

# How 'mobile-centric' fibre networks will make the UK a 5G leader

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# Executive summary

The UK's mobile network operators face a huge obstacle.

They need affordable dark fibre to link cell sites if they're to keep adding capacity to 4G networks in dense urban areas and to make a start on 5G.

## **But it's not readily available.**

This puts the UK on the back foot compared to many other large economies, where a combination of more favourable regulatory regimes and investment in fibre to the premises make it easier for MNOs to source affordable fibre infrastructure and roll out 5G.

If the UK doesn't surmount the hurdle, then customers and future investment in 5G will suffer.

This whitepaper looks at how the UK's MNOs can work with each other and with fixed infrastructure providers and investors to drive change. It advocates a cost-effective approach to fibre network deployment that meets MNOs' future network requirements while supporting fixed operators' full-fibre roll-out.

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# Introduction

The UK government has big ambitions for 5G.

It wants it to be part of providing “world class digital connectivity that is gigabit-capable, reliable, long-lasting ... – and to do so at pace.”<sup>1</sup>

And it recognises that “5G will require dense fibre networks.”

But there’s a hitch. The UK’s MNOs don’t have regulated access to the wholesale dark fibre networks they need to transport large and fast-growing volumes of mobile data.

Without affordable fibre access, 5G will remain largely stuck in the slow lane.

More immediately, a lack of wholesale dark fibre is already testing MNOs’ ability to add capacity to 4G networks.

But MNOs are capable of breaking the impasse by grouping together to build ‘mobile-centric’ fibre networks. These would carry MNOs’ aggregated traffic in the very busiest parts of their networks, such as central London.

With the right design, ‘mobile-centric’ fibre networks will have a significant impact on MNOs’ total cost of ownership (TCO). Essential, given operators’ competing investment priorities in spectrum, services and mobile infrastructure.

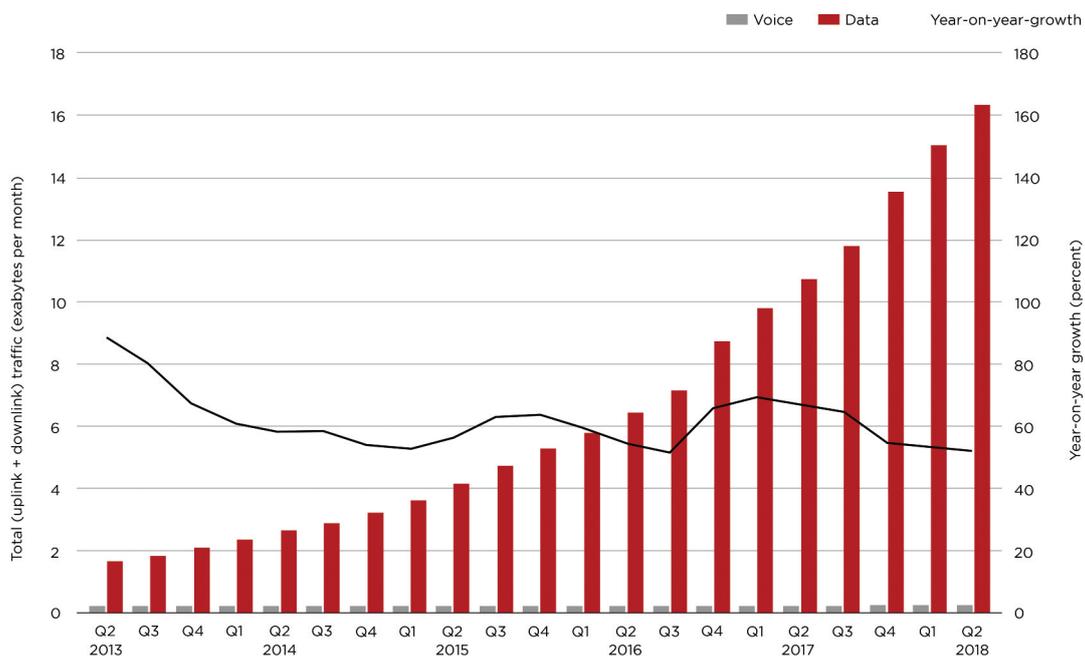


1. <https://www.gov.uk/government/publications/future-telecoms-infrastructure-review>

# Why we need mobile-centric fibre networks

The constant rise in mobile data traffic is already putting 4G networks under pressure in dense urban areas.

In its 2018 annual mobility report<sup>2</sup>, Ericsson reported that mobile data traffic worldwide grew 52 per cent between Q2 2017 and Q2 2018. The equipment manufacturer forecast mobile data traffic will continue to rise at a compound annual growth rate of 43 per cent by the end of 2023.



Source: Ericsson traffic measurements (Q2 2018)

And this forecast does not include traffic generated by fixed wireless broadband access.

One way to ease the strain on 4G networks is to create more capacity by using small cells to

densify networks.

But overall the move to use small cells in the UK has been slow and tentative, partly because of the lack of dark fibre to provide backhaul.

“There would be wider deployment of small cells in the UK if operators had a viable way to connect them. Dark fibre rings are the best technical solution, but they’re not available. What we have are [fixed wholesale] networks built for point-to-point and business-to-business use. They’re difficult and expensive to deploy and aren’t really suitable for mobile.”

Derek McManus, Chief Operating Officer, Telefonica UK (O2)

2. <https://www.ericsson.com/en/mobility-report>

This will need to change if operators, such as O2, are to prepare their networks for 5G.

One of the advantages of using dark fibre for 5G backhaul is its flexibility. It allows operators to use their own equipment to light and run their networks, which gives them greater control over their costs and operations. It's also cheaper than a lit, managed service.

Although under current UK regulations wholesale fibre network operators are under no obligation to lease dark fibre to mobile operators.

BT's EAD/LA product dominates the market for managed leased line services and mobile operators have little choice but to use it for backhaul.

For now, BT's Openreach is the leading provider of managed mobile backhaul services.

In its 2016 Business Connectivity Market Review (BCMR), Ofcom said communication service providers should be able to buy Openreach's un-lit fibre to deliver their own connectivity services.

As a result, Openreach was on the brink of launching a wholesale dark fibre access product in 2017. Yet, it was able to ditch its plans when it won an appeal against Ofcom's ruling.

The upshot is that Openreach isn't selling dark fibre nationally. And companies that do, the UK Alt.nets, face little pressure on pricing as a result.

UK Alt.nets are well established, typically serving the metro business communities in the biggest cities. But, Mentor's map of mobile demand shows these metro fibre networks rarely extend to the areas of highest mobile usage.

The UK's MNOs are getting by today - but only just. Traffic growth in the busiest areas is challenging fibre constrained capacity solutions.

Longer term, it doesn't make financial sense for them to rely on lit wholesale services to support 4G network densification - never mind 5G's high bandwidth and low latency network needs.



And as the French regulator, ARCEP, points out, small cells will be essential if MNOs are to provide 5G access speeds of as much as 10 Gbps in the 26GHz range.

Estimates of the number of cell sites an operator will need per km<sup>2</sup> in densely built up areas vary greatly – ranging from 50 to 350.

Typically, a BT 1G EAD line used for backhaul costs approximately £2,000 per year, rising to £4,000 for a 10G EA line. Any eventual decline in these prices is likely to be offset by the growth in mobile data usage driving operators to upgrade to 10G and 100G connections.

Such levels of pricing not only hold back MNOs from installing small cells, they are likely to prevent them from harnessing technology such as 'Massive MIMO' (multiple-input/multiple output) antennas.

MIMO adds together signals from many base stations and antennas to increase network performance and capacity.

In the US, Sprint is using MIMO to create '5G ready' networks in six cities and expects the technology to increase its current data capacity tenfold.<sup>3</sup>

Whatever route UK operators decide to take towards 5G, they can only plan for it with a clear

map of their backhaul and fronthaul requirements and local fibre availability.

But today the UK's MNOs don't know what dark fibre availability will look like, or how much it will cost – or, worse, who will provide it.

Ofcom is working to make it easier and cheaper to build new fibre networks. The UK regulator has instructed Openreach to provide ISPs with physical infrastructure access (PIA) to its existing cable ducts and telegraph poles – and to make sure the ducts are ready for use.

Ofcom believes PIA could halve the cost of laying fibre, since much of the cost of laying new networks stems from civil engineering.

The Government has also proposed delivering unrestricted access to Openreach's ducts and poles for both residential and business use. This would include essential mobile infrastructure, giving MNOs greater freedom to create networks that meet their specific requirements.

Ofcom's plan is to introduce a revised PIA in April 2019.

But, for now, the UK's operators are falling behind in the race to 5G, despite their service creativity and their customers' enormous appetite for mobile data.



3. <http://newsroom.sprint.com/sprint-unveils-5g-ready-massive-mimo-markets.htm>

## An island apart

In other major economies, the picture looks very different.

In the US, Crown Castle, which leases shared use of towers, small cells and fibre to mobile operators, is seeing rapid growth in demand for its fibre-linked small cells.

It says the service's profitability depends on aggregating the traffic of two or more operators.

"We are ... sharing the asset across multiple tenants to drive attractive returns, and it's playing out better than we could have expected," said Crown Castle's CEO Jay Brown, when discussing the company's small cell business during the company's Q2, 2018 results call.<sup>4</sup>

"All of this increases our conviction to continue to invest in fibre. It's remarkable how similar the opportunity around small cells and fibre is to the early days of the tower business."

Meanwhile, Verizon is using its fibre to the home and fibre to the building networks [FTTH/B] to underpin its 4G and 5G networks.

Nicki Palmer, chief network engineering officer and head of wireless networks at Verizon, said about the company's investment in FTTH/B: "It will help expedite our network densification, enhance our industry-leading 4G LTE network and lay the groundwork for 5G."<sup>5</sup>

The US is among the many major economies that are ahead of the UK when it comes to FTTH/B deployment.

With the right regulation in place, FTTH/B networks have the potential to bolster MNOs' network rollout.

The French regulator, ARCEP, for example, expects the country's fast-growing fibre networks to link 5G antennae and is examining

the conditions under which operators deploying a FTTH network should provide a base station connection solution. Currently 28 per cent of French homes are connected to fibre to the home, compared to three per cent of UK homes.<sup>6</sup>

Today the FTTH/B global leaders are in Asia – and they're the countries that look set to dominate initial 5G development and service roll-out.

**"The UK does not even feature on the FTTH Europe Council's ranking of the top 65 countries worldwide for FTTH/B coverage"**

David Hilliard, Mentor Chief Executive<sup>7</sup>

According to the FTTH Council Asia, the rate of homes passed with FTTH as a percentage of total households stands at nearly 100 per cent in Japan; 100 per cent in Singapore; 98 per cent in South Korea and 86 per cent in China.<sup>8</sup>

South Korea, which along with China is vying to be a world leader in 5G, has offered financial incentives to encourage operators to upgrade FTTH/B networks so that 50 per cent of the population has access to 10Gb Internet access speeds by 2022, according to news reports.<sup>9</sup>

The South Korean minister of science and IT sees the networks as the means to create a strong foundation for new services, including 5G.

4. <https://www.fool.com/earnings/call-transcripts/2018/07/20/crown-castle-international-cci-q2-2018-earnings-co.aspx>

5. <https://www.verizon.com/about/news/what-network-bandwidth>

6. [https://www.arcep.fr/fileadmin/reprise/dossiers/programme-5G/Programme\\_de\\_travail\\_5G-English\\_version.pdf](https://www.arcep.fr/fileadmin/reprise/dossiers/programme-5G/Programme_de_travail_5G-English_version.pdf)

7. [http://www.ftthcouncil.eu/documents/IDATE\\_European\\_FTTH\\_B\\_panorama%20\\_at\\_Sept\\_2017\\_VF.pdf](http://www.ftthcouncil.eu/documents/IDATE_European_FTTH_B_panorama%20_at_Sept_2017_VF.pdf)

8. <https://www.itu.int/en/ITU-D/Regional-Presence/AsiaPacific/Documents/Events/2018/ssceg2018/Presentation%20and%20Bio/Session%204%20Steve%20Foster.pdf>

9. <https://www.businesswire.com/news/home/20180502005544/en/Aquantia-Collaborates-KT-Deliver-Multi-Gig-Ethernet-Korean2022>

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# Can the government's full fibre project solve the problem?

The UK government recognises the economic and social importance of developing dense fibre access networks as well as 5G.

Ofcom has said it wants Openreach to replace its copper access network and is encouraging the whole industry to invest in what it calls 'full fibre' fixed networks.

It's a welcome development and one that opens opportunities for mobile operators.

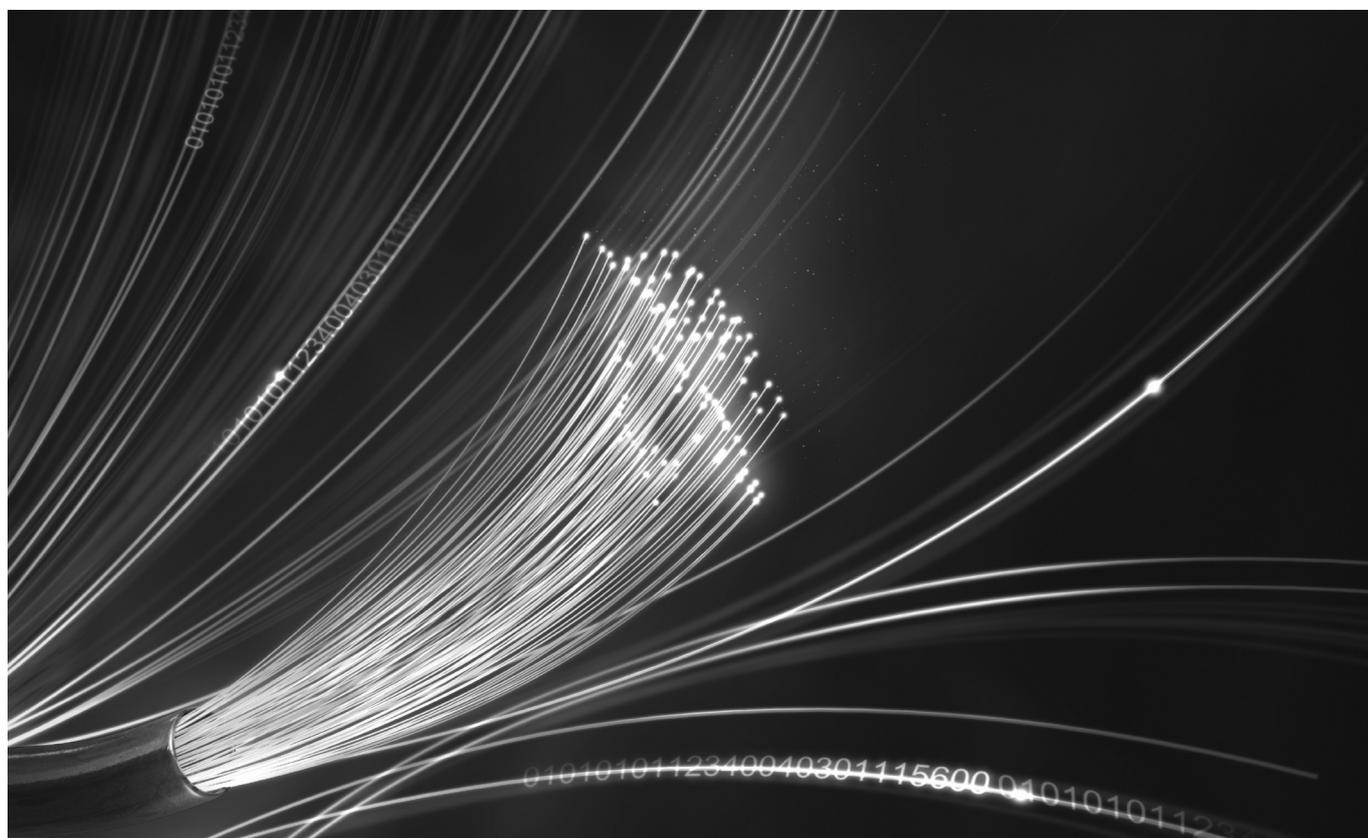
'Mobile-centric' fibre is a full-fibre network that has the capability to be extended into residential and business broadband usage.

Fixed operators' full fibre deployments are likely to initially target prime residential areas, whereas

'mobile-centric' fibre networks will focus on adding capacity to mobile hotspots in central London, and possibly in major cities such as Birmingham and Manchester.

Investors in a 'mobile-centric' network can cut their costs and bolster their business case by taking a mixed economy approach, which combines the use of existing commercial fibre networks, fibre in sewers and new digs to bring network rings close to mobile sites.

And PIA could allow a 'mobile-centric' network to use the last quarter mile of BT's duct and pole network to extend full fibre into homes and businesses, creating the opportunity to partner with broadband service providers.



# 5G won't fly without Fibre

It's not just the cost of transporting data over managed leased lines that should encourage MNOs to create shared dark fibre infrastructure in the areas of densest mobile use.

5G ushers in a major change to mobile network architecture. Operators are rethinking their radio access network [RAN] design as they pave the way towards flexible, software-defined networks that are easier to manage and which simplify the delivery of new applications.

One of the initial moves has been the drive towards centralised RANs (C-RANs).

C-RANs let operators centralise crucial functions that are currently performed on cell towers, such as baseband processing.

With a centralised system MNOs can increase effective network capacity by coordinating radio resources, while reducing operational costs.

But operators will need to connect the centralised RAN with remote radio heads. And to do this they'll need fibre.

China Telecom, Korea's KT, Japan's NTT DoCoMo, and Verizon in the US are among C-RAN's advocates. They either operate their own FTTH/B networks or are based in countries with dense fibre access. Without dark fibre connectivity, C-RANs risk being prohibitively expensive.

MNOs are also looking at how to re-architect RANs to harness the benefits of network virtualisation.

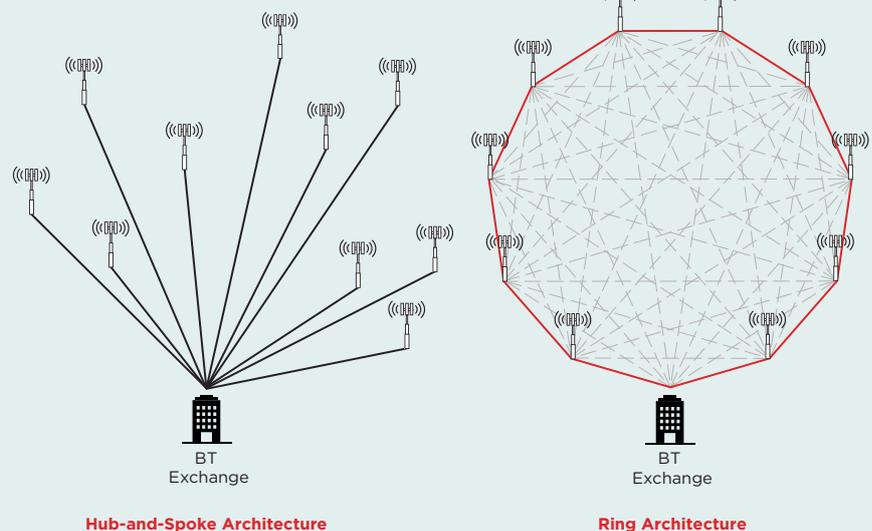
Deutsche Telekom, AT&T, SK Telecom, Verizon and Telefonica are among the members of xRAN.org, which is working to develop and standardise a software-based, extensible RAN (xRAN).<sup>10</sup>

"The xRAN architecture transforms today's static, highly proprietary RAN infrastructure into an extensible, software-based service delivery platform capable of rapidly responding to changing user, application and business needs," according to the xRAN organisation. Again, such a shift depends on the availability of fibre.

MNOs may be able to delay RAN transformation in the immediate term, but increasing data volumes, demands for high latency and the need to make operational costs savings will drive change – and the need for dark fibre-based connectivity.

## The architectural benefits of 'mobile-centric' networks

**Mentor's 'mobile-centric' fibre network design better equips operators for mesh networking, edge computing and virtualisation. It replaces Openreach's hub-and-spoke design, which was built to run analogue telephony over copper wires, with a ring architecture. This eliminates the inefficiencies that arise from routing all macro-micro interworking through the Openreach exchange.**



<sup>10</sup> <http://www.xran.org/members/>

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# Why operators need to co-invest in fibre networks

Even though the architectural advantages of a 'mobile-centric' fibre network are clear, it still only makes business sense to build one if it works out less expensive than using wholesale services.

The simplest way to keep costs down is to have at least two MNOs share investment in the network that carries their aggregated mobile data traffic.

In dense urban areas, a single operator would see little financial benefit from going it alone on a fibre network build.

Mentor calculates that over a twenty-year period, a 'mobile-centric' network offers little or no total cost of ownership gains for a single operator.

In contrast, a network investment shared by two MNOs would deliver a considerable reduction in TCO.

Even limited network densification, for example x2, would bring the total cost of a small cell's support infrastructure, including backhaul, to within £1,500 or less per year when two operators share a 'mobile-centric' fibre network. This is important as £1,500 is the cost threshold for small cells to become viable.

This calculation is based on bringing fibre within 10 metres of the tower and cell sites on the most densely used parts of an MNO's network.

Mentor's design, which draws on its mobile demand maps, shows that TCO reduces by a further 20 per cent if a third operator takes part in creating and using the network.

Mentor can guide MNOs on where to lay fibre, right down to the individual site grid reference. Mentor can also help them roll out fibre networks quickly, in priority areas, so that they can serve their customers' 4G mobile data demands cost-effectively.

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# Conclusion

A 'mobile-centric', highly targeted, approach, to creating fibre networks based on aggregated demand will put the UK's MNOs in a much stronger position in the race towards 5G. It will reduce MNOs' costs and generate large amounts of fixed capacity, allowing them to densify their 4G networks and plan longer-term for new 5G services.

Mobile operators already have experience of how sharing infrastructure can help them manage their costs. And since a 'mobile-centric' network will incorporate large quantities of spare dark fibre capacity, which complements full-fibre access builds, its business case can be further strengthened by partnering with broadband players and other investors.

By combining efforts, the UK mobile industry can drive investment in 'mobile-centric' fibre networks to improve their network architecture and give them a sound basis from which to launch 5G innovation.



Mentor has three solid decades of experience in running complex programs in the UK and European Telecoms markets. Breaking new ground by helping to create some of the first wave of Alt.net deployments, Mentor worked behind the scenes with most of the UK's infrastructure players.

Today, Mentor is helping mobile operators, fibre providers and infrastructure players to figure out how to respond to the huge opportunities presented by 4G densification and the move to 5G. Specifically for:

- mobile operators – crafting new design and deployment schemes for fibre networks and optical solutions across their core and access networks.
- fibre providers - designing solutions that meet the unique architecture, operational and business case requirements of the mobile operators.
- infrastructure players, and their investors, as they look to earn new revenues from the opportunities presented by the move to 5G.

With our strong industry relationships and independence – combined with deep design, operational and commercial experience – Mentor is the natural partner to help you develop compelling multi-party business cases for 'mobile-centric' fibre; support your internal teams; and, help get the job done faster than you might think.

**Why roll the dice? Get in touch with us now.**

**[mentoreurope.com](http://mentoreurope.com)**

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