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5G is Out There: How to Ride the Market Storm and Thrive

Edward Smith (Wokingham U3A)

Mauro Ugolini (Università degli Studi ROMA TRE)

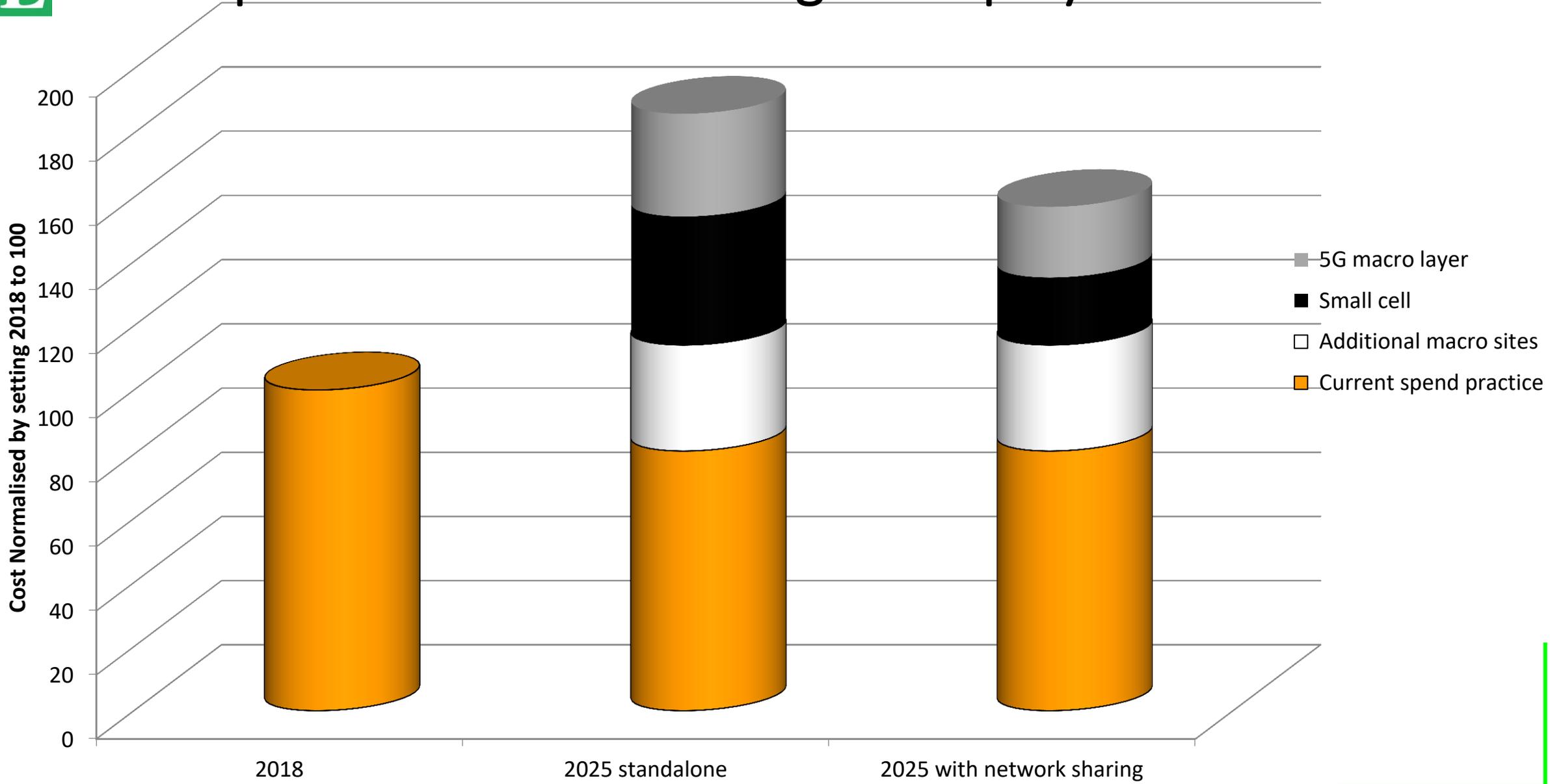
Outline

- In this paper we will cover the changes in the commercial model adopted by the mobile ICT industry, due to the advent of 5G technology and the impacts it is likely to engender. In terms of:
 - Challenges offered in rolling out a new infrastructure;
 - New markets this is likely to open up;
 - Impact on partnering decisions and the role of competing technologies.
- 5G will not be just an evolution of 4G services, supporting its existing markets. We examine the potential for the three main propositions:
 - eMBB, extended Massive BroadBand, representing the evolutionary path from the existing proposition;
 - mMTC, massive Machine Type Communications, delivering high density radio services for machine to machine (M2M) applications;
 - URLLC, Ultrareliable Low Latency Communications, fostering improvements in latency and reliability to allow mission critical applications.

5G: the Impact

- User data rate of initially 100 Mbps, an increase in spectral efficiency, a latency of 1-10 ms, a connection density of up to 1000000 devices per km² and improvements in availability, reliability and energy utilisation.
- An increase in capacity of 5G over LTE by a factor of between 1000 and 5000 fold is anticipated, requiring, as a consequence, an increase in backbone capacity.
- 5G is expected to generate opportunities, with a global economic impact of \$12.3 trillion, even if the economics and ability to monetise the investment remain unclear.
- Delivery will be commercially challenging.
- Investments in 5G can be deferred by building on existing LTE infrastructures.
- Deployment of 5G could double network costs, with a 60% increase in capital expenditures, for standalone deployments.
- Network sharing can reduce Total Cost of Ownership (TCO) by 30% and the cost of small cell deployments by 50%.
- Software Defined Networks (SDN) and Network Function Virtualisation (NFV) may provide further cost reduction opportunities.
- Network slicing is a virtualisation technique that could improve the commercial outlook for 5G, although there is little quantitative information on which to judge its impact.
- 5G will focus initially on eMBB and as the service matures, URLLC and mMTC will be added.

The Impact of Network Sharing on Deployment Costs



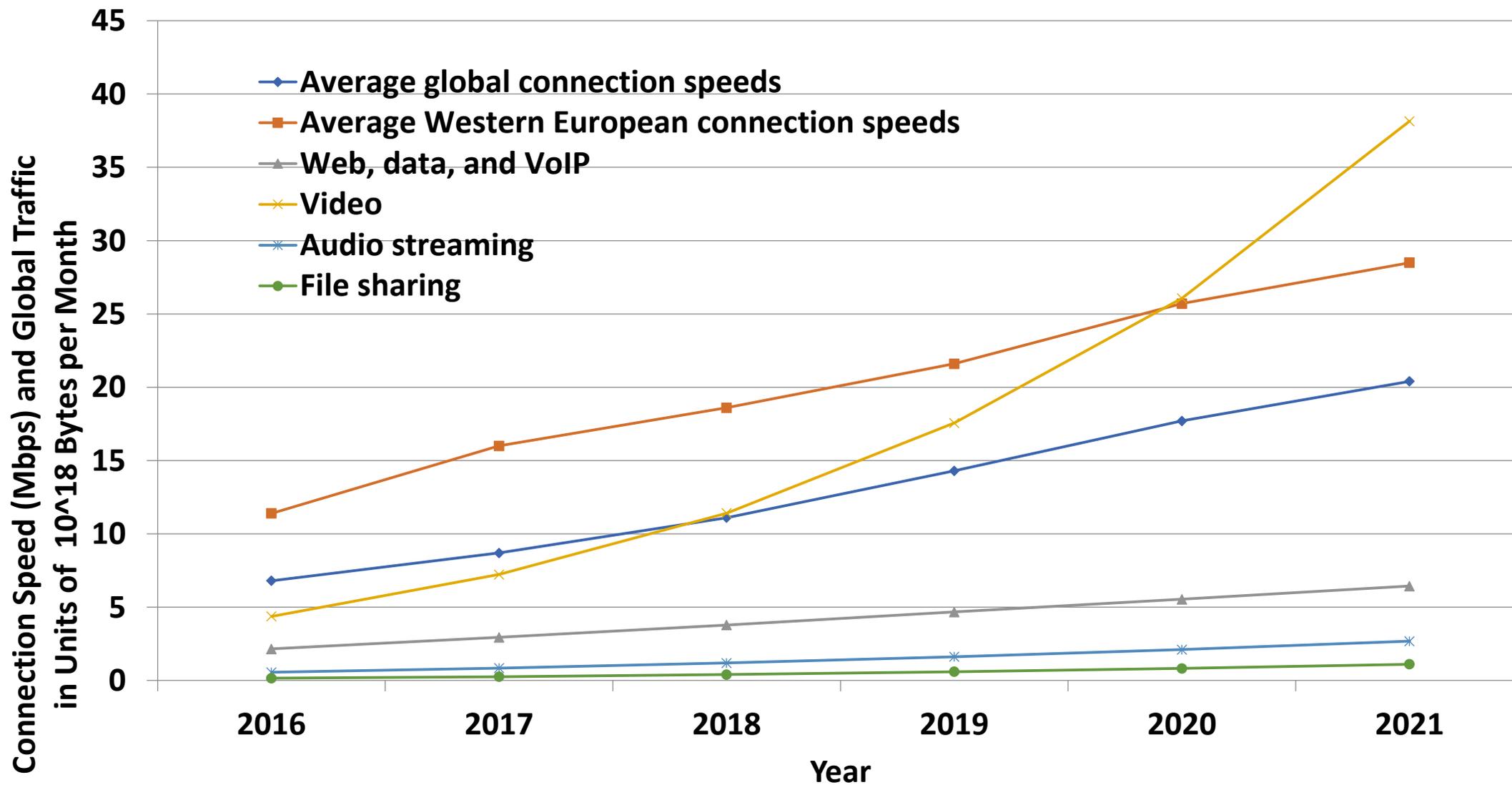
5G: Competition Amongst Communication Technologies

- Technology introduction can be commercially hazardous.
- Examples are:
 - ISDN lost out to broadband services for data and more recently SIP for voice;
 - SMDS and ATM had short commercial lives, yielding the high speed data space to MPLS.
- Longevity brings its own issues and many mobile applications still widely exploit GPRS, requiring mobile operators to incur the cost of its continued support.
- Many 5G use cases demand high bandwidth, but not necessarily mobility, making UltraBroadBand (UBB) a viable option. Wireless LAN supports growth in use of mobile devices, but can divert traffic away from the mobile network.
- In the mMTC area, wireless networks using low power consumption and unlicensed spectrum also provide competition.

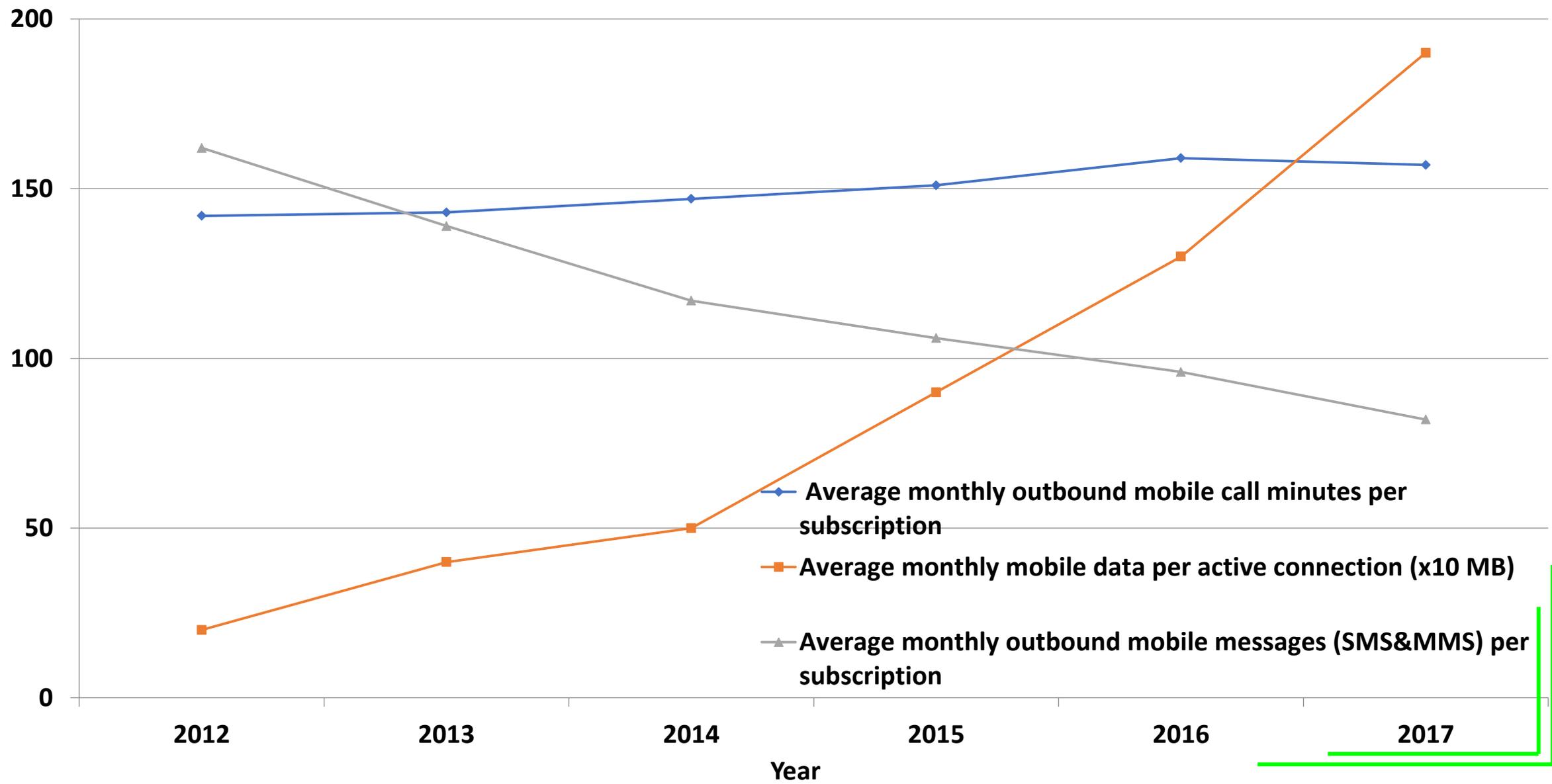
5G: the Market for Radio BroadBand (eMBB)

- How much value generated by 5G will flow to Mobile Network Operators (MNOs) is uncertain. Rapid traffic growth from Over-The-Top Providers video has been associated with declining average revenue per user.
- A pattern of revenues declining slightly, despite the rapid growth in subscribers and higher data volumes is seen across the world.
- Offload of traffic to Wi-Fi rather than cellular networks is an issue. During the peak commuter time data volumes on cellular networks peaked, while Wi-Fi use was higher in the evenings.
- Characteristically for mature markets, revenue accumulation lags traffic growth. Cost containment is imperative and much differentiation comes from creative tariffing.

Expected Connection Speeds and Usage for Mobile Networks Going Forward



UK Mobile Network Traffic Volumes



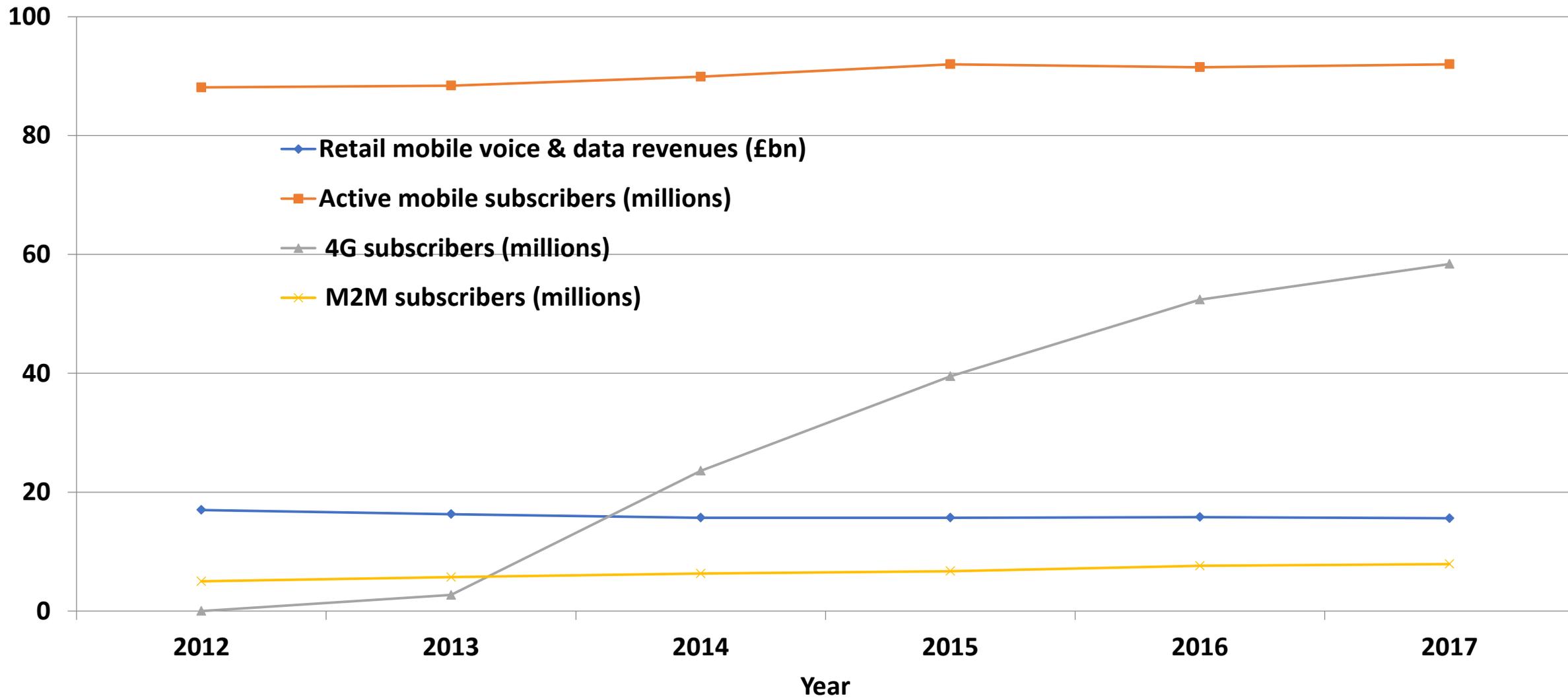
5G: the Market for Machine Communications (mMTC)

- mMTC offers density of the order of 1000000 nodes per km² with an evolution path from 4G services.
- Cisco predict a rapid rise in the number of M2M connections, but only a third of them connected to a mobile network. Numbers of mobile network connected and Low Power Wide Area (LPWA) M2M devices appear to be growing rapidly.
- There are differences in opinion on which applications will drive overall M2M growth.
- Smart Meters are a significant M2M application where systems integrators can take the lead and bypass MNOs as providers of the M2M network, using alternative network technology.
- Low Power Wide Area (LPWA) supports M2M applications requiring low bandwidth, wide geographic coverage and low power consumption, module and connectivity costs. It is expected to compete fiercely with 5G.
- LoRaWAN is a proprietary LPWA solution, uses unlicensed spectrum (868 MHz) and is limited to a transmission power of 25 mW or less.
- 5G technologies can support a range of Smart City scenarios as demonstrated by the 2019 FITCE congress, which included papers on autonomous vehicles and virtual reality (VR) enhanced tourism, fibre to the antenna, fibre based and 5G costs models for Smart City applications and the costs and benefits of deploying 5G enabled light poles.

M2M Projected Connections

TECHNOLOGY (Total values shown)	BILLIONS CONNECTIONS IN 2018	BILLIONS CONNECTIONS IN 2023	COMPOUND ANNUAL GROWTH RATE (CAGR)
Networked M2M devices	5.90	14.70	19.0%
M2M devices connected to a mobile network	1.14	4.45	31.0%
Smartphones connected to a mobile network	4.05	5.37	5.80%
LWPA connections	0.22	1.88	530%
Mobile connections	5.10	5.70	2.00%

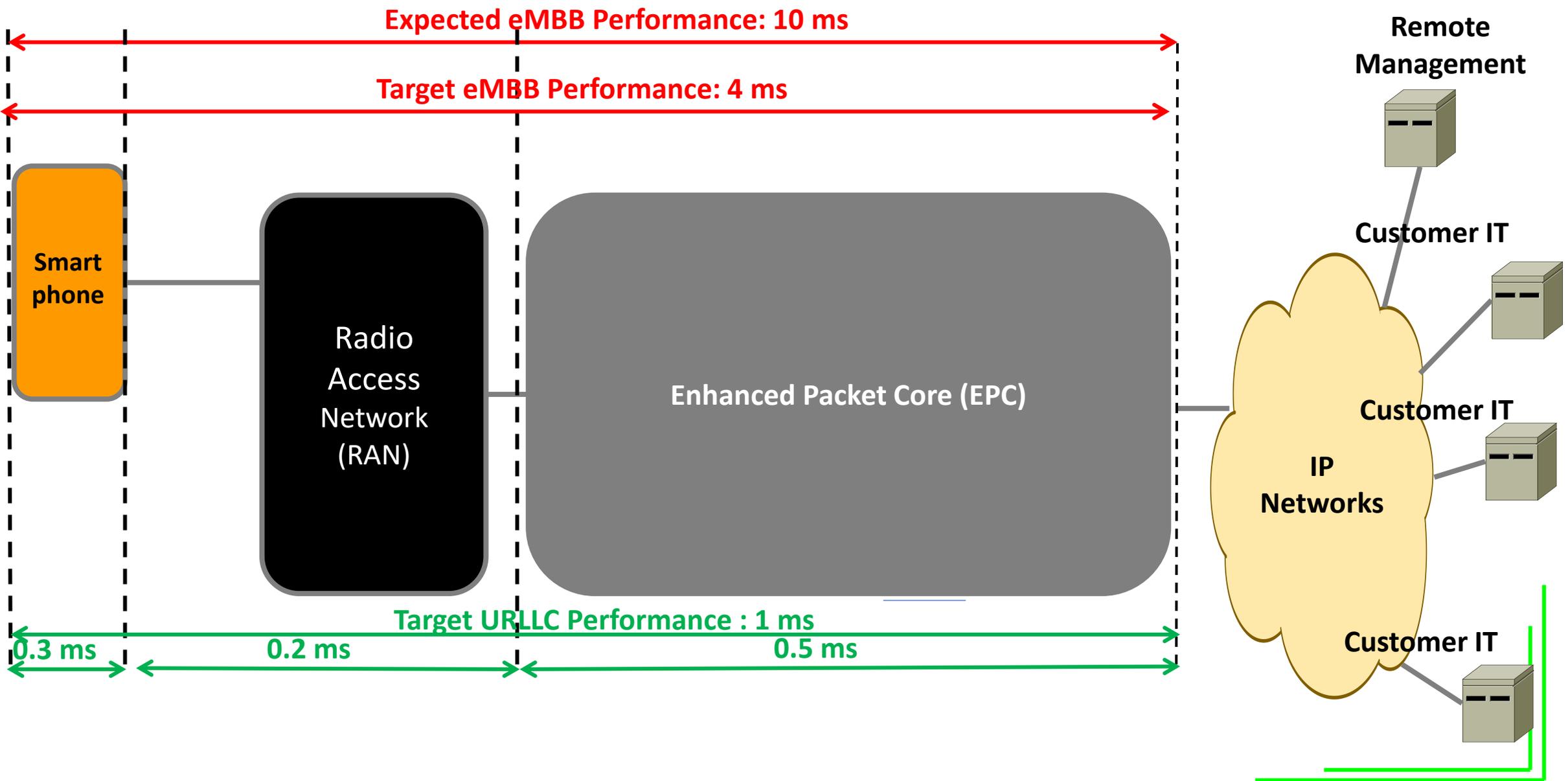
FTCE Mobile Data and Revenue Details from the UK



5G: the Market for Low Latency Communications (URLLC)

- URLLC requires a network latency of sub 1 ms, in comparison with LTE's 10 ms.
- This requirement for coverage of a small area and the use of a high frequency radio interface is commercially challenging and a private network or hybrid solution may be more effective than the Mobile Network Operator (MNO) network.
- URLLC will support emerging Augmented Reality (AR), Virtual Reality (VR), Edge Computing, Autonomous Vehicles and Immersive Multimedia Environments.
- Edge Computing has yet to be defined in detail but it may add operational complexity due to third party requirements.
- Connected Cars may not need 5G, but they will be able to use its enhancements and Autonomous Vehicles will require it.

URLLC – Latency Requirements



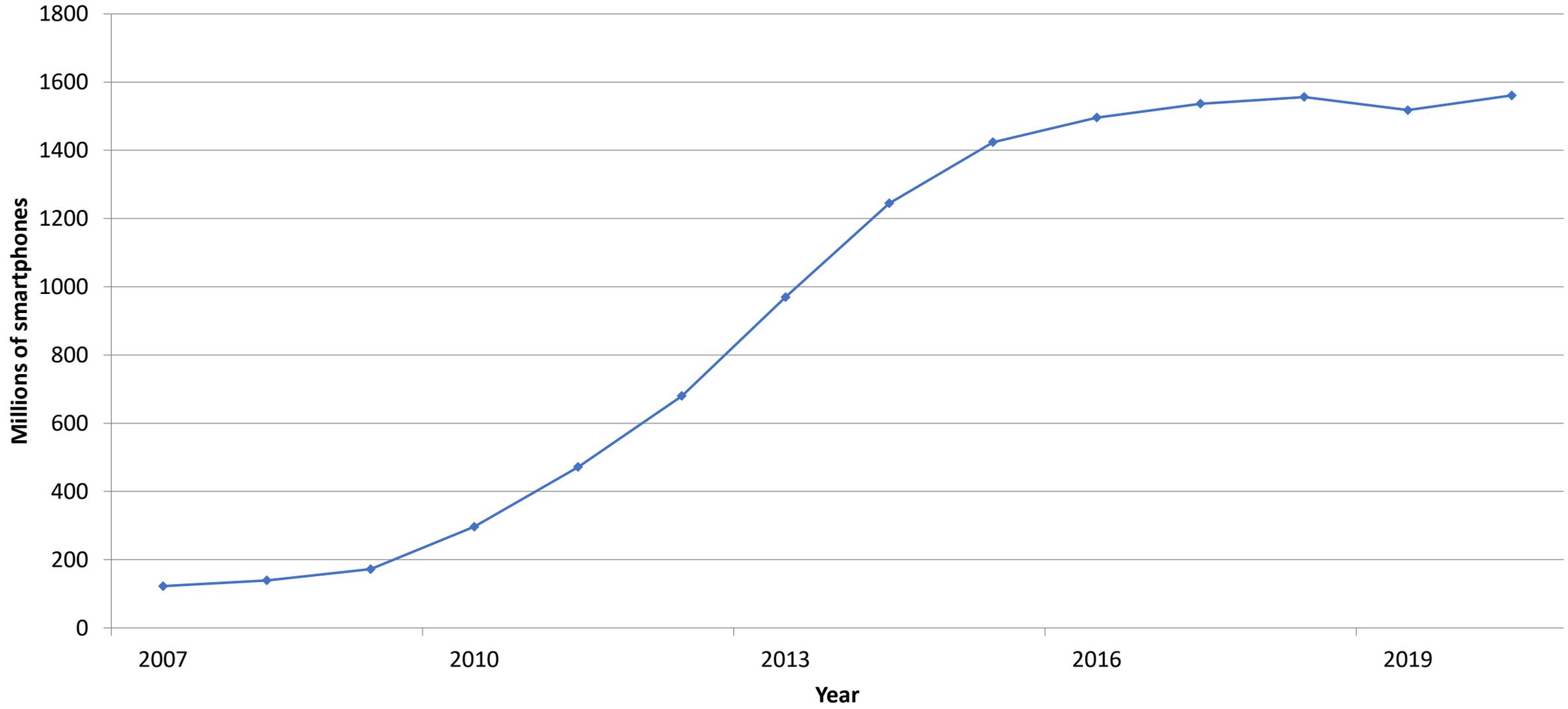
5G: Market Analysis

- The Braudel Rule: “freedom becomes value when it changes the limits of the possible in the structures of everyday life”. How does 5G satisfy this?
- What is the killer app that delivers this?
- 3G was driven by the Smartphone, 4G by OTT traffic.
- A McKinsey survey suggests that enhanced Mobile Broadband and the Internet of Things (IoT) are the most significant applications for 5G. Variations in business models need investment in Operational Support Systems (OSS) and Business Support Systems (BSS).
- Development of business cases, Operations and Maintenance strategies and commercial strategies significantly lags strategies for pilots and technology.
- Operators primarily see 5G as an opportunity to establish network leadership.
- New use cases are critical dependant on partnership, but whilst MNOs are proficient collaborating on standards, they have been less effective in collaborating with third parties.
- eMBB is a mainstream use case, but delivers much more bandwidth than appears to be required. What will take this from “feature” to “freedom” as social media/video did for 4G?
- Collaboration is vitally important, the Smart Meters case is a warning.
- For mMTC, high bandwidth case is at the convenience level and low bandwidth at low power is at the freedom level, but with well-established and attractive competition.
- Many applications require integration into a wider solution and therefore need bringing into line with a solution’s business.
- URLLC is the proposition at the earliest stage of development, with some clear technical challenges, which will impact its business case.

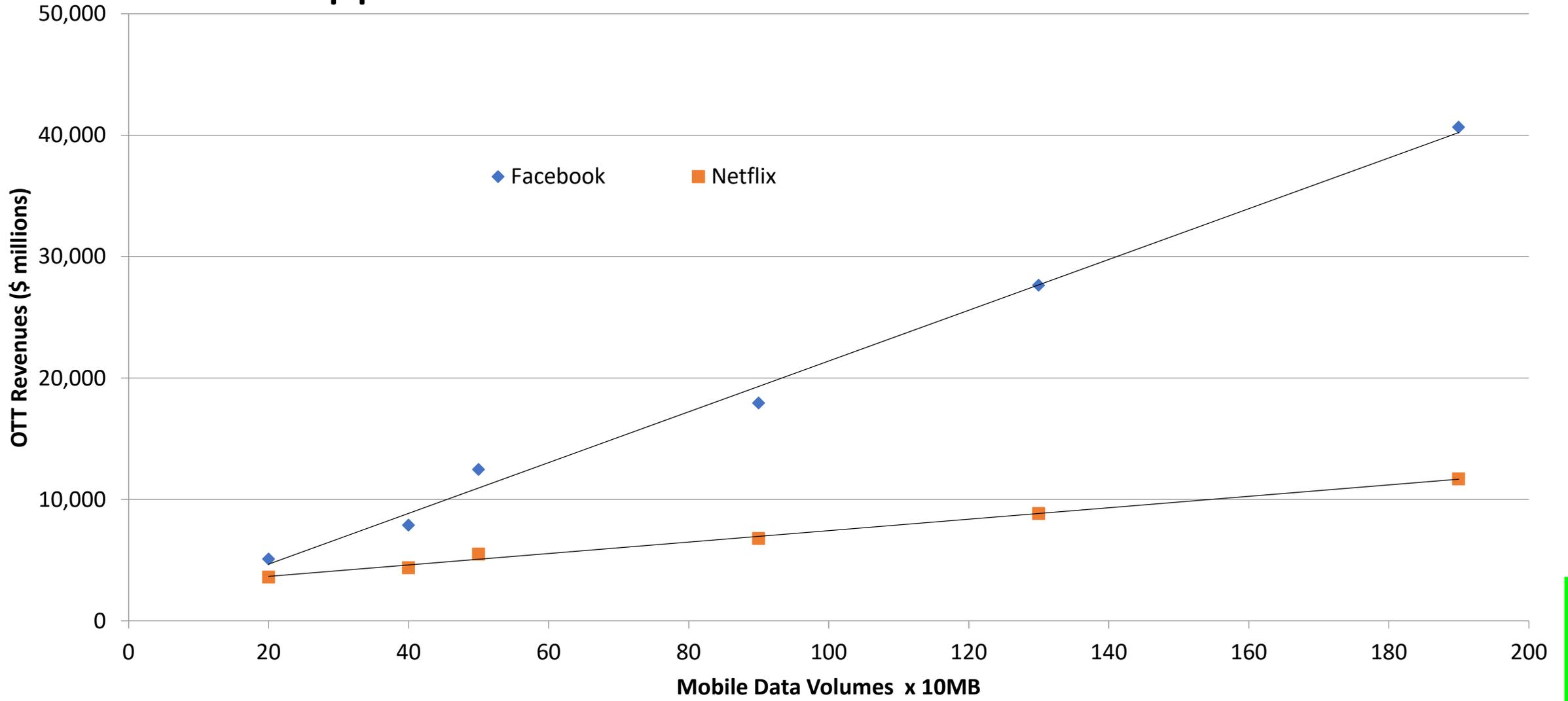
The Mobile Generations and Their Associated Killer Applications

GENERATION	KILLER APPLICATION	YEAR LAUNCHED
Analog	Mobile business voice	1986
2G	SMS and consumer mobility	1992
3G	Smart phone and Data	2003
4G	Video and OTT applications.	2012
5G	?	2019

The Saturating Smartphone Market



The Relationship between Mobile Data Volumes and New Applications Media Revenues



Examining the Maturity of 5G Technology in terms of Keen and Mackintosh's Matrix

	PROMISE	CHAOS AND CLUTTER	BUSINESS MAINSTREAM
Freedom	Monitor closely	Experiment	Make strategic
Convenience	Ignore	Avoid	Incorporate selectively
Feature	Distrust	Retreat	Buy at right price
No Clear Target	Do not invest	Short sell stock	Wish you had bought it
	↓	↓	↓
	URLCC	mMTC	eMBB

Conclusions

- There are challenges in rolling out a new infrastructure and this affects partnering decisions; technology overlaps may impact competition and market size.
- Roll out is expensive and cost saving strategies such as network sharing and automation are important.
- Other technologies can meet many 5G needs - technology markets have casualties as well as successes.
- The eMBB market will be price sensitive, with significant Wi-Fi overload, but will provide the bulk of revenues.
- mMTC challenges MNOs in the form of partnership requirements and competition from existing solutions.
- eMBB is the strongest proposition, but the application driving adoption has yet to be identified. A technologically driven white knight has ridden to the rescue in the past, this has also squeezed the profits of the operators.
- McKinsey identify Mobile operators seek to embrace the new opportunity and not be left behind technologically; but business cases are incomplete. The new applications identified by mMTC and URLLC may make a difference.
- A better understanding of the likely development of the market, by academia, regulators, adjacent sectors and operators is vital.
- MNOs need to understand the priority applications to focus on. Approaches involving the building of utility models, partnership analysis and optimisation may be helpful in analysing through the complexity of the market.
- The overlap with terrestrial services requires further non-consumer markets to be addressed to generate a sustainable business model requiring a change in thinking from the MNO industry.



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Edward Smith (Wokingham U3A – edward.a.smith@btinternet.com)

Mauro Ugolini (Università Roma Tre – mauro.ugolini@uniroma3.it)

Thank You for Your Attention!