



Mobile networks need supporting fixed line infrastructure now more than ever

Whitepaper

powered by

megabuyte

Foreword

UK mobile data growth of nearly 30% a year highlights clear demand for mobile internet access, video streaming, gaming, and remote working from the four MNOs (EE, Vodafone, Virgin Media O2 and Three). This is only likely to continue growing with 4G upgrades and 5G rollouts supporting faster, lower latency services.

In this whitepaper, prepared by Megabyte on behalf of BT Wholesale, I assess what this growth means for the underlying access and aggregation network infrastructure. Unsurprisingly, mobile networks need fixed line infrastructure more than ever before.



Philip Carse
Chief Analyst at Megabyte

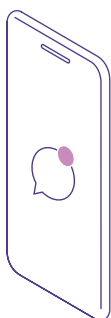
Megabyte

Megabyte is the leading source of independent intelligence on UK technology and digital businesses, providing proprietary data, insights and consultancy to the sector's leading CxOs, investors and advisers.

2

30%

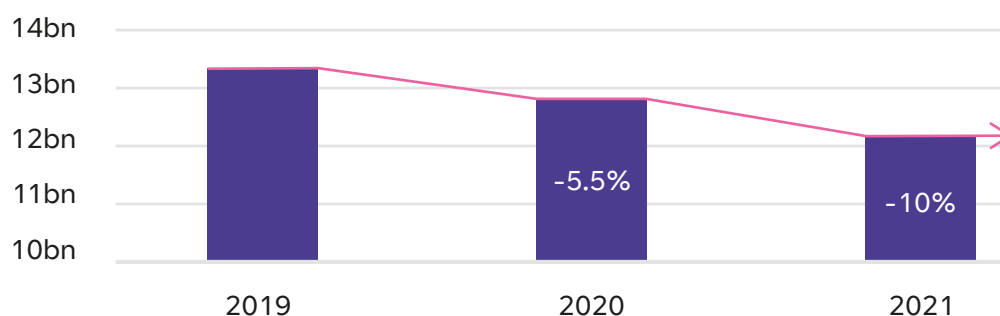
annual growth in
UK's data usage



Mobile numbers

On the face of it, the UK mobile market is fairly static. Ofcom for March 2021 reported 83.3m active mobile users (excluding machine to machine – m2m). This figure is actually down 1.2% since 2019. The MNOs generated annualised retail revenues of £12.1bn, down 5.5% in a year, and down 10% since 2019, albeit with a significant impact from lower roaming revenues and other pandemic impacts.

Annual MNO retail revenues



Mobiles are being used more for voice calls, up 8% to an annualised 194bn minutes. This is partly driven by the drop in business landline usage, with it **decreasing from 8.18m in 2013 to under 5m in 2019**, according to Ofcom. The pandemic and the move to remote working has accelerated mobile use further. SMS, however, was down a third to an annualised 38.5bn messages. There is clear evidence this is due to the continued success of IP-based alternatives such as WhatsApp.

The real change however, which is driving infrastructure investment, is mobile data volumes. These were up 28% to an annualised 5,100PB; and other data sources show similar 20-30% CAGRs (compound annual growth rates) over a longer time period with a similar projected growth rate over the next 3-4 years. For example, Vodafone's forecast is 25% CAGR.

Users aren't simply focusing on one technology, though. Mobile has 83.3m users and 194bn call minutes, while UK fixed line equivalents are 31.8m exchange lines, 27.4m broadband connections, and 45bn call minutes.

Mobile users

83.3_m users

194_{bn} call minutes

5,100 annual PB

UK fixed line equivalents

81.8_m exchange lines

45_{bn} call minutes

27.4_m broadband

add



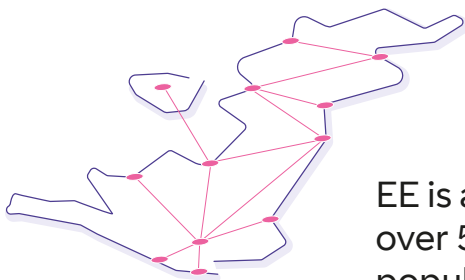
The 3Cs: coverage, capacity and customer

Whilst mobile data has grown at a fairly consistent rate, MNO network investments are more complex. Broadly, MNOs talk about three aspects of mobile service: coverage, capacity and customer (experience) (CX).

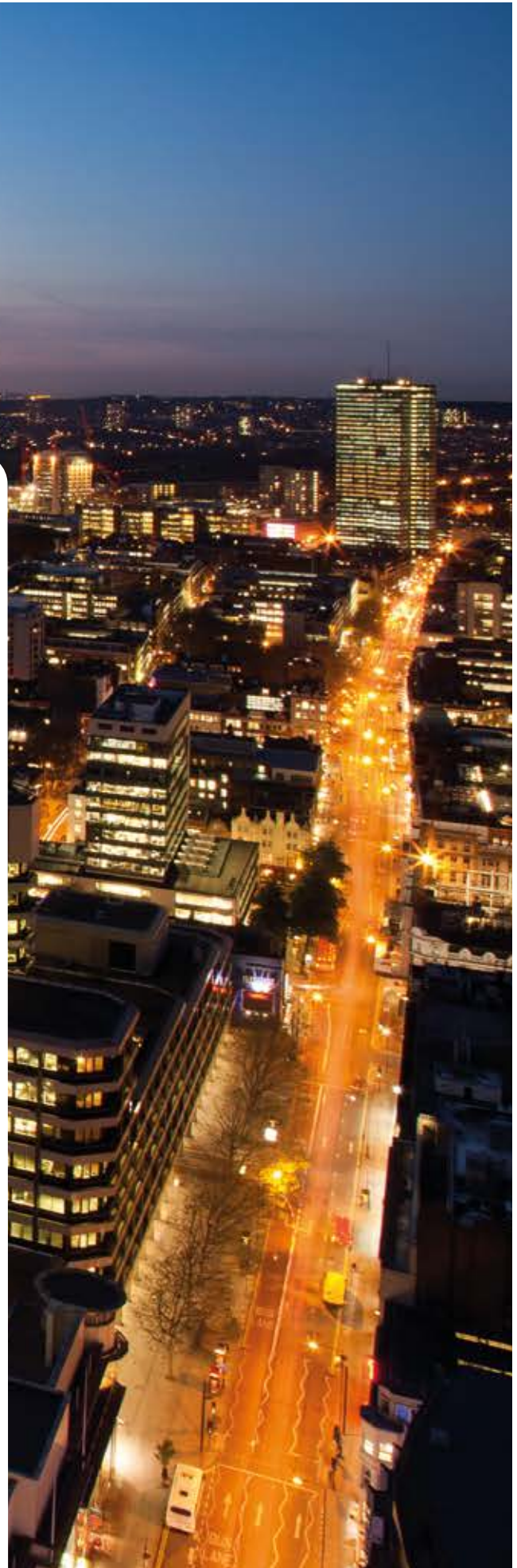
Coverage is primarily about expanding mobile services to very remote areas, whilst capacity is to meet those growing data volumes, which require different solutions for different types of environment (city centre, rural, indoor etc).

To put numbers on coverage; 2G, 3G and 4G networks each typically cover more than 99% of the UK population in outdoor environments and between 0.5 and 2.5% less in indoor environments.

However, geographic coverage is a lower mid-90th percentile for 2G and 3G and mid-80th percentile for 4G (according to VMO2 data). 5G coverage is still nascent; for example, 160 towns and cities for EE at March 2021. EE is aiming for over 50% 5G population coverage by 2023 and over 90% landmass coverage by 2028. It is also adding 4G coverage; over 4,500 square miles by 2025. Simultaneously, **VMO2 promises to reach 50% of the UK population with 5G services in 2023**. Vodafone forecasts, for its European operations, 5G's share of mobile connections rising from 2% in 2020 to 42% in 2024.



EE is aiming for over 50% 5G population coverage by 2023

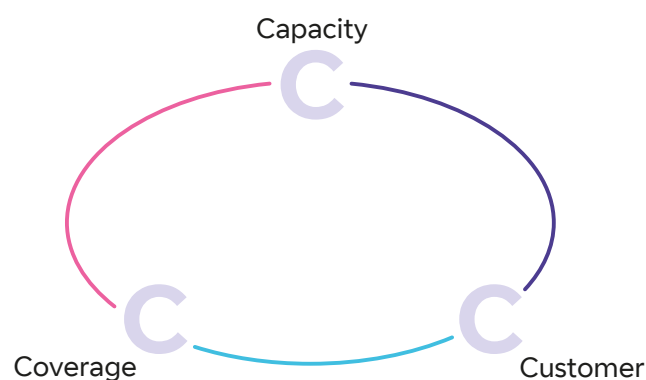




Customer experience (CX) is harder to define but recognises the differing needs of customers (e.g. consumer versus business) and solutions (e.g. services requiring very low latency and high bandwidth such as gaming versus low bandwidth ones including m2m/IoT monitors like smart meters). **Getting this right is critical as 65% of UK consumers believe CX is an important factor when it comes to making buying decisions, while one in three would walk away from a brand after a single bad experience.** Simply put, CX is directly linked to customer churn.

For providers, part of ensuring a good CX is understanding how technology can support new requirements, and the fact that new mobile technologies, especially 5G, support entirely new applications is a notable development. MNOs are already looking to converged fixed and mobile products to deliver better services/CX, a good example being BT's "Halo" product, a broadband router which uses the fixed broadband network as the core and the mobile network as a backup. In a similar vein, for mobile handset usage, Wi-Fi calling boosts service availability indoors, as well as shifting traffic to the lower cost of transmission within the fixed network.

Building blocks of network infrastructures



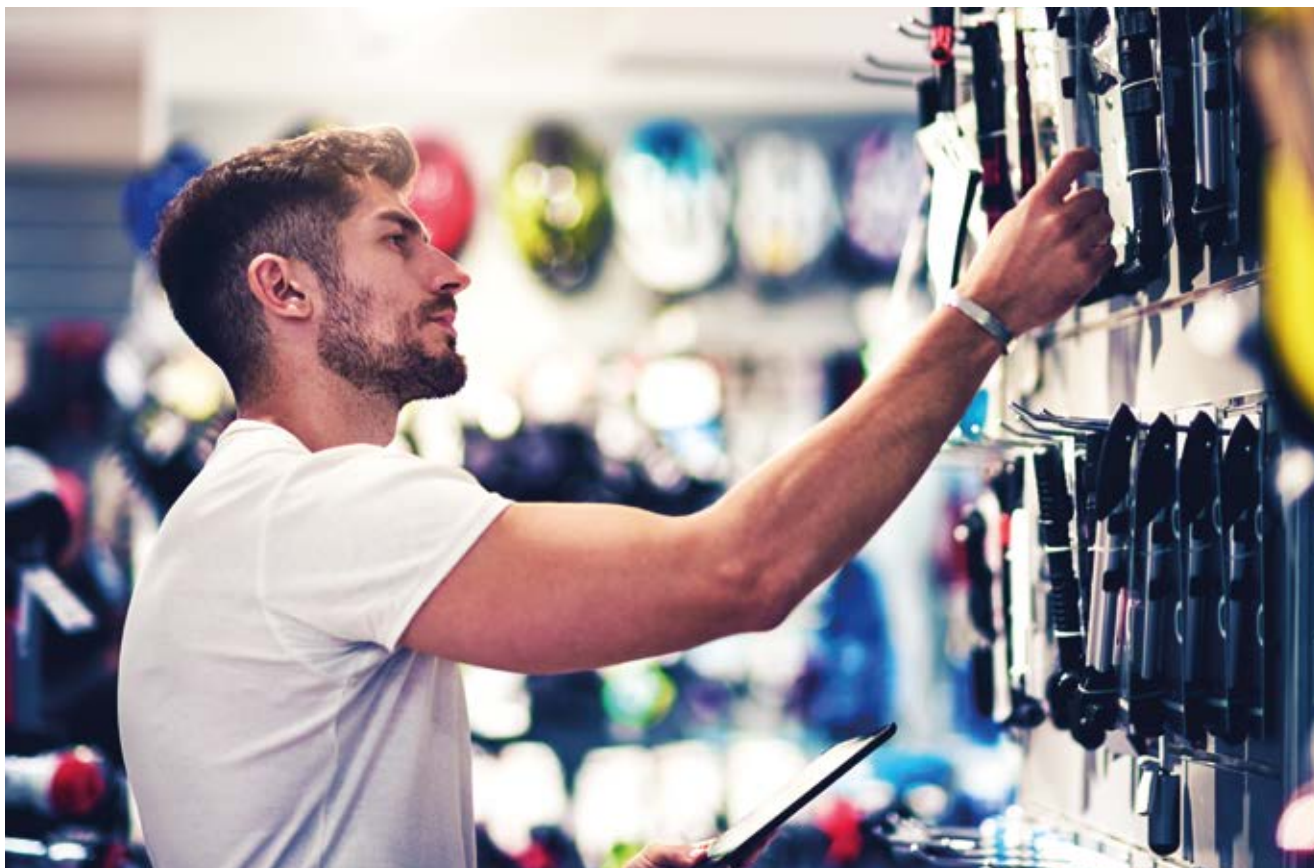
Meeting the 3Cs

So how are the mobile network operators planning to meet these evolving demands in terms of their network infrastructures? There are three essential and interrelated building blocks:

- Internationally recognised network standards, at the highest level represented by shorthand such as 2G, 3G, 4G and 5G, and specialised networks such as NB-IoT (narrowband networks for m2m/IoT) – these define service levels, standards and more. Even within more recent existing standards such as 4G, there are multiple variants, and continuous upgrades in capability in the so-called “releases”.
- Spectrum bands assigned to particular MNOs.
- The physical infrastructure, broadly defined as the access network (including towers, rooftop aerials, indoor access points and backhaul connectivity) and the core/aggregation networks.

As noted, these are all highly interrelated; spectrum availability drives the types of networks that can be provided, which in turn dictates the access and core network infrastructure. One thing is clear though; spectrum availability has increased significantly to meet actual and forecasted demand, and in particular the rollout of 5G networks, which in turn will drive a proliferation of access points and the required access and core network connectivity.

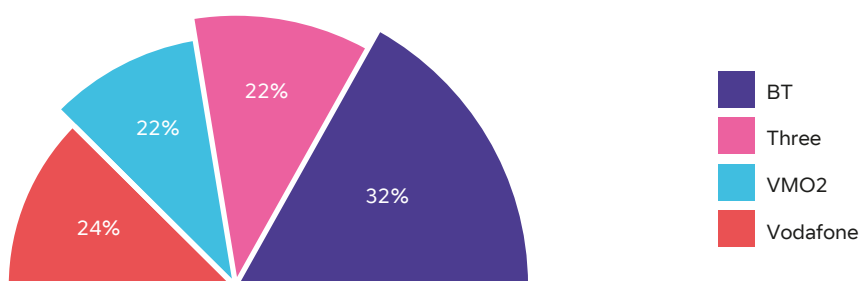




Spectrum auctions

Ofcom has held regular auctions of new spectrum to boost mobile capacities and new networks. As a historic aside, the most lucrative was the 3G auction at the height of the telecoms, media and technology boom in 2000, which raised £22.5bn. Subsequent auctions have been less lucrative but arguably more significant in service terms; for example the most recent 5G spectrum auction in March 2021 raised £1.4bn and increased available spectrum by 18%. It covered two spectrum ranges: 700MHz band aimed at serving wide area and indoor coverage, and 3.6-3.8GHz band aimed at urban capacity. And of course as a result of historic auction results, radio spectrum is split between the mobile network operators; overall BT has 32%, Vodafone 24% and VMO2 and Three 22% each.

Radio spectrum split by mobile network operators



Spectrum usage is also tied in with networks supported. Broadly speaking, 2G has a few more useful years left, supporting low power m2m/IoT applications and roaming, while 3G is likely to be phased out in the next few years to free up spectrum for 5G. 4G will become the mainstay for voice and continues to be expanded in coverage terms. 5G is very much about data. Turning off a network isn't easy, however. For instance, some 2G networks support critical telehealth applications, which would need to be actively migrated to other networks. It is a similar story on fixed networks, with most national telcos planning on closing the analogue PSTN network in favour of IP services, for example, by the end of 2025 in BT's case.

Base stations and small cells

Turning to infrastructure, and based on data provided by Vodafone tower subsidiary Vantage Towers for its stock market listing, there are around 35k mobile macro (i.e. 'large') sites in the UK owned/operated by the MNOs (in turn through O2/Vodafone – Cornerstone – and EE/3UK – MBNL – network sharing companies) and independent companies such as Cellnex and Wireless Infrastructure Group.

Most support more than one operator's network equipment. Further modest growth in macro sites is expected; for example, up to an incremental 2% by the Vodafone and O2 Cornerstone network sharing company by 2025, driven by rural coverage through the UK Government-driven Shared Rural Network.

Fewer additional macro sites are needed by EE, due to the historic investment into rural sites, partly to support the Emergency Services Network contract that it holds with the Home Office.

A real growth area in the access network will be in small cells, providing infill capacity in urban environments as well as coverage in rural areas where network volumes will be lower.

Low-powered cellular radio access nodes with a range from 10 meters to a few kilometres depending on the surrounding topography, small cells have been much hyped by interested parties over the years. It is reasonable to assume that there could be several tens of thousands of small cells in the UK within the next few years, both indoors and outdoors, owned/operated by MNOs, third party infrastructure providers (e.g. neutral hosts) and enterprises.





All of these new mobile access points/sites require connectivity, whilst core networks need upgrading to cope with increased data. In addition, 5G requires new network topologies to fully leverage its low latency capabilities. Core networks are almost entirely fibre based, with ongoing upgrades to 10Gbps and well beyond that figure in some cases.

The access network is slightly different; there has been a steady shift to fibre backhaul for a majority of cell sites, but fibre is not practical or economic in some circumstances. For example, remote areas, very urban areas with “wayleave” issues where circuits need to traverse private land, and where wireless backhaul is used instead.

Also increasingly being added to the mix is satellite; for example, BT uses 1k VSAT terminals for extreme rural areas and for resilience, and has made a recent announcement with low earth orbit satellite provider OneWeb to explore similar use cases.



5G accelerating

Meanwhile, the rollout of 5G requires new core networks to leverage very high data rates and low latency, particularly supporting applications at the edge of the network. For example, Three's new 5G core network divides the UK into ten regions, each with two data centres and multiple connectivity.

Much of the data generated by 5G applications is likely to be stored and processed in public Cloud environments, and the major providers Amazon Web Services and Microsoft Azure have increasingly been working with the MNOs to support these emerging trends. Microsoft has been buying 5G networks skills

(for example acquiring Metaswitch), highlighting how an increasing proportion of data volumes will be carried over mobile networks.

Also of interest are private 5G networks, where 5G's ultra-high bandwidth and low latency supports applications that are simply not possible with existing wireless networks such as 4G and Wi-Fi. Multiple trials and use cases are emerging typically involving environments such as ports, manufacturing plants, hospitals and schools. Note that a 'private' 5G network can cover a wider area than just a campus environment using network virtualisation.

Summary

Fundamentally, much of the UK's four mobile networks infrastructure relies on BT's local exchange footprint, through local loop unbundling, and in fibre and radio connectivity services provided by companies such as BT, Virgin Media and Vodafone. Although, some more specialist providers such as CityFibre, Zayo and Neos Networks have entered the market in recent years.

Annual growth in data volumes of up to 30% barely tells half the story in terms of required network upgrades. The proliferation of network access points through small cells to add coverage and capacity will require a significant increase in backhaul links, whilst the rollout of 5G requires new core networks to truly leverage its high bandwidth and low latency capabilities and the shift of application processing to the edge of the network. Fibre is the predominant fixed line network technology, but there is also a role for radio and satellite.



About BT Wholesale

The way businesses communicate is changing. As the legacy network switch-off gathers pace in 2021, businesses need technology that is fit for the future. BT Wholesale is offering a partnership that will take you and your business further, as you move your customers to digital. Together we can transform your sales potential with a single, scalable solution and equip you with the knowledge you need to sell.

BT Wholesale's Mobile services include solutions, technologies and information we've developed specially for mobile network operators and mobile virtual network operators. You are supported by our market-leading reach, coverage, speed and reliability from the most reliable fixed and mobile network that protects the UK's critical national infrastructure. What's more, we're future-proofing our network to enable next generation access and pave the way for future technologies.

Get in touch

Email: btw@bt.com

Visit: btwholesale.com/all-ip



Offices Worldwide

The services described in this publication are subject to availability and may be modified from time to time. Services and equipment are provided subject to British Telecommunications plc's respective standard conditions of contract. Nothing in this publication forms any part of any contract.

© British Telecommunications plc 2020. Registered office: 81 Newgate Street, London EC1A 7AJ. Registered in England No. 1800000.

March 2022