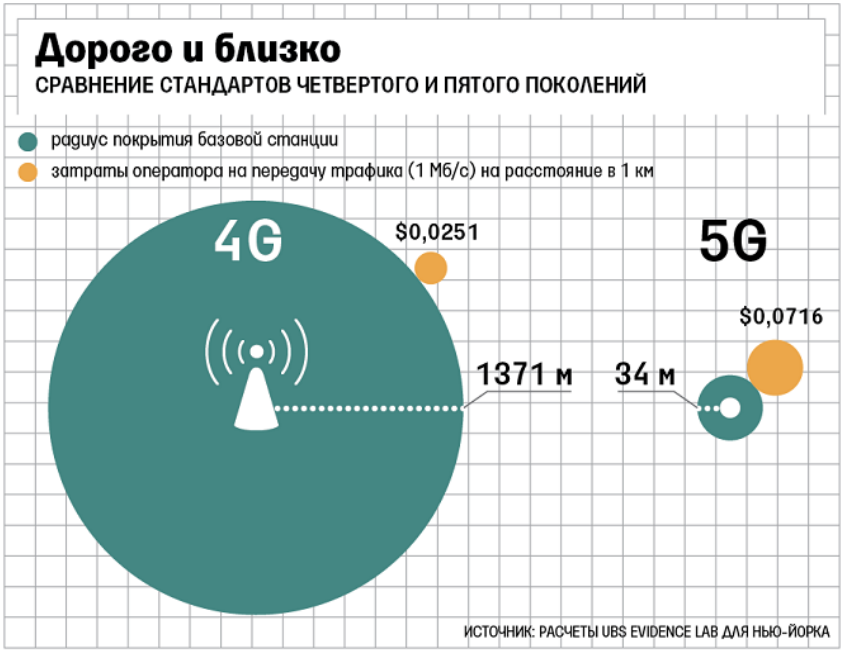
MULTEFIRE



juniper NETWORKS

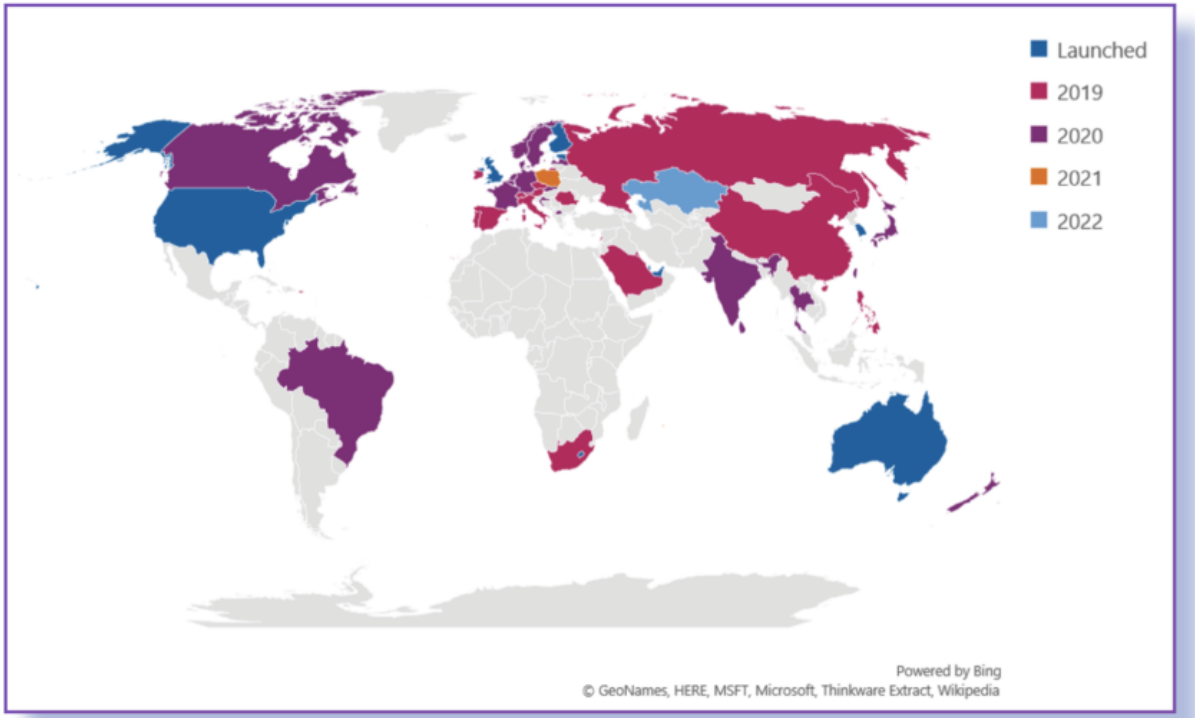
5G BUSINESS CASE





5G ROLLOUT ROADMAP

Figure 14: Earliest expected 5G commercial launch dates (includes mobile or FWA, includes limited availability launches)

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