analysys mason

CONNECTED EUROPE: BUILDING THE GIGABIT SOCIETY

Contents

Introduction

Connected Europe: Building the gigabit society

I am pleased to present this compilation of articles from Analysys Mason covering a range of topics relevant to building the gigabit society in Europe.

First, we look at the costs of delivering different connectivity targets across Europe, an analysis we undertook for the European Commission last year which helped shape policy makers' thinking on this matter. Next, we turn to the demand side and one of the critical issues associated with financing the very large investments needed in European infrastructure, namely the rate of FTTH activation, with a specific focus on the experiences in France. Then we provide a summary of some new work we have just published in the UK on lowering barriers to infrastructure deployments, with 19 firm recommendations for operators, regulators and governments.

We then switch attention to 5G, starting with a spectrum roadmap, highlighting a number of issues to be overcome if 5G is to deliver on its promise. We also discuss how fixed, mobile and potentially utility networks could share resources more effectively to deliver better market outcomes. We close with an article about a new technology, blockchain, which over the longer term may have a far-reaching impact on our industry and others.

As a sector-specialist in telecoms, media and technology, Analysys Mason is active advising clients across Europe on the above topics. Our clients include operators, investors, regulators and governments, and increasingly our advisory work is becoming gigabit-focused.

I hope you find these articles of interest. We welcome your feedback and encourage you to contact the authors directly if you would like to discuss any of the points they have raised, or are looking to understand how a specific issue or trend will affect your organisation.

We look forward to working with you.

MATT YARDLEY
Partner, Analysys Mason Consulting

The commercial challenges of delivering the gigabit society

ANDREW DALY
Manager, Consulting

> “Commercial operators will be concerned about the return on their investment, and the uncertainties around deployment of new networks will cause them to take a cautious approach.”

The telecoms industry is embarking on its next important phase of development. Fixed operators continue to (gradually) roll out more fibre into their networks, while mobile operators continue to upgrade capacity and expand their networks as they include the technologies that will deliver 5G.

In its communication “Towards a European Gigabit Society”, the European Commission (EC) has set three targets for connectivity across Member States to be achieved by 2025:[1]

1. Gigabit (1Gbit/s) connectivity for all main socio-economic drivers such as schools, transport hubs and main providers of public services as well as digitally intensive enterprises
2. All urban areas and all major terrestrial transport paths to have uninterrupted 5G coverage
3. All European households, rural or urban, to have access to internet connectivity offering a downlink of at least 100Mbit/s, upgradable to gigabit speed.

These targets are ambitious. In Europe in 2016, 49% of homes were covered by a network capable of supporting 100Mbit/s.[2] Significant further investment and deployment will be required to meet the targets.

It is noteworthy that the EC stopped short of targeting ubiquitous gigabit services at this stage. Analysys Mason undertook a detailed piece of analysis for the EC, shortly before the three targets were formalised.[3] The main result of our work is shown in Figure 1.

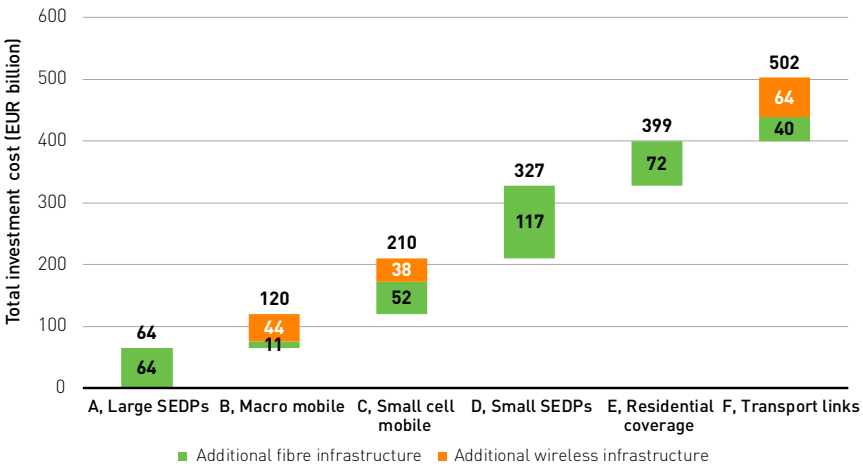


FIGURE 1: SUMMARY OF INCREMENTAL COSTS BETWEEN SCENARIOS
[SOURCE: ANALYSYS MASON, 2017]

[1] https://ec.europa.eu/digital-single-market/en/news/communication-connectivity-competitive-digital-single-market-towards-european-gigabit-society

[2] https://ec.europa.eu/digital-single-market/en/european-digital-progress-report

[3] https://publications.europa.eu/en/publication-detail/-/publication/e81ae17f-9d27-4b68-8560-7cd45dbe21d8/language-en/format-PDF/source-42152468

The work was based on six scenarios:

A. Providing 1Gbit/s to large socio-economic drivers and professionals (SEDPs), e.g. medium enterprises, hospitals, schools and local authority

B. Providing 50Mbit/s wireless connections from macrocells, covering 95% of the population

C. Providing 1Gbit/s wireless connections from small cells (equivalent to a wireless 'hotspot' model), covering 95% of the population

D. Providing 1Gbit/s to small SEDPs, e.g. micro and small enterprises, teleworkers, libraries, museums and other cultural sites

E. Providing 1Gbit/s to all residential areas

F. Providing 50Mbit/s wireless connections from macrocells, covering all major transport links (road and rail).

The analysis revealed the following interesting insights:

- Fibre deployed to cover residential areas can also be used to connect SEDPs and wireless base stations (both macro and small)
- Economies of scale are crucial for deploying 1Gbit/s-capable fibre connections: although connecting on large SEDPs is relatively low cost, the cost of each connection is very high.
- Regarding future mobility, anticipated developments in mobile technology should ensure that average speeds of 50Mbit/s can be achieved
- However, significant additional costs would need to be incurred to either a) extend mobile coverage to all major transport links, and/or b) deploy very dense small cells to realise mobile speeds of 1Gbit/s or more, across a wide area.

Another important insight is the role of the commercial sector. For example, our analysis forecast that the commercial sector is expected to meet around 30% of the cost of providing 1Gbit/s to all residential areas. As noted above, this investment can also help meet the other targets, to connect SEDPs and provide wireless connectivity. Commercial operators will be concerned about the return on their investment, and the uncertainties around deployment of new networks will cause them to take a cautious approach. These uncertainties include the cost and practicalities of deployment, take-up of new services and the prices that can be charged. Policy makers have an important role to play here, to help reduce these uncertainties, for example by lowering deployment barriers, facilitating co-investment or demand-guarantee arrangements, and providing regulatory certainty over wholesale prices.

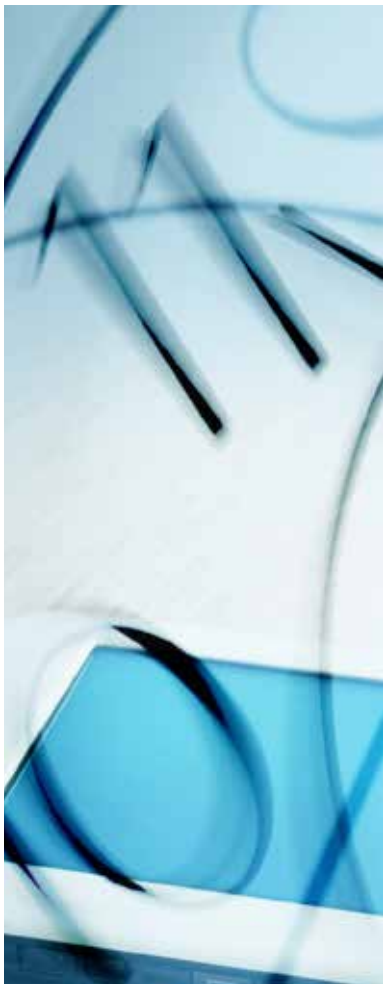
It will be interesting to see how the new European connectivity targets translate into action at the Member-State level. National broadband plans will continue to play an important role here, enabling policy makers to outline their ambitions whilst also taking account of their own market's specific supply-side and demand-side conditions.

Questions?
Please feel free to contact Andrew Daly, Manager, at andrew.daly@analysysmason.com

Annual FTTH activation rate in France has tripled, which will stimulate investment to finish the planned roll-out

"The percentage of French customers that will switch to fibre within a year when it is available has tripled between 2010 and 2016."

OMAR BOUHALI
Principal, Consulting



The annual activation rate of FTTH lines in France continues to increase consistently, as the number of new FTTH roll-outs exceeded 2 million lines for the first time in 2016.[1] This trend will be critical to securing financing for FTTH roll-outs, especially in the less densely-populated areas of the country.

The French national broadband plan consists of rolling out over 30 million ultrafast broadband lines (mainly using FTTH) by 2022, which represents over EUR20 billion of investment. Operators are deploying their networks on a commercial basis (or have expressed interest in doing so) in areas that cover around 57% of the population, representing EUR6–7 billion of investment. Local authorities are deploying public initiative networks in the rest of the country, including the less-densely populated areas. These offer wholesale access to commercial operators and wholesale prices are held in line with those in more densely-populated areas by public subsidies (which represent around half of the remaining EUR13–14 billion to be invested).

Return on investment in these public initiative networks will mainly come from the co-investment or line rental paid by retail operators, which use these networks to sell retail FTTH services. The main driver for return on investment is therefore take-up of rolled-out lines, as wholesale prices are set in line with more densely-populated areas. The key question for financing these public initiative networks is thus how quickly customers will switch to fibre (even if there is little doubt that they will eventually do so), given that existing copper and cable lines often offer relatively good speeds.

Analysing market development may provide an answer to this key question. Less than 6% of available FTTH lines (rolled-out lines on which no service was delivered at the beginning of the year) became active during 2010, taking into account deactivations (Figure 1). However, this rate of activation has consistently increased over the past 6 years, reaching almost 18% in 2016. In other words, the percentage of French customers that will switch to fibre within a year when it is available has tripled over the past 6 years.

Two factors can explain this trend. On the demand-side, mainstream online services increasingly depend on the technological characteristics of FTTH (such as its downstream and upstream speeds and low latency) as penetration reaches a critical mass, which encourages customers to switch. On the supply-side, all major operators will have to actively promote FTTH to defend their long-term market share as it becomes mainstream. These two factors will reinforce each other and create a virtuous circle, but the speed at which this happens is critical to any investment decision.

It is essential to quantify the rate at which customers switch to FTTH in order to optimise financing of the massive investments required to finish the planned roll-out over the next few years.

Questions?
Please feel free to contact Omar Bouhali, Principal, at omar.bouhali@analysysmason.com

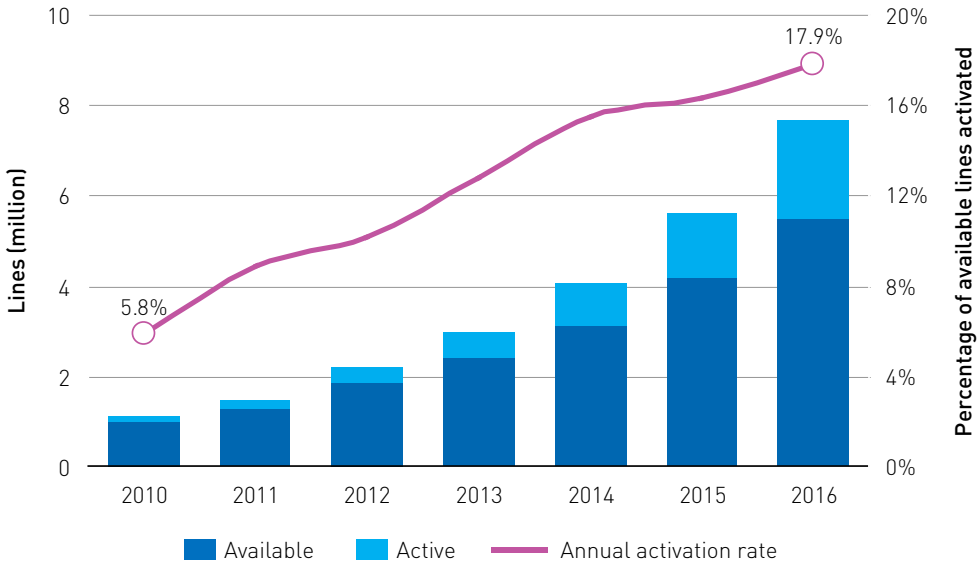


FIGURE 1: AVAILABLE AND ACTIVE FTTH LINES AND PERCENTAGE OF AVAILABLE LINES ACTIVATED EACH YEAR, FRANCE, 2010–2016 [SOURCE: ANALYSYS MASON, 2017]

[1] Annual activation rate refers to the percentage of available lines activated each year, taking into account deactivations.

Unlocking future investment in fibre and mobile: practical deployment issues need to be resolved quickly

IAN ADKINS
Principal, Consulting

"There is a strong drive worldwide to invest in network infrastructure."

Analysys Mason has recently completed research into lowering barriers to telecoms infrastructure deployment,[1] which applies to both fixed and mobile networks. After consultations with telecoms operators and local government highways and planning authorities in the UK, we identified **19 specific issues that are currently having a detrimental impact on the deployment of new telecommunications infrastructure.** The issues identified in our study could potentially apply to any country.

There is a strong drive worldwide to invest in network infrastructure and to deploy new technologies with an even greater ability to meet the burgeoning demand for bandwidth. However, the business case can be challenging, and to compound these commercial challenges, telecoms operators often face practical deployment challenges across several fronts; ultimately, these challenges either lengthen deployment timescales, or increase deployment costs – or both.

In our study, we found that there was consensus and acknowledgement, from telecoms operators and local authorities, that a range of issues exist. To resolve these issues, the recommendations in our study focus on lowering barriers to unlock investment in new networks such as FTTP and 5G networks. The recommendations address key areas, which are summarised in the three tables below.

Although there were clearly tensions between the parties, particularly around the inconsistencies in the way guidance is interpreted, there was a desire from both telecoms operators and local authorities for a more-uniform, less adversarial approach; **a better working relationship between operators and local authorities is a key enabler** to help lower barriers to telecoms network deployment.

In summary, solving these issues and creating an environment suitable for telecoms network deployments is an important challenge for governments (national, regional and local), regulators and telecoms operators to solve. Our recommendations are positioned to enable all parties to play their part to overcome the issues and to help **achieve the significant economic and social benefits** that deployment of next-generation telecoms network infrastructure, such as fibre networks and 5G networks, can bring to citizens and businesses alike.

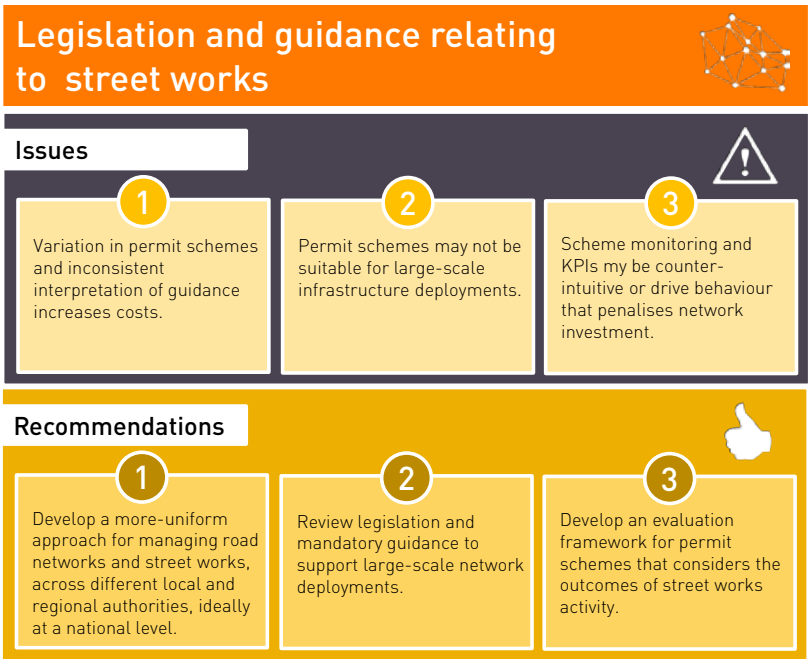


FIGURE 1: SUMMARY OF ISSUES AND RECOMMENDATIONS ON LEGISLATION AND GUIDANCE RELATED TO STREET WORKS [SOURCE: ANALYSYS MASON, 2017]

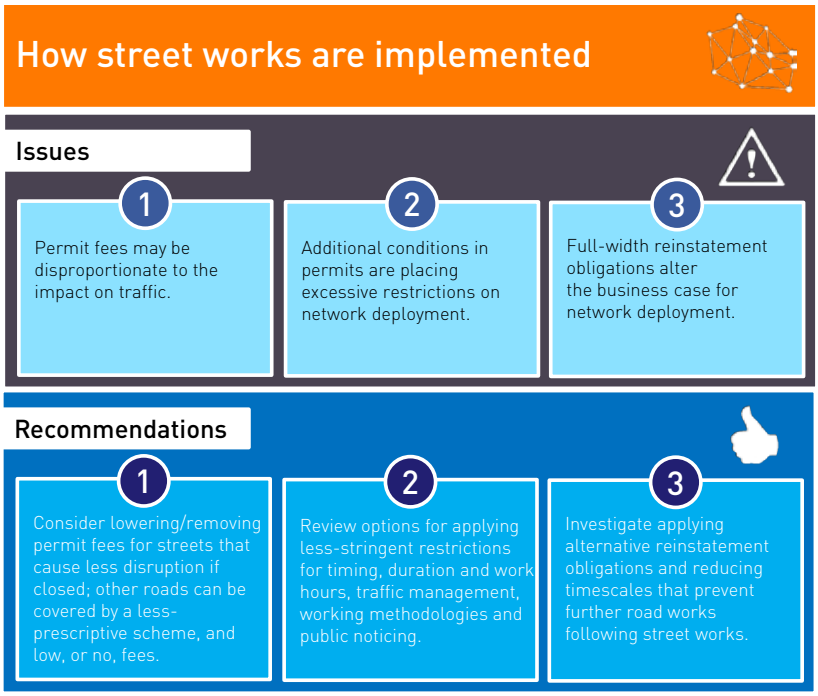


FIGURE 2: SUMMARY OF ISSUES AND RECOMMENDATIONS ON HOW STREET WORKS SCHEMES ARE IMPLEMENTED [SOURCE: ANALYSYS MASON, 2017]

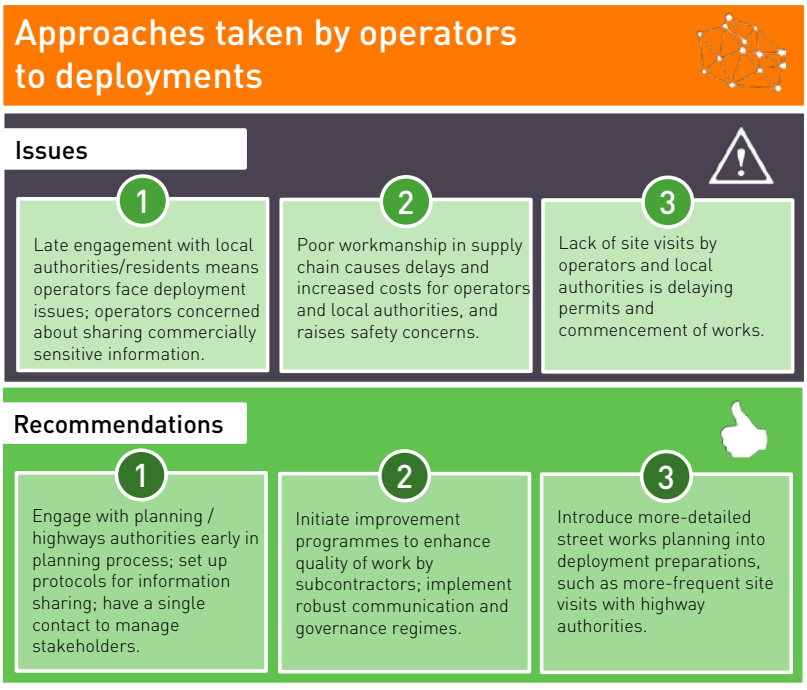


FIGURE 3: SUMMARY OF ISSUES AND RECOMMENDATIONS ON APPROACHES TAKEN BY OPERATORS TO DEPLOYMENTS [SOURCE: ANALYSYS MASON, 2017]

Analysys Mason advises governments, regulators, operators and investors on telecoms policy and business planning to address practical deployment and operational issues such as those identified above.

Questions?
Please feel free to contact Ian Adkins, Principal, at ian.adkins@analysysmason.com or Robert Woolfson, Associate Consultant, at robert.woolfson@analysysmason.com

[1] See Analysys Mason's study report Lowering barriers to telecoms infrastructure deployment. Available at: www.analysysmason.com/Lowering-barriers-to-telecoms-infrastructure-deployment.

A spectrum roadmap towards 5G

> “Achieving greater capacity, better reliability and increasing reach of coverage will require mobile networks to transform.”

JANETTE STEWART
Principal, Consulting

We are fortunate in the UK to have a telecoms and media regulator whose policies are at the forefront of international best practice. In relation to spectrum policy – the main topic of this blog – Ofcom's spectrum management reforms over the past decade have resulted in spectrum assignment practices in the UK that are market-driven and flexible (within the bounds of international regulations).

The government's Digital Economy Bill – on its way to becoming law after a third reading in November 2016 – puts forward further innovations such as dynamic spectrum access, requiring Ofcom to introduce this new practice. Society's need for greater access to broadband connectivity, including wireless, is a key motivator for the new law. The continuing growth in demand for wireless data services means that the UK's 3G and 4G mobile networks are becoming increasingly congested. New emerging applications – especially in relation to the Internet of Things – are reliant on mobile connectivity being available continuously. Achieving greater capacity, better reliability and increasing reach of coverage will require mobile networks to transform, with the deployment of many more smaller cells, and massive MIMO antenna technology.

These transformations are embraced within the next generation of mobile connectivity, known as 5G. The government is putting weight behind policies to promote 5G deployment in the UK – as evident in recent budget announcements and in DCMS's 5G Strategy.[1] Governments in European markets are also keenly interested in 5G, and European institutions such as the European Commission and the RSPG are working closely to harmonise European spectrum availability for 5G.

The consequences of the 'Brexit' vote in this regard have yet to become clear but indications from Ofcom are that the frequency bands that will be made available for 5G in the UK will be aligned with emerging European policy.

Ofcom has already set out indications about the wide range of bands that might be included in the overall 4G–5G transition (we provide a summary of Ofcom's indications in Figure 1).

Key over the coming year will be to develop further detail of how new bands will be released to market, including the licensing terms of different bands, and how these relate to roll-out and coverage obligations.

At least for the provision of mobile broadband services, 5G might follow the same coverage patterns as 4G, subject to suitable spectrum being available. However, if 5G is to deliver connectivity to transform the way that many local, utility and public services are delivered as well as connecting railway corridors and roads, enhanced coverage will be needed, including within buildings and to locations where mobile reception has traditionally been weak. How different 5G bands might be brought to market in the UK is a topic that the UK Spectrum Policy Forum (SPF) will be considering during 2017.

Questions?
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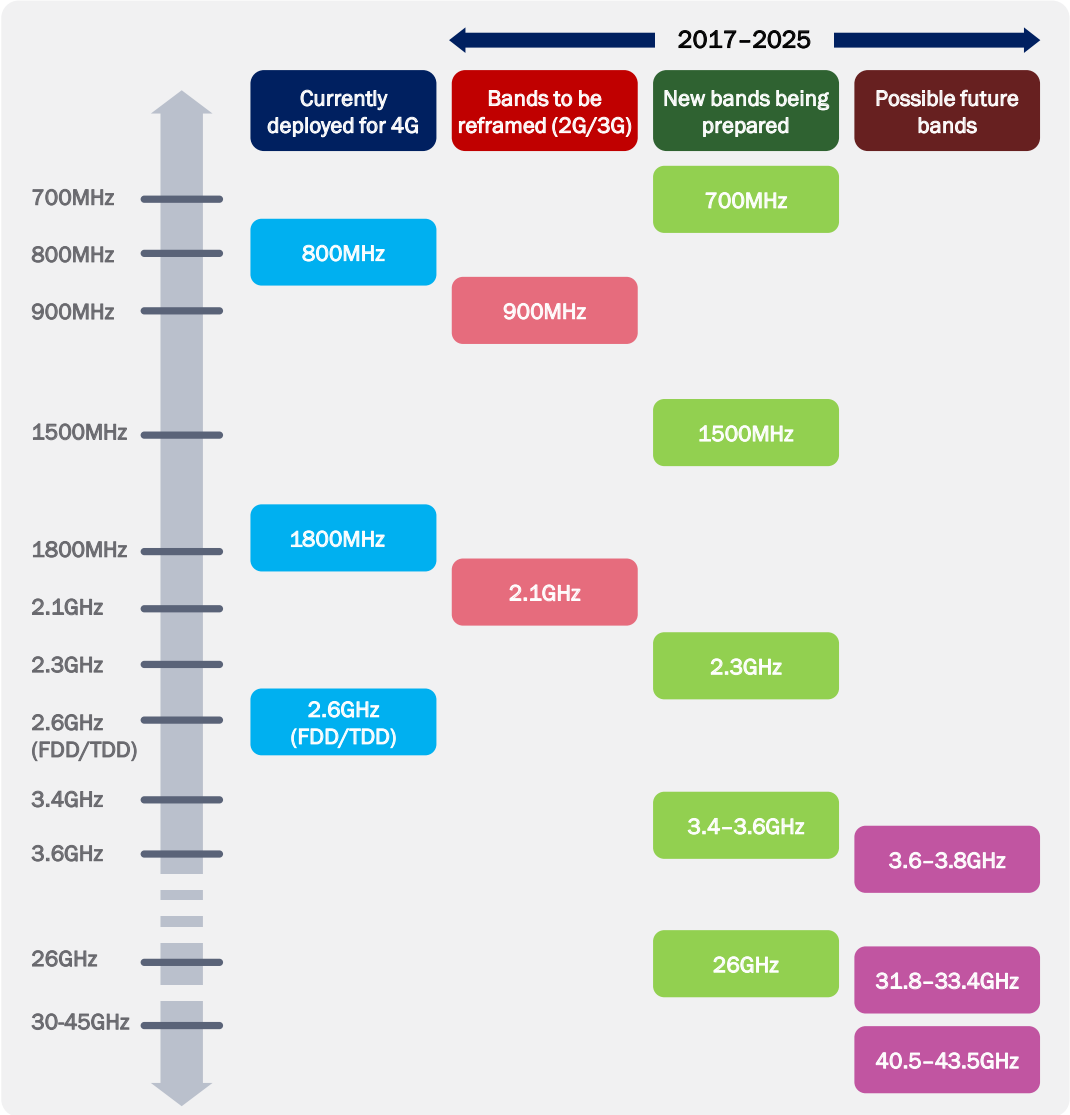

FIGURE 1: 4G–5G SPECTRUM TRANSITION [SOURCE: ANALYSYS MASON, 2017]

[1] https://www.gov.uk/government/publications/next-generation-mobile-technologies-a-5g-strategy-for-the-uk

5G viability requires operators to share cross-platform resources

RUPERT WOOD
Research Director

> "Unless mobile operators, fixed operators and utilities find better ways to share resources, 5G will become an impossible capex burden on most operators, and controlled by too small a number of players for any real dynamism."

Most people who are following 5G developments will be familiar with the three use cases that are often used as the commercial justification for 5G:

- enhanced mobile broadband
- massive connections (that is, IoT)
- ultra-reliable networks.

The fixed–wireless case shows that there are really four use cases.[1] Fixed–wireless is likely to be the first to appear, and could be of greater commercial value than the other three combined for several years to come.

Whether or not this actually happens – and there are sound reasons to be cautious – 5G promises to be about significantly more than mobility. It promises to cut across fixed and mobile services, supplanting the last 200 metres of fixed access, possibly swallowing Wi-Fi and even perhaps competing against LPWA etc., thereby becoming a sort of universal access network.

Competing visions of multi-functional fixed–mobile converged (FMC) networks are emerging

5G has a corollary in, and is, in some but not all respects, compatible with the NG-PON2 vision of the future of fibre access (see Figure 1).

The NG-PON2 vision is that fixed access networks are about more than consumer and small business broadband. Orthogonal requirements are met on a single optical infrastructure by separating functions and service providers onto discrete optical wavelengths.[2] The 5G vision is conceptually similar: it allows sliceable networks that fulfil orthogonal requirements. 5G will have a single universal air interface, but 5G systems will allow different waveforms and frame structures to meet differing service requirements. In both visions, software-defined networking (SDN), network function virtualisation (NFV) and network orchestration allow for the creation of logical sliced networks.

It may be that none of the use cases individually justifies the investment hump (or does so quickly enough to satisfy investors), but together they do. However, Verizon reckons that fixed–wireless alone justifies investment in 5G.

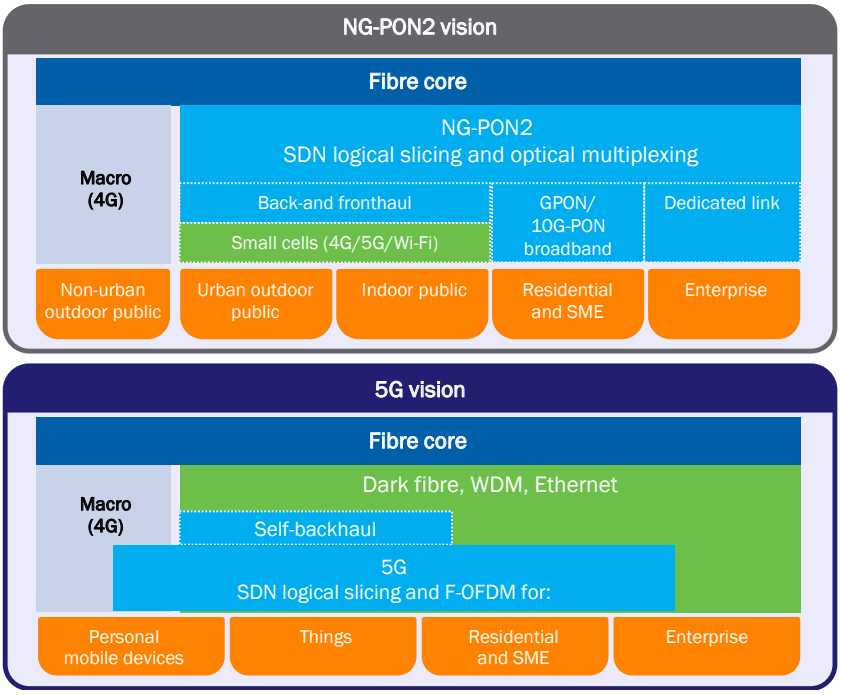

FIGURE 1: TWO MULTI-FUNCTIONAL VISIONS [SOURCE: ANALYSYS MASON, 2017]

Both visions show that fixed technology and 5G are critically interdependent. NG-PON2 depends on the value of 5G mobile (plus other small cells, C-RAN); 5G depends on fibre, and may also depend critically on non-mobile use cases.

The inherent logic of fixed–mobile convergence is network sharing across fixed and mobile. New fibre and mobile networks will each be sliceable for end-to-end delivery of an orthogonal range of services, but to unlock the full potential of 5G and of dense fibre networks more co-ordinated thinking has to happen. Work on co-ordinating standards across what have been siloed standards bodies has barely begun; hence a timely plea for more collaboration from Deutsche Telekom's 5G programme manager in July 2016.[3]

In fact, it is possible to draw a similar schematic diagram for the physical infrastructure layer. Investment in renewal, or build-out, of utility infrastructure (ducts, poles etc.) works better if it is treated as a multi-purpose investment. For example, ESB's investment in renewing power transmission infrastructure in Ireland has an improved RoI because it also enables lower-cost FTTP deployment in otherwise economically challenging areas for entrant fixed operators.

The high costs and mixed revenue potential of 5G will require operators to take a holistic approach to investment

5G is going to cost a lot, and the mainstream use case, that of enhanced mobile broadband, looks rather weak. 5G requires overcoming an infrastructure capex hump that is of a different order of magnitude from that of LTE, which essentially optimised the legacy macrocell architecture.

Most of the overall cost will not be for radio equipment: it will be for infrastructure, planning, gaining access to sites and labour. This spread of costs is very familiar to fixed telecoms operators. The investment required (or re-use of existing sunk-cost assets), and the timescales involved in roll-out, are closer to that of FTTx than what is typical for mobile deployments.

5G will also incur the cost of a virtualised core centralising some processing functions and enabling faster software-defined configuration of networks for specific use cases. Virtualisation is likely to intensify the need for fibre behind the radio heads, because unprocessed or semi-processed radio signal requires fatter pipes than traditional backhaul. In addition, future 5G services, especially those that fall into the ultra-reliable use-case category, will require investment in mobile edge computing (MEC), which pushes in exactly the opposite direction from the centripetal pull of the virtualised C-RAN.

The revenue outlook, while not bleak, makes it difficult to justify investment in 5G unless a more holistic approach is taken.

- 5G fixed–wireless promises some revenue uplift as a potential entrant strategy to fixed broadband and video. For others, it will be a lower-cost means of delivering fibre-like services. Fixed broadband services have some revenue growth potential – revenue is currently growing at mid-single-digit percentage rates worldwide.
- 5G-enhanced mobile broadband may be useful as a marketing tool for operators that are keen to maintain their reputation as service leaders. However, gigabit speeds on smartphones and tablets are probably of little real value to end users. The gradual introduction of 4.5G speeds and capacity into the mobile market does little to boost revenue and even its impact on traffic volumes seems short-lived. The European mobile market appears to have bottomed out, but the revenue outlook is negative in most other regions.
- 5G IoT faces challenges from LPWA and caution is required about the potential revenue for operators. IoT revenue is about 1% of mobile revenue, and will grow at about 20% per annum worldwide during the next 5 years.
- The ultra-reliable high-performance use case looks furthest out and is hardest to predict, but this is perhaps the only use case that exploits the unique capabilities in the 5G performance targets.

In a commercial environment where overall revenue shows at best modest growth, and where the promise of new revenue streams still looks somewhat remote, fixed and mobile network businesses – and even utilities – need to share resources more effectively and pro-actively. Fibre will be the key enabler of 5G, and 5G might even become the last mile (in reality last couple of hundred metres) technology of choice for fixed operators. Unless operators find a commercially successful way to share resources, 5G will become an impossible capex burden on most, and will be controlled by too small a number of players for dynamism to flourish.

Questions?
Please feel free to contact
Rupert Wood, Research Director, at
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[1] For more information, see Analysys Mason's The investment case for 5G mobile is more distant without fixed wireless. Available at www.analysysmason.com/5G-fixed-case-Aug2016.

[2] See Analysys Mason's Harnessing the value of TWDM-PON. Available at www.analysysmason.com/TWDM-PON-2015.

[3] See www.broadband-forum.org/news/download/pressreleeases/2016/PR07_BBF_DeutscheTelecom_FINAL.pdf.

Permissionless innovation with blockchain technology: computer says yes

"There is currently much interest in using and building on blockchain, the technology underlying Bitcoin, and regulators and governments will have to adapt to this change – in some cases, they may also wish to adopt these new technologies."

JAMES ALLEN
Partner, Consulting

Underneath Bitcoin is a distributed, persistent and encrypted public database called 'blockchain', which forms the ledger of Bitcoin transactions. It is in effect the guarantee that a given Bitcoin cannot be copied and spent twice by the current owner. The 'miners' who maintain this distributed database are paid for their efforts (in Bitcoin); the encryption protects both identities and the transactions that have been accepted.

A new era of permissionless innovation

There is currently an explosion of start-ups seeking to leverage blockchain technology. This is similar to the rush to find (and patent) new applications in all possible fields for the Internet in the late 1990s. It is true that blockchain shares some characteristics with late-1990s-era Internet Protocol (IP): it is publicly available, the relevant standards and payment mechanisms exist, it already has critical mass for the platform as a whole, and there is a developing ecosystem of support businesses building on it and offering related services. Just like IP was then, blockchain is now a technology allowing 'permissionless innovation' and, just like IP, it has attracted a mix of technologists, bankers, economists, venture capitalists, philosophers and artists.

Blockchain offers a flexible public co-operation mechanism

Blockchain offers an opportunity for groups to co-operate in database systems offering a 'single truth' without the complexity of all parties having to agree to trust a single master entity, which also represents a single point of failure. This property obviously has many potential use cases, which is part of the reason for the vast array of start-ups. Given that the Bitcoin blockchain is publicly accessible, matters of public record, such as public registers of copyright or land ownership,[1] are an obvious choice. The financial technology sector is currently in the vanguard in seeking applications. For example, settlement of stock market trades currently takes 3 days, when it could take much less time, offering the potential for substantial cost savings in IT and in capital held against counterparty risks. Considering the telecoms industry, number portability databases also offer an immediate potential application (these systems currently use a database held by a trusted party). Blockchain can also be applied to IoT – for example to register devices, authenticate users and support access and payment for data.

Blockchain is extensible

Not all blockchains have to be public: private blockchains also offer opportunities. Here, the participants can be controlled and it is easier to build something that exactly meets the needs of a particular situation. However, moving away from the existing platform, with its established critical mass, standards and payment mechanisms, has its own risks – in the end, a private blockchain is just a multi-user database (even if it uses a new and trendy technology). Of course, there is no need to reinvent everything: for example, blockchains can be linked together such that their payment mechanisms are convertible.

Beyond the 'ledger' or database function, there are already multiple attempts to increase the capabilities of the Bitcoin blockchain. For example, Ethereum (a more capable blockchain) builds in 'contracts', written in a programming language, that allow events (such as payments) to be triggered when other specified events occur. This addition makes the blockchain into an application and widens the scope to encompass everything software (or contracts) can achieve: from wills, through cooperative communities and electronic voting, to virtual nation states. While a future author will no doubt make great use of a blockchain-implemented will as a plot device, Neal Stephenson has already written a novel including virtual nation states (*The Diamond Age*).

Such an extension also enables practical solutions to some real problems. To give an everyday example, it would allow electronic equivalents of bank accounts where any two from six people have to approve a transfer or withdrawal, which in the current bank settlement world is achieved by two physical signatures on a cheque. It has already been used to demonstrate both a music market with no intermediaries between creators and consumers and the ability to trade electricity between producers and consumers. However, it also raises the possibility of distributed systems against which traditional enforcement mechanisms may struggle to gain purchase. For example, investigations of financial transactions will only find a public key, rather than a named individual.

These are exciting times. Some of these companies and technologies will be successful in niches, while some will become utilities and will form the basis of new and even more fruitful businesses. Regulators and governments will have to adapt and, in this case, as discussed above, they may also wish to adopt.

Analysys Mason has been observing connected ICT and advising operators, enterprises, government and regulators since 1985.

Questions?
For further insight into the implications of blockchain technology in terms of services, business models, regulation and policy, please contact James Allen, Partner, at james.allen@analysysmason.com or David Abecassis, Partner, at david.abecassis@analysysmason.com. For queries related to IoT, please contact Tom Rebbeck, Research Director, at tom.rebbeck@analysysmason.com.

[1] The participants still have privacy, as they are identified by public keys.

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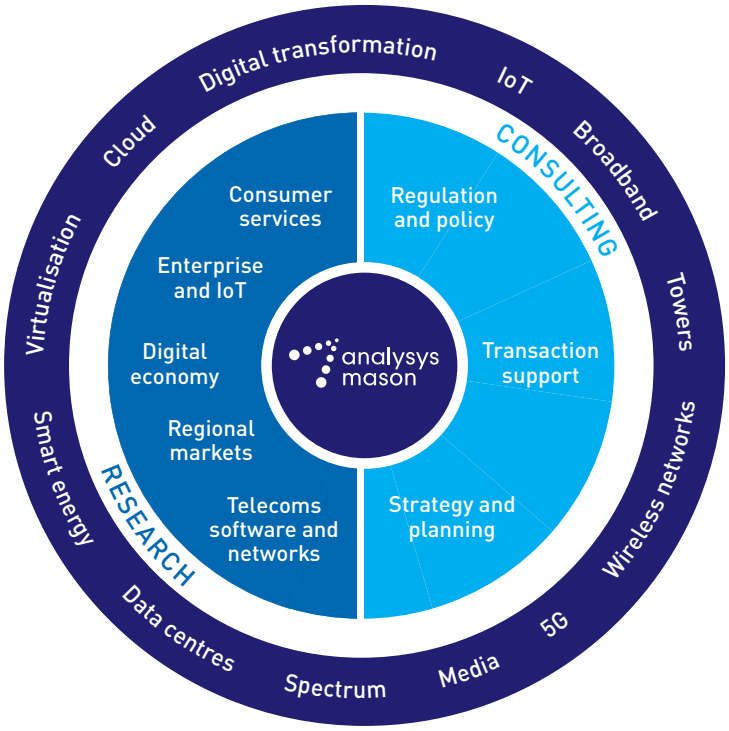
At Analysys Mason, we understand that clients in the TMT industry operate in dynamic markets where change is constant. Our consulting and research has helped shape clients' understanding of the future so that they can thrive in these demanding conditions.

CONSULTING

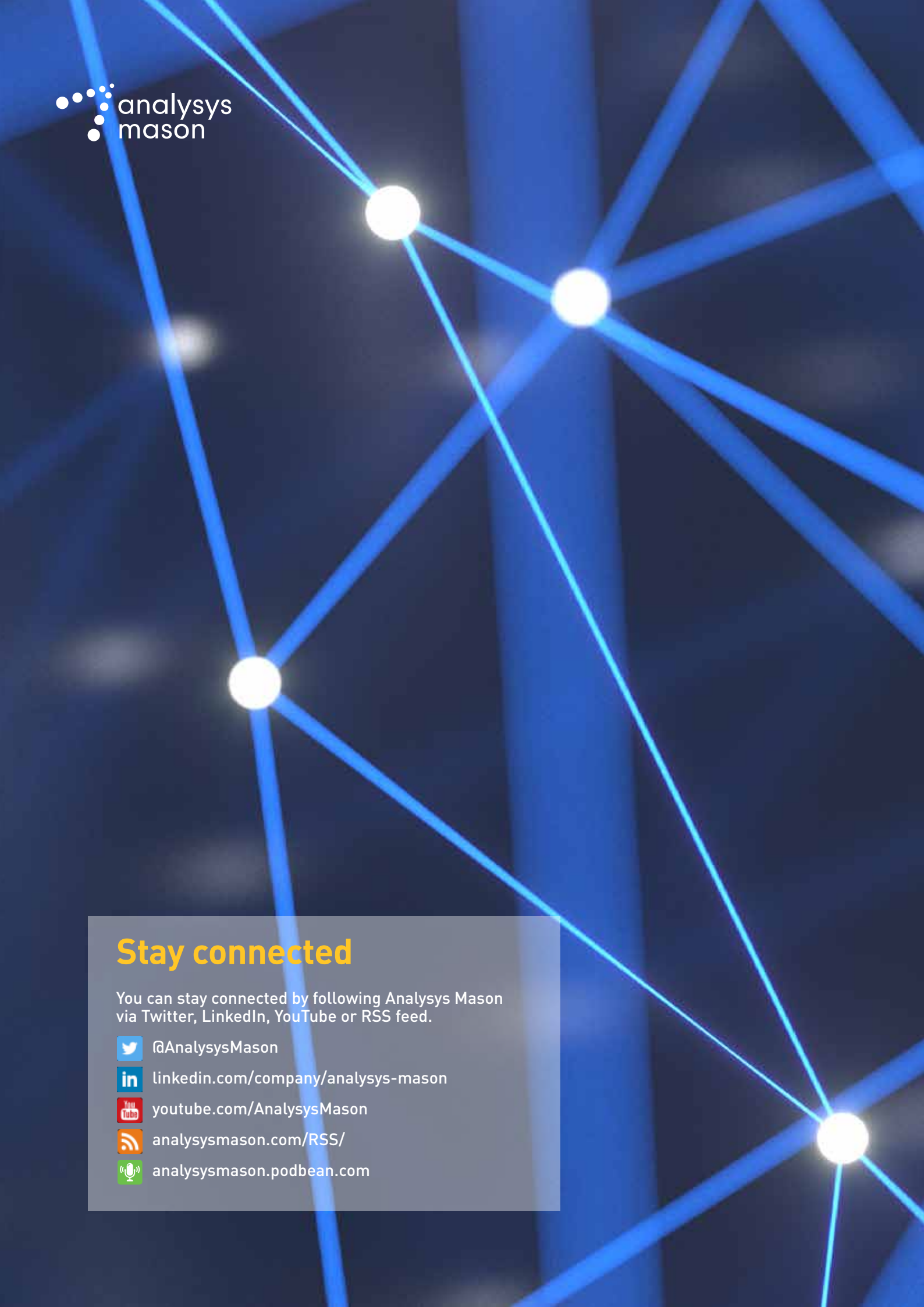
- We deliver tangible benefits to clients across the telecoms industry, including communications and digital service providers, vendors, financial and strategic investors, private equity and infrastructure funds, governments, regulators, broadcasters and service and content providers.
- Our sector specialists understand the distinct local challenges facing clients, in addition to the wider effects of global forces.
- We are future-focused and help clients understand the challenges and opportunities that new technology brings.

RESEARCH

- Our dedicated analyst team tracks and forecasts the fixed and mobile services accessed by consumers and enterprises.
- We offer detailed insight into the software, infrastructure and technology that deliver those services.
- Clients benefit from regular and timely intelligence, and direct access to analysts.



"Analysys Mason is a global consulting and research firm, specialising in telecoms, media and technology (TMT). Since 1985, Analysys Mason has played an influential role in key industry milestones and has helped clients through major shifts in the market. We continue to be at the forefront of developments in the digital economy and are advising clients on new business strategies to address disruptive technologies."



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