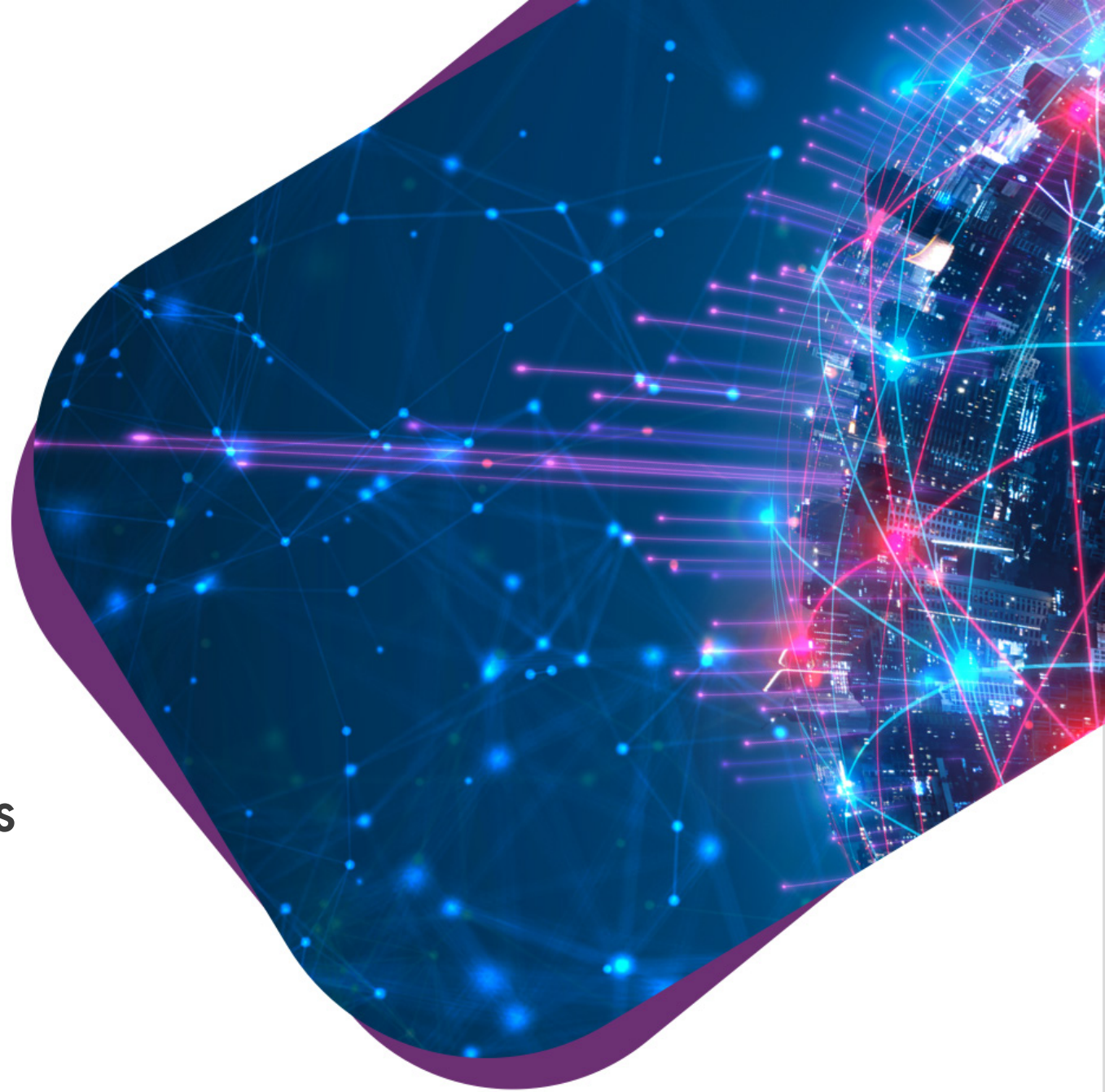# esri UK
THE SCIENCE OF WHERE™

The Race to 5G and Full Fibre:

How Telecoms, Media and Entertainment Leaders are Reshaping the Future

Produced by

TechPros.

Contents

Executive Summary

The future of a connected Britain rests on the widespread availability of 5G and Full Fibre to homes and businesses.

Advances in Artificial Intelligence, Machine Learning, Autonomous Driving, Smart Cities, and the Internet of Things, will only be realised by building resilient networks; those able to offer faster speeds, greater bandwidth, and low latency.

Alongside this, the UK Government's levelling-up agenda cannot succeed if 5G and Full Fibre aren't quickly connected within more regional and rural areas, to match the high-speed offerings already in place in so many bigger urban towns and cities.

However, for the network operators and vendors, this is a complicated journey to navigate. The race towards 5G and Full Fibre is a marathon, not a sprint, and there are many hurdles to leap over, as well as plenty of obstacles in the way of success.

In this eBook, sponsored by Esri UK, we will examine the opportunities and challenges offered by both communication technologies, and explore how the infrastructure to support this is being installed above and below ground.

As part of that, Techpros.io has taken the pulse of the telecommunications industry, speaking to many experts working in this space, from the big players to the alt-nets. The views that follow demonstrate the power of change on the horizon.

For its part, Esri brings its experience to this e-book of working with telcos and alt-nets across the UK, and globally. As the global market leader in Geographic Information System (GIS) software and Location Intelligence, it delivers solutions ranging from a digital twin of the network to OSS/BSS integration, as well as network planning. Esri UK clients include BT, Openreach, Vodafone, and EE.

As you read through the following pages, **you will learn and understand:**

- The challenges and obstacles to rolling out 5G and Full Fibre

- The benefits that 5G and Full Fibre will bring to our everyday lives

- How all industries will be transformed by these new technologies

- How the networks, operators, and vendors conduct future-planning

- The technology involved in identifying the right sites for installations

- The barriers to getting cable in the ground and cells on masts

- Where the telecommunications industry is heading next

We hope you enjoy this eBook, and trust it will inspire discussion and action among your own C-suite.

Introduction

A successful telecoms transition is critical for society and the economy

We now live in a hyper-connected world, where digital technology and real-time data form the backbone of our daily existence.

Globally, everything from our cars to our washing machines 'speak' to the smartphones in our pockets, while the planes we travel on - and the machinery used to make our favourite products - constantly feed information on their productivity and progress back to computers and cloud-based servers.

However, if innovation is to continue at pace and adoption is to grow exponentially, consumers and businesses will require greater levels of telecommunication speeds and bandwidth. Lower latency will also be demanded if we are to exchange digital information faster and across shorter distances.

Underpinning this societal transformation will be the ongoing rollouts of 5G and Full Fibre happening across the UK; these are designed to ensure homes and work premises get access to all the benefits such gigafast connections can offer.

And they are certainly needed as the *Ofcom Communications Market Report 2021* demonstrates. It found fixed and mobile customers continue to use more data, with the average monthly data consumption per fixed broadband connection being 429GB per month in 2020 (36% higher than in 2019), while the average monthly data used per mobile data connection was 4.5GB (up 27%).

We also know that 5G and Full Fibre technologies will enable the future; they will ensure Artificial Intelligence, the Internet of Things, Machine Learning, Autonomous Driving, and Smart Cities, can enhance how people live their lives and carry out their jobs - thanks to the maximum speeds possible.

For example, 5G could be 100x faster than 4G, and 5G's low latency is another major positive too. Full Fibre also brings its own huge improvements in broadband reliability, bandwidth, and speed, being up to 1,000 times faster.

For the UK Government, these enabling connections lay at the heart of its plans to level-up the country, and represent a massive opportunity for increased employment, entrepreneurial innovation, greater business productivity, and supercharging post-pandemic remote working.

New homecare and healthcare applications will also benefit, and sustainability will be boosted too, including via lower energy usage vs existing copper and cable.

However, the deployment of 5G and Full Fibre infrastructure is a complicated jigsaw to get right - and a puzzle that might not ever be fully finished. There is a massive and complicated ecosystem of operators, vendors, and suppliers to navigate.

It is big business too. The same *Ofcom Communications Market Report 2021* found telecoms revenues make a £31.5bn contribution to the UK economy. Retail fixed and retail mobile services generated £14.0bn and £12.5bn in revenue respectively in 2020, with the remaining £5.1bn coming from wholesale services.

So, as the race hots up to deploy this infrastructure as quickly as possible, this eBook will go on to explore what actions are being taken right now, as well as examine the challenges ahead. It will also highlight the opportunities a successful telecoms transition will deliver to the future of our society, and the economy.

£31.5bn
TELECOMS REVENUES
CONTRIBUTED TO THE
UK ECONOMY IN 2020

Chapter One

The hurdles ahead for this "infrastructure of the 21st century"

For those companies running in the race towards 5G and Full Fibre, there are many challenges and obstacles; it is a marathon, not a sprint.

However, the implications of the rollout cannot be underestimated. Kevin Murphy, MD at Openreach, describes it as creating "a completely immersive connectivity environment across the UK".

And Nokia's Chief Technology Officer for Northwest Europe, Alessandro Bovone, suggests this will be the first time since telecommunications were invented that "fixed and mobile are having a major upgrade and major shift at the same time".

Reaching that milestone though isn't easy, and it's a journey that won't ever actually end. What started for 5G with the spectrum auctions in 2018, will inevitably give way to 6G eventually. We will also say goodbye to 3G when it is switched off in the UK in 2033.

Until then, delivering the 5G and Full Fibre to replace it is a massive - and expensive - undertaking for networks and operators, not least ensuring that rural communities are as well-served as those living in urban districts.

There are considerable hurdles to leap and hoops to jump through, including Government regulation, match-funding, and investment, as well as neighbourhood fears and concerns. The role of landlords with objections against infrastructure being sited on their land or properties is also a factor, as are the obligations of local and regional councils with planning permissions.

The sheer scale of competition in the telecoms industry is also hugely complicated, with incumbent network operators now being challenged by the smaller and nimbler alt-nets. But all must co-exist if we are to ensure Full Fibre cables get into the ground, and 5G masts and sensors are installed on structures to strengthen indoor and outdoor mobile coverage.

Resourcing and supply chain management are critical to the success of the business. Openreach's Murphy suggests this is the biggest challenge when he says: "Demand across the industry is going to pick up in the next two years when everybody is trying to build and provide provision at the same time. That's why having a strong recruitment, training and contracting strategy integrated with continuous process and system innovation keeps downward pressure on unit costs."

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> *This will be the first time since telecommunications were invented that "fixed and mobile are having a major upgrade and major shift at the same time."*
>
> **Alessandro Bovone**
> Chief Technology Officer, Nokia Northwest Europe

Elsewhere, "capital investment" is the major hurdle with 5G rollouts according to Keri Gilder, CEO of Colt Technology Services. "The amount of capital that has gone into the spectrum vs the actual rollout of the 5G infrastructure itself is very different from region to region," she explains. "Here in Europe, the spectrum was so expensive that there was little capital to actually deploy the physical infrastructure of the 5G network and we are still struggling with some of that."

Hitting deadlines and targets also becomes a major factor. For instance, in the UK the Government is aiming to deliver nationwide gigabit-broadband to a minimum of 85% of premises by 2025. The networks are also aiming to have widespread 5G coverage by the end of this decade.

What isn't in doubt, however, are the benefits of both technologies. Gabriel Yepes, Head of Networks for Gigaclear, describes 5G and Full Fibre as "complementary to the solution of bringing broadband and connectivity to everybody. They don't necessarily negate each other", he also suggests.

And according to *PWC's Powering Your Tomorrow global report*, the rollout of 5G technology will drive a business, skills, and service change worth £43bn to UK GDP by 2030 - suggesting it "puts a new lens on advancing productivity and rethinking entire business models for the future".

For Juan Francisco Redondo, Senior Manager in Three UK's Strategy and Architecture Team, a healthy competitive landscape, along with economic and political stability, is a fundamental requirement to incentivise 5G and Full Fibre investments. "This is the infrastructure of the 21st century," he says, and a "key enabler" for the next generation of apps, content and 'magic' to be born and flourish under a thriving ecosystem of technology and business partnerships.

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> *This is the infrastructure of the 21st century and a "key enabler" for the next generation of apps, content and 'magic' to be born and flourish under a thriving ecosystem of technology and business partnerships.*
>
> **Juan Francisco Redondo**
> Head of RAN Strategy and Architecture, Three UK - Hutchison 3G

Chapter Two

Achieving operational efficiencies and breaking down barriers

The rapid deployment of telecoms infrastructure dominates C-suite decision-making within the telecoms industry, and elsewhere across all industries.

Speed-to-market of 5G signals alongside Full Fibre in the ground creates a competitive advantage for the networks and vendors - and drives customer acquisition and growth for the providers.

Colt's Gilder suggests that the power of 5G and Full Fibre means "the line between consumer and enterprise is starting to blur". "You'll start to see the access infrastructure becoming ubiquitous," she says.

For the consumer, this offers many positive outcomes, from access to remote healthcare monitoring to becoming part of online gaming communities. In the future, it will also allow people to play a full and active part in the metaverse.

Another critical function will be the unlocking of the potential of the Internet of Things and Augmented Reality, as well as real-time data. This will be critical to the progress of so many companies.

Additionally, 5G's enabling of widespread remote operations—such as remote fixes and working away from the office—will also transform workplaces and cultures.

Gilder adds: "I believe data and analytics will take the lead on business decision making. Regardless of what your operating model is—whether it's smart manufacturing or finance and banking—you're going to have an environment that is more data-driven, more AI-driven."

> " We've done a lot of work with infrastructure companies across the UK around smart buildings and smart infrastructure. There's a lot of thinking going on now around sensors being built into infrastructure so everything will talk to everything; this is all enabled by high-speed connectivity.

Kevin Murphy
Managing Director, Fibre and Network Delivery, Openreach

To achieve all of this, and hasten the arrival of smarter digital cities, many conversations must first happen in boardrooms, with lots of difficult decisions to take in partnership between networks, providers, and vendors.

Openreach MD, Kevin Murphy says: "We've done a lot of work with infrastructure companies across the UK around smart buildings and smart infrastructure. There's a lot of thinking going on now around sensors being built into infrastructure so everything will talk to everything; this is all enabled by high-speed connectivity."

However, this will throw up several issues, such as cost responsibility for building and maintenance. Establishing the right IT systems, architecture, and infrastructure becomes a joint responsibility to achieve.

Big choices remain on the siting of Full Fibre cabling. Who owns the land and what permissions are needed are chief concerns, along with knowing what environmental obstacles might prevent 5G's signal propagation. For example, transmission cabling might be required to connect 5G cells, rather than them daisy-chaining wirelessly, if the likes of trees and buildings are in the way.

For rural community rollouts, an early understanding of what sort of terrain you are working with is also top of the list of requirements.

Gigaclear's Gabriel Yepes says: "Planning is a major problem for us, plus permission studies and regulation with local authorities. It makes it challenging sometimes to dig up roads and motorways, for example."

"Obviously we want a nice and beautiful countryside not cluttered with equipment, but at the same time, we need the equipment to provide these services."

In some areas, overbuilding will need to take place to prepare these services for future housing and commercial properties. However, this takes much oversight of local plans and potential planning applications, and disruption of works to nearby communities must also be factored in.

Some of this could be solved by using 5G 'fix wireless access'. *Deloitte's TMT Predictions 2022* highlight how 5G is giving fixed wireless access (FWA) a popularity boost versus wired broadband, and this could potentially help to bridge some of the digital divide.

It is this technology that leads Three UK's Juan Francisco Redondo to admit "we can't expect to continuously dig stuff or build new towers or a new master." He references "the power of landlords" in the upgrading of infrastructure and says the whole ecosystem must understand "the nature of the beast to contribute or facilitate."

He adds:

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We want 5G technology and the deployment of new antennas, fibre, and the systems that are needed to support them, to happen swiftly. That's not necessarily the case, but the benefits we will get from these new technologies are incentivising everybody to try to overcome the challenges. That's good news!

Juan Francisco Redondo
Head of RAN Strategy and Architecture,
Three UK - Hutchison 3G

Chapter Three

How location intelligence will enable the speed to succeed

The race to 5G and Full Fibre is not being run in a straight line; it's not even being run along a flat surface. The rollout of both technologies requires complex investigation, planning, and inspections of all kinds of terrain before cables can be laid or masts erected.

Initial investment in this stage of the process is critical and costly, but too often reliant on many field visits and much human-led data mining. It is time-consuming to unearth the required information and regulatory details about proposed or potential sites.

However, technology is now making this process simpler and easier. A Geographic Information System (GIS)—like those offered by Esri—can create, manage, analyse, and map all types of data; for instance, location data (where things are) and descriptive information (what things are like there).

This in-depth oversight from afar—and from the start—is crucial to a successful rollout and can speed up the process. It can also remotely identify issues that crop up, reducing the frequency and cost of site visits.

Such systems are also instrumental post-rollout, helping engineers to find faults and get fixes done fast. Openreach's Kevin Murphy says: "We have invested a lot in our GIS systems, the ability for our engineers to visualise the network in real-time, almost like a digital twin."

"We've used a lot of computer power to interpret the network, the ability to use AI to understand how these connections are made, what's right and wrong, and to give more intelligence to the engineer," he adds.

Better planning of network infrastructure through GIS can prioritise profitability, ROI, and community need, assisting with a better understanding of the environment, the target market, and competitors.

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Kevin Murphy
Managing Director, Fibre and Network Delivery, Openreach

Bringing together so many different data streams can offer a competitive advantage, especially when knowing who owns which pieces of land or which buildings. Identifying the right structures to mount on, having sight of the obstructions in the way, and what the flood risks are, remain key to this too.

Three UK's Juan Francisco Redondo explains: "More and more we can do network planning work remotely, as well as managing what we do when on field visits, both proactively and reactively."

Gigaclear's Gabriel Yepes also speaks highly of the critical dataflow from telemetry tools, especially for on-going monitoring and maintenance of networks. It reduces the number of people the company must deploy to sites, cabinets, and underground cabling to investigate in-person.

AI and Machine Learning have a major and growing role here too. Yepes says: "We need less people to run and maintain the network. All the datasets can now be combined into our analytics platform so we can send out specific people with the right skill set. We are more intelligent on how we deploy."

To achieve this, the company takes advantage of Augmented Reality (AR) technology, using Microsoft's HoloLens which allows a technician on-site to show the problem to someone elsewhere who may have greater technical skills.

At Openreach, GIS reduces the amount of paper and emails needing to be read manually. "It is a real gamechanger," says Murphy, "because for the networks that were built over the past 100 years—the manholes, telegraph poles, etc.—things haven't always been recorded properly and things have changed."

He adds: "To be able to see it all visually, a digital twin representation in your hand, and be able to modify that instantaneously, has fundamentally changed things for our engineers who do provisioning. We've pushed a lot of power into the engineers' hands."

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>
> **Gabriel Yepes**
> Head of Networks

Conclusion
A geo-spatial approach is key to achieving 5G and Full Fibre goals

For many network operators and vendors, this push towards 5G and Full Fibre is not about winning the race, it's about staying competitive —and in it.

The rise of the alt-nets is forcing bigger players to think and act more cleverly, and if a connected Britain is to compete on the world stage, there might be a need to work more closely together to deliver on this aim.

Openreach's Kevin Murphy suggests: "There's a lot of communications providers, everybody is looking for a foothold in the market."

One of the new telecom operators is CityFibre, and Alex Blowers, Director of Regulatory Affairs at the company says its aspiration is to build at least eight million connections to premises across the UK by 2025. "We see ourselves as the kind of emerging challenger to BT and Virgin Media, a sort of third player in that ecosystem to particularly build in parts of the country that have been left behind and neglected."

CityFibre is one of a growing number of these nimbler players. David Payne, Technology Strategy Manager at Virgin Media, explains how not so long ago, there were only a "very small handful of main players offering connectivity"; this has exploded in the UK in the last three to five years.

He says: "You've got your traditional infrastructure owners like us, Openreach, and so on, and then the likes of CityFibre, a new player in that space. The difference they bring is they're doing a wholesale-only model. That's challenging the lower income brands like ourselves to think about our offerings."

"Can we offer wholesale packages of connectivity, be it 5G or fixed fibre, the gigabit speed stuff, as well as the traditional business to customer offerings?"

Payne believes all this competition will eventually lead to greater differentiation around additional layers of offerings, from customer service to driving customer value as well as the numbers of sensors and environmental monitoring devices each company can invest in and install to drive smarter cities.

There is no doubt that the UK telecommunications industry over the next few years will be at the forefront of country-wide transformation. The competition to roll out 5G and Full Fibre though is fierce and many experts remark how we might see much merging and consolidation, as a more common standard comes to the fore.

In the meantime, the telecoms market has a geographical challenge and operators need to automate and optimise performance to allow speed-to-market to secure new territories before their rivals.

Investing in a geo-spatial approach across the enterprise (not just the planning team) will reduce the total cost of deployment and increase the value of the business by having a digital footprint of the network. Interesting times are ahead!

For more information regarding Esri UK's products and services, please contact Richard Stevenson via email at rstevenson@esriuk.com

Richard Stevenson
Telecoms Commercial Lead, Esri UK

Further thoughts

Keri Gilder
CEO
Colt Technology Services

5G will be integral to the gigabit society but you can't have 5G independent of full fibre - as our world becomes more wireless it also becomes more wired. This provides a critical foundation for the digital infrastructure of tomorrow.

Alex Blowers
Head of Regulatory Affairs
CityFibre

Delivery of M&E is fundamentally changing with the 5G & full fibre rollout. The consumer will be one of the key winners in this, enabling them to consume anywhere, anytime, without experiencing old issues.

Alessandro Bovone
CTO North & West Europe
Nokia

With 5G private networks, we'll be capable of doing things that were not manageable before, facilitating robot connection and connectivity that will allow the industry to speed up production and operate more efficiently and with fewer errors.

Chris Taylor
Project Manager
Virgin Media O2

Edge computing would be an enabler for the more efficient processing of 5G data, and this separation of infrastructure, with more intelligence moving out towards the cell sites leads to a network that is less centralised.

Further thoughts

Kevin Murphy
Managing Director, Fibre and Network Delivery, Openreach

Since the late 90s, the trend has been to "move the brain to the center" and "the eyes and hands to the field." However, as companies merge, they'll need a "strong hand at the center" to avoid the danger of limited integration and poor customer experience.

Ash Roots
CDO
BT

One of the by-products of digital transformation and agile, which I think is the more powerful thing to value, is not the cost or speed to market; it's the fact that the organisation transforms from being a delivery organisation to an ideas organisation.

Juan Francisco Redondo
Head of RAN Strategy and Architecture, Three UK - Hutchison 3G

As we continue to roll out 5G and Full Fibre, we are, literally and preverbally, paving the way for the next generation of apps, content, and 'magic' to be born and flourish.

Shawn Nolan
Head of Technical Operations
BDUK

For us all to truly benefit from what 5G can enable, such as driverless cars, the infrastructure has to be in place across the whole country, not just in parts.

Rashdan Rashid
Digital Transformation Director

In the long run, before we get to 6G, we will see private mobile wireless become as easy to set up as our wifi at home.

Hitesh Parekh
Senior Program Manager
Nokia

You've got to understand the data you need and the value it will add. Otherwise, you'll spend more money analysing data rather than gaining its actual value.

Umar Sattar
System Introduction Manager

First and foremost, the physical infrastructure must be in place to unleash the unparalleled power of 5G and full fibre.

Chris Jefferies
Acquisition Senior Manager
Vodafone

To gain the full benefit of full fibre and 5G, acquiring and setting up sites is of primary importance now and for the foreseeable future.

Malcolm Corbett
CEO
INCA

Network availability to provide high capacity and low latency will be beneficial to monitoring and making reasonably quick decisions on how your assets are being managed.

Further thoughts

Gabriel Yepes
Head of Networks

Every interaction on a mobile phone or laptop provides telemetry data back to the network, which presents the problem of dealing with massive amounts of data. As technology improves, we can process this information more easily in back-end systems, which can sift through these vast data sets.

Milan Parmar
Head of Service Management
Ericsson

The business case, investment, and technology required for 5G and full fibre rollout is already in place; however, we are dependent on competent field services to deploy this technology on the ground. There is a considerable gap between the demand and supply of the qualified resource.

Soundar Rajan Kannan
Head - ORAN and Edge Cloud solutions and Engineering
Nokia

Smart factories make up about 10% of the overall factories across the world with various levels of digital maturity. 5G has enormous potential to transform factories in many areas, from automotive to other manufacturing industries and high-tech manufacturing with robotics, AI and industrial automation.

Jose Revuelta
IT Solutions Architect
BT

5G is currently just an extension of existing consumer mobile services; there isn't any penetration within enterprise businesses. It looks very nice on the road map, but there is still a long way to go and a market to be explored.

Peter Wilson
Principal Technology Partner
BT

The home will be the battleground in terms of experience with full-fibre as an access technology. As is rolls out in parallel with IoT, device proliferation around the home is scaled up. You might have 50+ devices, one of which could create issues that have nothing to do with the access technology.

David Payne
IT Innovation Architect

We must look at the pandemic's impact on people's general perception of data and how we use it. For example, there was much concern around the vaccine track-and-trace app and being asked to check in or have their movements monitored. The public is apprehensive now, not realizing this has been the case for several years through social media, when we attend events, take pictures with friends, then tag the location when we post the content.
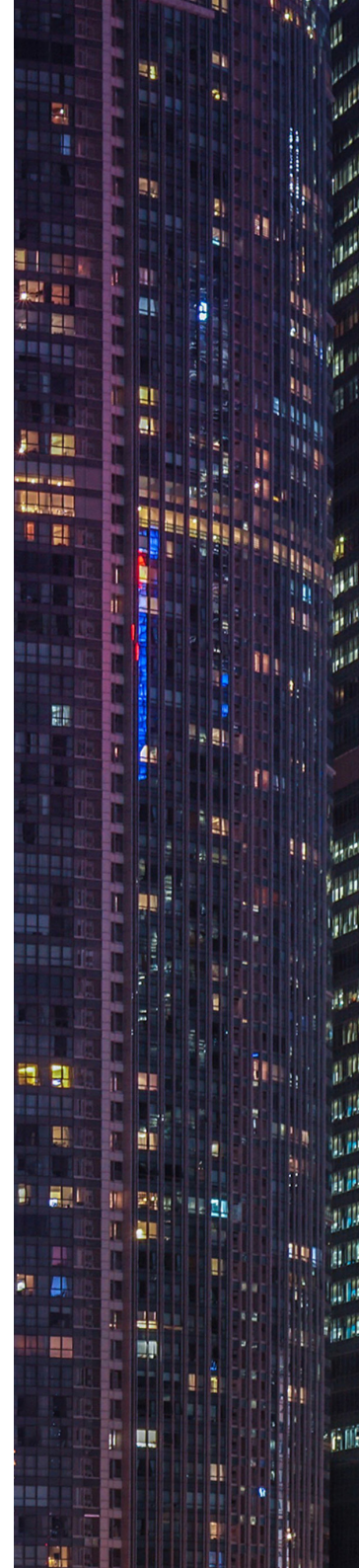
Find out more

Esri is the global market leader in geographic information system (GIS) software, location intelligence and mapping, helping customers unlock the full potential of data to improve operational and business results. Founded in 1969, Esri software is deployed in more than 350,000 organisations including 90 of the Fortune 100 companies.

Esri UK offers GIS solutions to a wide range of markets in both the public and private sectors. Customers include EE, BT, Openreach and Vodafone.

To explore how location intelligence is key to solving the challenges discussed in this eBook, please contact us by email at **sales@esriuk.com**, by calling us on 01296 745599, or by visiting our dedicated UK telco industry webpage at **esriuk.com/telecoms**.

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