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Contents

Edge networks make the internet cheaper and faster for all

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As the internet continues to become a critical part of our economic and social lives, it continues to evolve to become more efficient and resilient. Companies that distribute content from the edge of ISPs' networks, rather than from centralised data centres, are a leading example of this evolution. Our increased reliance on the internet throughout the COVID-19 crisis illustrates its benefits, under the most unfortunate of circumstances. Policy and regulation should be used to continue to encourage the spread of infrastructure that supports these benefits.

Three overlapping trends over the past 10 years have changed the way in which we consume content on the internet. First, an ever-increasing amount of content is being made available; much of it is video, which now accounts for the majority of internet traffic. Second, major content aggregators such as Google (YouTube), Facebook and Netflix have become a very large source of this traffic, and third, the demand for this content is now truly global.

These overlapping trends have been made possible by changes in technology and business models. It is not optimal for an online streaming provider to serve the total worldwide demand from a central point. Instead, content is increasingly being served by content delivery networks (CDNs) from the edge of the ISP's network, thereby bringing it closer to the end users. Some CDNs are independent companies such as Cloudflare, while others are developed by content providers such as Google (YouTube) and Facebook. CDNs are putting static content such as videos in caches around the world and are also building points of presence (PoPs) in various countries in order to deliver more dynamic content, such as live events.

These edge networks benefit all stakeholders. The time taken for content to reach the end user falls significantly when content is delivered locally. When content is not local, the round-trip delay and associated latency is frustrating for users; reducing this frustration results in greater engagement and usage of online services. In addition, accessing content locally saves ISPs from having to pay for expensive international connectivity; these costs would otherwise be paid for by end users.

Edge networks currently benefit from a legacy of pro-competitive policy decisions that have helped to fuel the growth of the internet since its earliest days. Interconnection arrangements have been commercially negotiated, rather than regulated, from the start, and this approach remains widespread and is generally considered 'best practice'. Freely negotiated interconnection allows all parties (CDNs, ISPs and content providers) to choose how they interconnect based on business considerations including cost, efficiency and resilience.

Edge networks are becoming increasingly extensive and important as the complexity and scale of the demand for online and cloud services grow. The demand for video streaming will continue to increase, websites will become more dynamic, applications will become more real-time (for example, with the introduction of cloud gaming) and enterprises will continue to migrate to public and hybrid cloud services. As a result, edge infrastructure will continue to rely on more international connectivity, provide more PoPs in more locations and make greater use of caches distributed throughout countries and networks.

On the other hand, there is also an increasing call for national regulators to address the economic and social concerns that arise from the edge networks. Local ISPs often complain about the cost of delivering video content, even though such content is demanded and paid for by their end users. They seek to impose interconnection charges on CDNs, through regulation if necessary. There is also a worry that CDNs will become liable for the third-party content that is made available through the edge network, given the understandable concern about the nature of some content.

Both of these regulatory reactions may be built on a partial understanding of how content is delivered in the modern internet. National regulation will simply result in CDNs not investing in edge network infrastructure in a given country; they will instead make the same content available to the ISPs from outside the country. This will have costs for these ISPs, because they will have to buy more IP transit to access the content, thereby lessening their incentives to provide sufficient capacity for a good user experience. Local end users will also suffer more latency when accessing the content. In addition, the country will lose out on the broader economic benefits of edge networks.

The internet has benefitted from favourable policy and regulatory forbearance for many years. This has led to issues, including harmful content and behaviour, which are being proactively addressed in many advanced nations (for example, through the UK's online harms regulatory agenda). However, it has also been extraordinarily successful in enabling the internet to evolve into what it is today and to reach a previously unthinkable number of people worldwide.

The ability of the internet to absorb the demand shock caused by the COVID-19 crisis provides a dramatic (albeit accidental and unwanted) example of the efficiency and resilience of the internet infrastructure that this regulatory regime has enabled. Without the edge networks to help to meet the demands for increased content and services, the end user experience would probably have suffered considerable degradation, thereby limiting our ability to communicate, work, study, play and even access remote healthcare during these unprecedented times.

Analysys Mason works closely with stakeholders across the internet value chain, including regulators and governments. Recently published studies analyse the benefits of caching, the impact of Facebook's connectivity investments in ASEAN and sub-Saharan Africa and the impact of Google's network infrastructure in Asia–Pacific. We have also written a white paper on internet interconnection in the context of South Korea's drive to regulate these arrangements.

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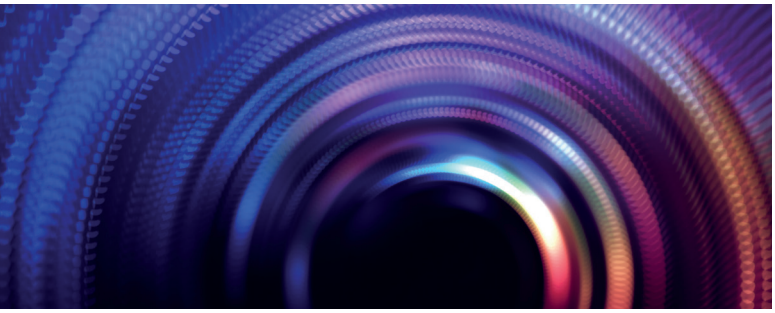
Regulators face difficult decisions in assigning 26GHz spectrum

Mark Colville, Principal, Consulting and Gentiana Shiko, Manager, Consulting



The EC proposed, in its 2016 5G action plan, that member states should grant access to at least 1GHz in the 26GHz band for mobile use by 30 March 2020, provided that there is market demand. The plan envisaged that 5G networks would start to be introduced by 2018, and that at least one major city in each country would be '5G-enabled' by the end of 2020. All urban areas and major terrestrial transport paths in all member states were expected to have uninterrupted 5G coverage by 2025. The Implementing Decision set out common technical conditions in order to allow the use of the 26GHz band for 5G systems by 31 December 2020. At present, it is expected that this band will initially be used in traffic hot spots, transport paths and/or industrial sites, with enhanced mobile broadband (eMBB) services likely to be deployed first.

The deadline for assignment that was originally set in the EC's 5G action plan has now passed, and awarding 26GHz spectrum by 31 December 2020 continues to look ambitious. At the time of writing, regulators in Italy and Finland were the only ones to have awarded 1GHz in the 26GHz band for mobile services, and consultations (with the aim to award some of the 26GHz band in 2020) were only underway in a further six member states. The COVID-19 pandemic is likely to slow progress for these states and others that are working towards a post-2020 timescale.

Uncertainty regarding the commercial use case remains, in our view, the main barrier to further assignments in the 26GHz band. This uncertainty makes it difficult for operators to assess when and how the spectrum might be of use to them and hence, the quantity of spectrum that they need and the value that they might place on it. At the same time, there is a potential demand from enterprises for spectrum to use in private networks, which could, at least partly, be addressed by spectrum in the 26GHz band.

It is therefore extremely challenging for regulators to determine how much 26GHz spectrum to assign for mobile services, when to assign it and how this should be done, including the detailed design of an appropriate award mechanism, such as an auction. Nonetheless, regulators are required to both uphold the EC Implementing Decision and meet their other statutory duties such as ensuring an efficient assignment of spectrum and protecting (or enhancing) competition. In this context, we suggest that regulators focus their thinking around four key considerations.

- **Sufficient bandwidth needs to be made available to** support emerging commercial use cases and encourage competition in the market. There is some variation in the approach used in the 26GHz spectrum awards in Europe that have already been planned, but typically, at least 1–1.2GHz is being made available to MNOs via exclusive national licences. This is broadly consistent with equipment vendors' suggestions of optimum bandwidths of at least 200–400MHz per operator. Regulators in a small number of countries are following a hybrid approach, whereby the upper 1–2.4GHz is awarded via exclusive nationwide licences, and the lower 26GHz band is reserved for use by local private networks. It will be important to monitor market developments in order to understand whether larger spectrum blocks will be beneficial and, specifically, for what applications, noting that existing users of spectrum in the 26GHz or adjacent bands may impose additional constraints in some markets.
- **Licences should be issued with appropriate geographic scope and duration** in order to encourage investment and large-scale deployments, while supporting local demand and innovation. Nationwide exclusive licences allow the greatest flexibility for MNOs, while regional licences could be considered if there is evidence of localised demand that may not be met by MNOs in individual markets. Licences with a longer duration (akin to the 15–20 year licences typically issued for low- and mid-band mobile spectrum) will allow for time to recover any initial investment and may encourage higher capital expenditure, thereby widening the geographic coverage and potentially bringing forward the launch of new services.

- **Licence costs and obligations should be carefully considered.** Low licence costs, particularly in terms of upfront fees (which can potentially be either deferred or partially replaced by annual licence fees), may stimulate demand. Benchmarks are limited in number, but licence costs for spectrum in the 26GHz and 28GHz bands have so far been reasonably low, as shown in Figure 1. Licence obligations for mmWave bands have generally been minimal and tailored to the most likely deployment scenarios (for example, high-capacity small cells), although the deployment requirements in South Korea were more stringent.
- **The award process needs to reflect the local market demand** and the expected competition for the spectrum. A competitive process such as an auction may be most appropriate in markets where the total bandwidth available in the 26GHz band is limited and/or there is high or uncertain demand for additional spectrum. By contrast, an administrative approach may provide additional flexibility and encourage new entrants in markets where the demand is likely to be lower and/or be significantly localised.

Careful consideration of each of these areas should help to ensure that regulators are able to assign 26GHz spectrum licences in the most appropriate manner for the individual market concerned.

Analysys Mason offers services including spectrum valuation and auction support, as well as advice on business planning and spectrum management issues, to operators and regulators around the world. For more information about our services, please contact Mark Colville, Janette Stewart or Gentiana Shiko.

[1] EC (2016), European Commission 5G for Europe Action Plan, COM(2016) 588 final. Available at: https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=17131.
[2] EUR-lex (2019), EU decision 2019/784 of 14 May 2019. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32019D0784.
[3] These states are Belgium, Denmark, France, Germany, Spain and the UK; the regulator in Sweden is planning to award some 26GHz spectrum in 2021.
[4] We will consider the issue of 26GHz licence valuation in more detail in an upcoming article.
[5] The regulator in Finland reserved 850MHz for local private networks, and the Swedish regulator has plans to do the same. The regulator in Hong Kong reserved 400MHz for local shared access. The regulator in the UK has made 2.25GHz available for local shared use, but this is limited to indoor use in order to lower the risk of interference with current users.
[6] In Italy, services are to be made available in each region 48 months from spectrum assignment date. In Hong Kong, the regulator relaxed the short-term roll-out obligation timelines following feedback from the MNOs. In South Korea, the conditions for the award of 28GHz spectrum include that it should be rolled out to 100 000 base stations (macro or small cells), including 15 000 within the first 3 years. In Finland, services should be launched within 2 years of the licence start date (1 July 2020), but this is open for reconsideration based on technology advances and the economic situation.
[7] Normalising to a licence duration of 20 years, assuming a 6.0% WACC and adjusting to 2020 real terms; ALFs are included where applicable.

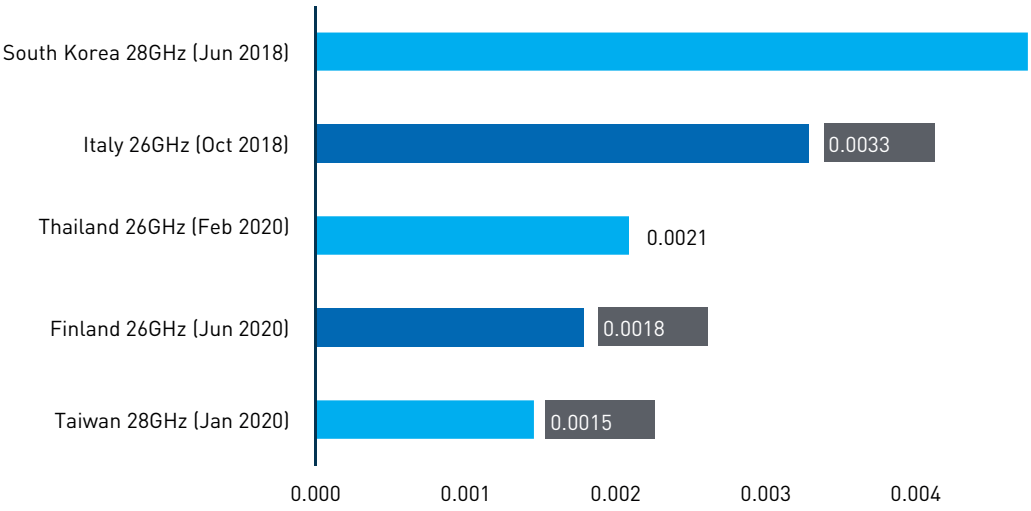


FIGURE 1: NORMALISED PRICES[7] FOR RECENT SPECTRUM AWARDS IN THE 26GHZ AND 28GHZ BANDS
[SOURCE: ANALYSYS MASON, 2020]

Questions? Please feel free to contact Mark Colville, Principal, Consulting at mark.colville@analysysmason.com or Gentiana Shiko, Manager, Consulting at gentiana.shiko@analysysmason.com

Fibre carve-out: apparent similarities hide important differences that investors need to understand

Stéphane Piot, Partner, Consulting

Over the last few months, we have seen a significant number of fibre transactions all over the world. Analysys Mason has been fortunate enough to be involved in most of them. We expect that this trend will continue (or even accelerate) in the next few months.

On the demand side, the recent COVID-19 outbreak has, if anything, demonstrated the need for good broadband, and fibre connections in particular. This is expected to incentivise customer migration and fibre take-up. On the supply side, fibre deployment requires significant investment that operators will find difficult to finance from their own cashflows.

One option used in several recent deals is a fibre carve-out, whereby (in a manner similar to creating a towerco from a mobile operator), a fixed retail broadband operator splits its current (and/or to be deployed) fibre network into a newly created 'neutral' wholesale-only-focused fibre operator. The retail operator becomes an anchor tenant to the wholesale operator (often keeping a share of the new vehicle) while giving exclusivity to the new vehicle and agreeing on wholesale prices.

Based on our significant experience, we note that these deals have specific characteristics that are important. Even deals that seem alike can in reality be materially different, due to important features such as anchor tenant commitments, network technical factors or regulatory aspects.

In the figure below, we present the key characteristics to review when performing commercial and technical due diligence of fibre carve-outs.

Regulation

- **Broadband policy/plans and potential subsidies.** The existence of government initiatives and specific targets for

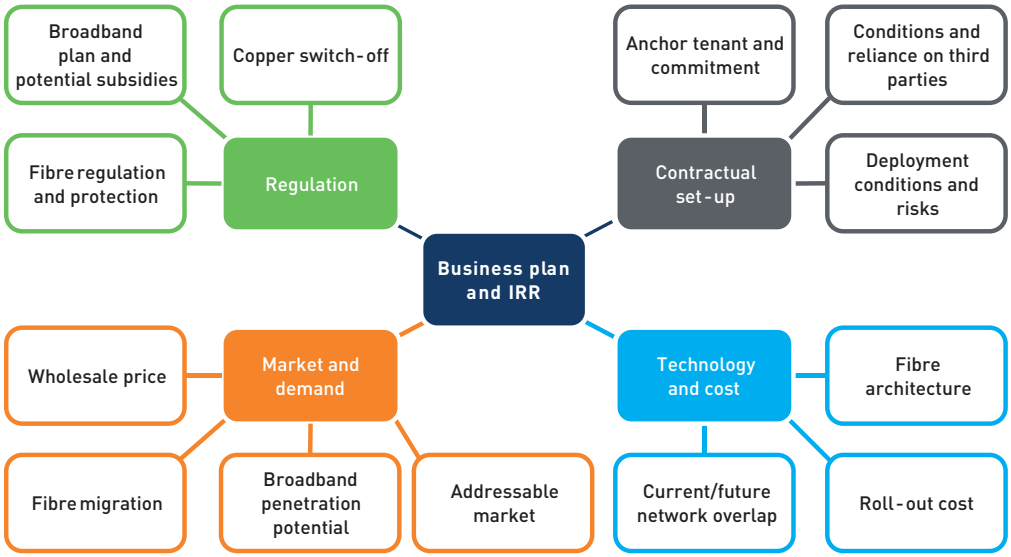


FIGURE 1: KEY PARAMETERS OF A DUE DILIGENCE FOR A FIBRE CARVE-OUT [SOURCE: ANALYSYS MASON, 2020]

fibre take-up and coverage can shape the market. In particular, the associated measures and any ways in which the regulator and government may intend to intervene (allocation of subsidies, binding commitment ...) are relevant to assessing future fibre demand/supply.

- **Fibre regulation/extent of overbuild protection (if any).** The extent to which fibre is likely to be regulated (or not) will influence wholesale price levels and their evolution. Similarly, the potential legal protection or regulatory/economic disincentives for network overbuild may or may not result in a quasi-monopoly for fibre deployment.
- **Copper switch-off plans.** The timing of copper switch-off is a key driver for the schedule of broadband users migrating to fibre.

Market and demand

- **Addressable market.** Care is needed to understand the potential market size: not all premises passed are potential subscribers (second homes, addresses with no buildings or empty buildings, agricultural buildings, etc). Furthermore, the source of information should be carefully considered. The number of premises in initial network roll-out designs is often based on an estimate from national statistical institutions, for which the most recent census could be a few years old. Real network deployment projects will often reach between 5% and 10% more premises than census data may suggest.
- **Wholesale price (co-investment/rent).** The tariff structure scheme (monthly rental, co-investment/indefeasible right of use (IRU)) and price levels (current and expected evolution, and their consistency with retail tariffs) are obviously essential for the revenue assessment and the cash generation profile of the project.
- **Fibre migration and long-term potential.** Short to medium term take-up is mainly fuelled by standard broadband migration. In this context, the assessment of the retail market dynamics (market share, incentives and strategies to promote fibre take-up in covered areas) will dictate the shape of that curve. The long-term potential is a reflection of the overall potential for fixed broadband in the covered areas. The potential typically depends on the nature of the premises covered (that is, the proportion of secondary/empty sites) and the country's macroeconomic environment.

Contractual set-up

- **Anchor tenant and commitment.** A key characteristic is the existence of one or several anchor tenants. The strength of these operators on the retail market (typically their market share) and the type of commitment they want or can legally take (due to deconsolidation objectives) provide quasi-guaranteed revenue and minimise the project risk.
- **Conditions and reliance on third parties.** Similarly, the reliance of the business plan on third parties and therefore not committed revenue is a key risk factor.
- **Deployment conditions and risks.** Some projects are based on a fixed cost deployment contractually agreed with companies that manage the deployment and often the maintenance of the network. This set-up obviously minimises the risk of cost overruns. Penalties for deployment delays are also sometimes covered.

Technology and cost

- **Fibre architecture.** The architecture (point-to-point network or GPON network with associated splitting ratio) and the type of services offered (passive, active, access, backhaul, co-location, residential, business etc.) are important to the cost and revenue potential.
- **Roll-out cost.** The deployment cost (even if in some cases contractualised) should always be assessed. The network architecture, capacity to reuse existing ducts and poles, the use of aerial or buried infrastructure, the need for civil engineering, site density and local labour costs are all key parameters.
- **Current and future network overlap.** The capability, economic incentives and strategic incentives of other operators to overbuild the expected network fibre deployment of the project are paramount to assess the retail market share that the fibre network can ultimately serve.

Please contact Stéphane Piot, if you want to discuss fibre due diligence projects or just want to discuss the key characteristics and differences of most recent (or forthcoming) operations.

Questions?
Please feel free to contact Stéphane Piot, Partner, Consulting at stéphane.piot@analysysmason.com

COVID-19: the role of telecoms policy makers in levelling up

James Allen, Partner, Consulting

This article discusses issues that policy makers may choose to focus on as a result of the COVID-19 pandemic, lockdown, and future economic recovery efforts. It is deliberately wide in scope, and is no doubt only a partial summary. The world is badly affected, and new issues arise daily. I have divided telecoms network policy issues into those that I see as being addressable in the medium term and longer term respectively, and address each in turn below.

Medium-term issues

These issues go beyond the immediate short-term responses and represent things that can be achieved with changes to networks and their configuration. Specific items discussed below are:

- a potential conflict between rapid network upgrades and seeking 'trusted' vendors
- assisting in optimising the ICT system as a whole
- prioritisation of what capacity we have.

The conflict between rapid network upgrades and seeking 'trusted' vendors

If we start to run out of network capacity, new technologies may be deployed on existing infrastructure, such as massive MIMO and 10G PON systems. If we want lots of massive MIMO in the short term, we might need to worry less about whether the vendors of such systems are 'trusted'; or we may need to push the trusted vendors harder, or accept slower growth in capacity.

Assisting in optimising the system as a whole

Governments and regulators might have a co-ordination role, because we might be able to make better use of what we have, if we understood better where the bottlenecks or 'pain points' are.

- Operators may seek to reconfigure their mobile networks for more FWA-like traffic or configure their DSL management/vectoring to preserve upstream capabilities to better support video calls.
- End users might buy customer premises equipment (CPE) with better Wi-Fi, or might cable up their home office/kitchen table.

This coordination role could for example take the form of mass-endpoint network performance monitoring that could be correlated with end-user experience on their applications of choice; the resulting data would potentially let operators and end users see which network parameters were correlated with a poor experience (for example, if latency spikes or packet loss resulted in certain types of poor audio quality during Teams calls), and whether these were related to in-home, access network or internet service provider (ISP) performance issues. This is not easy, for several reasons: application performance is a complex mix of factors; existing mass-monitoring solutions tend to neglect in-building factors and measure when the link is not otherwise in use by that end user; and finally, the resulting performance indications could be contentious if ISPs (or CPE vendors) thought that they were not fair.

Prioritisation of what capacity we have

In EU member states and in some other countries, net neutrality rules make it difficult for ISPs to offer services that prioritise traffic in a targeted way (for example, services that prioritise specific educational or work-related conference calls). But they do allow these things to be done by end users (for example, as features on an end-user's firewall), and most CPE already have simple web interfaces.

Obviously policy makers could change their stance on net neutrality, although the merits of such change are debatable and would take years to achieve. But even without doing so, governments and regulators could help users to help themselves configure their in-home devices (or run new services on their home devices) to better manage the conflict between the Zoom lessons, the Teams work calls and the OneDrive synchronisation. Some kind of 'pump-priming' investment in upgrading capabilities on mass-market CPE or providing additional legal clarity regarding whether ISPs could assist in managing such solutions on behalf of end users might help here.

Longer-term issues

In the longer term, it is likely that there will be an increased focus on the following existing areas of network-related public policy:

- universal service for broadband
- system resilience of critical infrastructure
- competition policy in telecoms.

Universal service for broadband that is 'good enough'

First, the case for high-quality broadband for all is stronger than before. There are widespread benefits if more people can work from home or attend online lessons, for example. These benefits do not just flow to those who can themselves work from home – we are all in this together (that is, there are externalities), which is the guiding principle of a funded universal service obligation (USO).

Second, the required standard to be 'good enough' may have changed, assuming that several people in the same household are trying to work or learn simultaneously. Until now, the ability to support one channel of streaming video of a quality roughly equivalent to terrestrial DTT has been seen by many policy makers as the threshold for 'acceptable' broadband speeds in rural areas (for example, in the UK). Now, teleconferencing (or to some extent remote login to centralised, virtualised IT) may add new constraints in terms of higher speeds, upstream requirements and desire for lower latency.

This may favour FTTH or 5G FWA and may require larger-scale use of subsidies to provide FTTH in commercially uneconomic rural areas. Ireland decided to do this even before the impact of COVID-19. During the coming recession, public investment in infrastructure could provide local employment and build FTTH in uneconomic areas, possibly in co-ordination with 'green' investment, for example in reducing the need for commuter travel.

System resilience of critical infrastructure

The ICT system has shown that it has a critical role to play, and will need to remain operational in an extended COVID-19 crisis and in other kinds of crisis.

A major cyber attack similar to WannaCry or a solar storm of a similar scale to the Carrington event of 1859 could cause major damage to the power and ICT networks that would render a pandemic lockdown even more crippling and/or disable critical health services at the same time, greatly increasing danger to life. In turn, ICT will need to be strengthened, which is likely to mean more regulatory intervention regarding cyber resilience, diversity of routing, diversity of supply, and operator interconnectivity, and some resistance from operators that do not want to pass these higher costs on to customers at a time when many are losing their jobs or are worried about finances. Capitalising these costs and spreading them over time may be important.

We can expect a renewed debate about whether public services should be provided using commercial networks (and hence where the available spectrum should be used), although it is not obvious that COVID-19 has changed the merits of either argument for or against reserved spectrum for public services.

Working from home and e-learning makes home networking more important, which might encourage regulators to allocate more spectrum for Wi-Fi or similar uses (although 5G FWA may also have a crucial role in improving the ability to work from home in rural areas, at least until the FTTH investment can be delivered).

Some operators are already beginning to think about what they want from policy makers so that these network improvements are as cheap as possible to deliver (for example, see recent Vodafone comments about planning and permits).

In countries where the retirement of the highly resilient, but costly, PSTN is not planned for a number of years, another relevant point is whether the industry can bring forward this switch off and replace it with voice over broadband.

Do we need to think about competition policy in telecoms?

A post-lockdown economic crisis and a need for more network coverage and more resilience will potentially be seen conflicting with the desire to protect competition.

In theory, resilience is improved by parallel networks (we can use mobile if fixed fails) – but in practice there are ways in which inter-operator interconnection can be a weak point in such systems (for example, if it is underdimensioned or misconfigured in ways that are not exposed except at times of crisis). Fixing these weaknesses may require government or regulatory supervision including, for example, audits of network configuration, paper exercises or simulations to test the impact of loss of specific interconnection points; one difficulty is that there is no 'test rig' for the national communications infrastructure and it is hard to justify 'live' testing when the communications network may be carrying important data or calls at any time of the day or night.

There is a balance to be struck between static and dynamic efficiency. Static efficiency would favour having the lowest total cost (and hence, a single network); dynamic efficiency favours multiple networks and hence (to a certain extent) infrastructure competition even if there is some duplication of costs (that is, static inefficiency). This can be seen in the policy conflict between multiple independent networks, or multiple operators on one physical infrastructure, (for example, with regulated wholesale access, or access to dark fibre).

The model of a regulated fibre utility (based on local franchises) may deliver higher coverage than the European model where there can be no franchises, leading to the possibility (and reality in some places) of direct parallel infrastructure competition. Even if policy stances remain unchanged as a result of COVID-19, we will start to get answers to these questions over the next few years, because we have 'natural experiments' arising across the EU, where local markets for FTTH are radically different in different member states, and if we compare the EU to (say) the broadband networks of New Zealand and Australia, each of which took radically different policy options as regards monopoly supply and the nature of state involvement in funding FTTH deployment.

These longer-term debates are just beginning and are likely to form a significant backdrop to the rebuilding of the economy that we will need to do in the decade ahead. Since the end of the second World War only 75 years ago, the current generation (with our parents and grandparents) have rebuilt a war-ravaged world, and lived through an age of relative material wealth and substantially improved health. We can do so again. COVID-19 has brought a lot of suffering, and there will be more suffering yet. We owe a huge debt to the caring professions. But until we can meet face to face and travel freely again, we can communicate, we can build a better network together, and we can dream of a better future.

Questions?

Please feel free to contact James Allen, Partner, Consulting at james.allen@analysysmason.com

Cloud developments are providing data centre co-location investment opportunities in the GCC

Soufiane Fares, Consultant, Consulting and Jacopo Pichelli, Manager, Consulting

There have been several significant cloud developments in the Gulf Co-operation Council (GCC) region in the last few months, and a number of global cloud service providers (CSPs) have launched their services (Figure 1).

Amazon and Microsoft have been the most-active cloud providers in the GCC region lately, but they are using different approaches. Amazon Web Services (AWS) offers its products from a central hub in Bahrain using its own infrastructure. It relies on remote points of presence (PoPs) to serve other countries in the region. Microsoft has no proprietary data centre in the region and instead relies on a decentralised organisation, and each country is served by a local data centre.

CSPs tend to build their own infrastructure to serve the country/region (for example, Amazon's hub in Bahrain) once they have launched their services, as demonstrated in more-developed markets. CSPs represent a major source of demand for co-location providers, so this trend is likely to have a significant effect on how the co-location market evolves.

The growing interest in public cloud should reduce the enterprise demand for co-location services

Co-location is the service provided by a data centre facility that enables a business to rent space for servers and other computing hardware. The co-location market is fuelled by enterprises' demand to outsource their IT equipment for reasons such as cost, scalability and fitting with their IT outsourcing strategies.

The IT expenses of SMEs and large enterprises have grown substantially thanks to digitalisation and IT transformation. This has provided a solid base for the growth of the co-location market in the GCC in the last 5 years.

However, the co-location business is under threat from the alternative: public cloud. In this case, the server itself (or the software services that it provides, such as virtual machines, databases and message queues) can be rented from a cloud provider, rather than having to buy a server and hire space, power and cooling for that server in a data centre. Enterprises are increasingly shifting towards public cloud services offered by global CSPs, and this is likely to have a profound effect on the co-location market and its structure. Indeed, the demand that previously came directly from enterprise clients is increasingly being 're-routed' through public cloud providers, who in turn, are outsourcing the data centre co-location parts of their businesses.

Country	Development
Bahrain	AWS launched services in Bahrain to serve the Middle East (with three availability zones) in 2019.
Qatar	Microsoft Azure announced that it plans to launch services in Qatar in late 2020.
Saudi Arabia	Both Microsoft Azure and Oracle Cloud launched in Jeddah in February 2020.
UAE	• Alibaba started to develop its second data centre after completing the build of its first data centre in 2016. However, it put the new development on hold in mid-2019 in order to re-evaluate its business in the region. • Microsoft Azure has been available in Dubai/Abu Dhabi since June 2019. • AWS launched a point of presence in Dubai in 2019, connected to the Bahrain availability zone.

FIGURE 1: RECENT CLOUD DEVELOPMENTS IN GCC REGION, JANUARY 2019–JUNE 2020 [SOURCE: ANALYSYS MASON, 2020]

Telecoms providers are facing a crucial dilemma on the supply side

There are three types of players in the co-location market:

- carrier-neutral data centre providers that are focused on the co-location market
- telecoms providers that are focused on the continuity of their traditional services as telecoms operators in the data centre space
- specialist IT services players that are focused on value-added services and cloud, but also offer co-location.

The data centre market in the GCC is currently dominated by telecoms providers. Many of these players entered the market by extension of their main connectivity business and have benefitted from their large enterprise clients' digitalisation and IT transformation activities. However, the demand for co-location services is shifting, in terms of both quality and quantity, and the growth in this demand is now expected to come from tech players and global CSPs. CSPs' demand is different to enterprises' in terms of scale, and requires greater sophistication and adaptability, as well as multi-carrier connectivity.

Telecoms providers are therefore facing a crucial dilemma. They either have to invest to keep up with the market demand or sell off parts (or all) of their data centre businesses. The latter will provide investors with interesting opportunities to buy stakes in an operator's data centre business or their infrastructure and there have been several examples of such deals in other markets. Carlyle recently announced its plans to acquire a 25% stake in Bharti Airtel (India's largest integrated telecoms operator), Brookfield invested in A&T's data centre business (mainly in the USA) in 2019 and Asterion Industrial Partners invested in Telefónica's data centres in seven countries in North and Latin America.

Investments in the co-location market should enable infrastructure providers to match CSPs' requirements in terms of reliability and performance, which should limit CSPs' motivation for building their own infrastructure to just economic aspects, that is, cost efficiency (which should be conditioned by the size of the demand due to economies of scale).]

A number of legal and technical factors are driving the demand for local co-location in the GCC

Many enterprises need to be close to their co-located hardware, meaning that their co-location provider needs to be local. A shift to the cloud could remove this particular constraint. However, a variety of legal, technical and financial factors are strongly encouraging local co-location.

There is no federal law for data protection in the GCC and only some aspects of data protection are covered in the general laws. However, governments are starting to place a greater emphasis on data protection for the sake of their citizens' privacy and are thinking of constraining or regulating the handling or location of sensitive data, particularly when it comes to serving the government, healthcare and banking sectors. Proximity to end users is also important in achieving low latency, which affects application responsiveness. Content providers need to cache some of their data close to the end user in order to minimise distribution costs, so international bandwidth costs can be reduced if local data centres are used. All of these factors favour the use of local data centres, but it is not yet clear to what extent CSPs will self-supply.

Indeed, CSPs may have plans to build their own infrastructure in the region, and this is likely to be a threat to the co-location market. However, the aspects discussed in this article should offset the impact. Firstly, global CSPs will need to have a certain level of local demand before it is efficient for them to open their own infrastructure (and this why Alibaba has put the building of its second data centre on hold; see Figure 1); this may take some time, even for very large players. Secondly, we expect to see a shift from centralised facilities towards resources that are closer to the end user (and are thus smaller), which will increase the number of 'edge data centres' in locations where CSPs' investment in private facilities is not justified.

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IoT in agriculture: emerging markets provide important opportunities for operators

Michele Mackenzie, Principal Analyst, Research

The agricultural sector has been considered to be a strong market for IoT, particularly since the advent of LPWA, but activity has been limited. However, some technology providers are now making progress in this sector, though some barriers, such as a fragmented upstream supply chain to the producers, still remain.

We estimate that the IoT revenue for suppliers in the agricultural sector will exceed USD6 billion by 2028, and that the majority of this revenue (USD5.7 billion) will come from applications and hardware solutions. The agricultural sector is therefore an attractive revenue growth opportunity for technology suppliers provided that they can deliver an integrated solution with hardware, applications and connectivity. Furthermore, investment to develop solutions in the agritech sector is growing. Indeed, agritech start-ups raised USD16.9 billion in 2018 (a 43% increase over 2017) according to the Agfunder Agrifood Tech Investing Report 2018.

Identifying channels to market is complex, and the need for end-to-end solutions deters some providers from addressing the sector

There are multiple challenges in delivering IoT services for the agricultural sector. Farmers require end-to-end solutions and services that are simple to install and operate. Suppliers do not always have the assets and skills to deliver such end-to-end solutions. They can only address this through internal builds, partnerships or acquisitions, all of which require investment and carry significant risk.

The agricultural upstream supply chain to farmers is fragmented, meaning that it is difficult for suppliers to identify channels to market. There are many small companies and only a few large ones (such as John Deere and Monsanto). It is more difficult for technology companies to identify key stakeholders in the agricultural sector than in the automotive or utilities sectors, which are more-concentrated industries.

Opportunities to sell IoT solutions in the agricultural sector may be as important in low- and middle-income countries as in high-income countries because agriculture accounts for a greater share of GDP in the former. However, the opportunity varies by country, and market structure and regulation must be factored into any market entry strategy. For example, governments may have established quota systems or subsidies, which by their nature undermine farmers' incentives to increase productivity and hence adopt new technologies. The agricultural sector also has a large number of use cases, a fragmented customer base and a supply chain that differs by country, whereas the smart metering use case, for example, is similar in many countries, has a small number of buyers (utilities) and a relatively simple supply chain.

All of these factors make it difficult for technology suppliers to create scalable solutions.

Some companies are developing routes to market and creating innovative solutions

We evaluated the strategies of several technology suppliers that have developed IoT solutions for the agricultural sector in our recent reports, IoT in agriculture: the role of operators and IoT in agriculture: case studies and analysis. An overview of the approaches of these suppliers is shown in Figure 1.

The technology providers listed in Figure 1 are pioneers in providing IoT solutions to the agricultural sector. Some have identified sound routes to market, and others are developing solutions as a direct response to customer needs. Some are also addressing requirements in emerging markets. It is still too early to identify best practice, but the firms included in our research are demonstrating solid early progress.

- Mezzanine's MYFARMWEB solution is a comprehensive precision farming platform that has been developed with Mezzanine's partner and specialist agronomy consultancy, Agritechnovation. Mezzanine has understood the supply chain and this understanding has been key to its success.
- Libelium works with systems integrators and application providers to build solutions based on its sensor technologies. It also works with other institutions such as banks and the public sector to take solutions to market.
- Nokia WING has built smart agriculture and livestock solutions with partners and delivers them as SaaS to operators. It has developed interesting business models to lower the cost of adoption and is seeing growing demand in emerging markets.

Dedicating resources to developing IoT solutions in a largely unproven sector, such as agriculture, is high-risk and many technology providers will choose not to target this vertical with their IoT propositions. Those that do target the sector will need to develop solutions, build a solid understanding of the supply chain and channels to market and explore the opportunity in emerging markets.

Company	Location(s)	Comment
Bosch.IO	Developed countries such as Japan and Spain	Bosch.IO has developed products to monitor high-value crops, mainly through its local opcos in developed countries.
KPN	The Netherlands (home market)	KPN is focusing its resources in its home market; the Netherlands is the second-largest exporter of agricultural products after the USA.
Libelium	Developed and emerging countries including Colombia, Indonesia, Russia, Spain and Vietnam	Libelium is developing solutions with local partners in a variety of countries.
Mezzanine	Australia, New Zealand, South Africa and the USA	Mezzanine's solution has mainly been adopted in developed countries. There is interest in other African countries outside of South Africa.
Nokia WING	Currently North Africa and Latin America, but open to all operators that use the Nokia WING platform	There is demand for Nokia WING solutions in developing countries and Nokia WING is working with local operators to deliver full solutions.
NNNCo	Australia	NNNCo is only present in Australia and is building a dedicated rural LoRaWAN for agricultural use cases.
TELUS	North America initially, but plans to offer services wherever it has an existing presence	TELUS has acquired Canadian agritech companies that have customers across North America. It has ambitions to expand its services to other countries where it has an international presence.

FIGURE 1: AN OVERVIEW OF THE KEY IOT PLAYERS IN THE AGRICULTURAL SECTOR
[SOURCE: ANALYSYS MASON, 2020]

Questions?
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Driving transformation in the telco sector

"Faced with disruption from numerous angles, telcos are under great pressure to transform, but with most change programmes failing, they need to approach transformation the right way."

The telecoms industry is in a period of significant transition. Disrupted by digital native companies from across the media, internet and communications sphere, telecoms firms' voice, data and messaging services are under threat. Also they must transform their operations and business models to keep up with fast-changing customer expectations.

Challenges facing the industry have driven consolidation and convergence of services, but when mobile telcos scoop up fixed telecoms operators or vice versa, it only adds to the silos and complexities in their legacy IT systems that inhibit them from innovating at speed.

The business side of telcos is eager to create a more seamless customer experience, but this requires a firm strategy for transforming not just all IT applications, but also people, processes and ways of working.

Transformation, however, is not easy. It's something that by definition must involve most of the company's workforce, which in a telco means impacting the day-to-day work of thousands of people over several years.

Some companies take a piecemeal approach, upgrading bit by bit over a longer journey, while others do a full replacement of all the core IT and customer-facing systems in a shorter, but more disruptive, time period. Either way, the odds are against any transformation programme from the beginning.

"Doing any big BSS [business support system], OSS [operations support system] or digital transformation is incredibly hard," says Peter McMenemy, managing partner at Analysys Mason Germany and formerly managing director of Allolio&Konrad, a telecoms consultancy recently acquired by Analysys Mason.

"The vast majority of them go wrong, significantly over budget, take years longer than initially envisaged and most don't even deliver the benefits expected. Thankfully, there is also a lot you can do to really help these programmes along and get them back on track."

Analysys Mason has been working with telecoms companies since 1985, supporting them through every phase of innovation. In the last decade, it has supported many of its telco customers to define the right strategy for their transformation, before assisting them to set themselves up to run a successful programme from the outset.

Crucially, Analysys Mason helps its customers negotiate outcomes-based contracts with the large external software vendors and system integration partners, rather than allowing them to bill based on a traditional time and materials and software licensing basis, which often leaves them all pulling in different directions.

Software vendors, naturally, want to sell as much software and development days as possible, while systems integrators aren't motivated to get the job done on time when they are getting paid by the day.

"Guiding customers through the journey of working with software vendors and systems integrators is what we have proven to be very successful at," says McMenemy. "Because we've been supporting transformation programmes for so long, we see where the mistakes are made and we understand the levers the telco operators have to pull to make this successful. When going into any transformation of this complexity, cost and duration, you really need to line up everyone behind the same outcome."

Once everybody is aligned and pushing in the same direction, it's then important to ensure people are at the heart of the transformation. Replacing IT systems in itself does not transform a business and overlooking the people element is a common error. Another familiar mistake that Analysys Mason often finds is the habit of constantly building new applications, albeit of great value to the business, but failing to simplify.

"Sometimes we see operators with 1,000 applications in their daily business-as-usual operations. That's a phenomenal number," says McMenemy. "We'll often ask how many applications have you taken out? And the answer is normally zero.

"It's important we get telcos to think about their simplification agenda. Imagine the capacity you can free up to focus on innovation when you only have to support 100, rather than 1,000, applications. Simplification allows you to go faster. Speed of execution and time to market are critical to telcos, and simplification is key to driving those goals."

This article was published in The Times on 22 June 2020 in a special report on Digital Transformation

Questions?
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THE IMPACT OF FACEBOOK'S CONNECTIVITY INITIATIVES IN SUB-SAHARAN AFRICA

800 million people across sub-Saharan Africa are not Internet users due to various barriers to connectivity

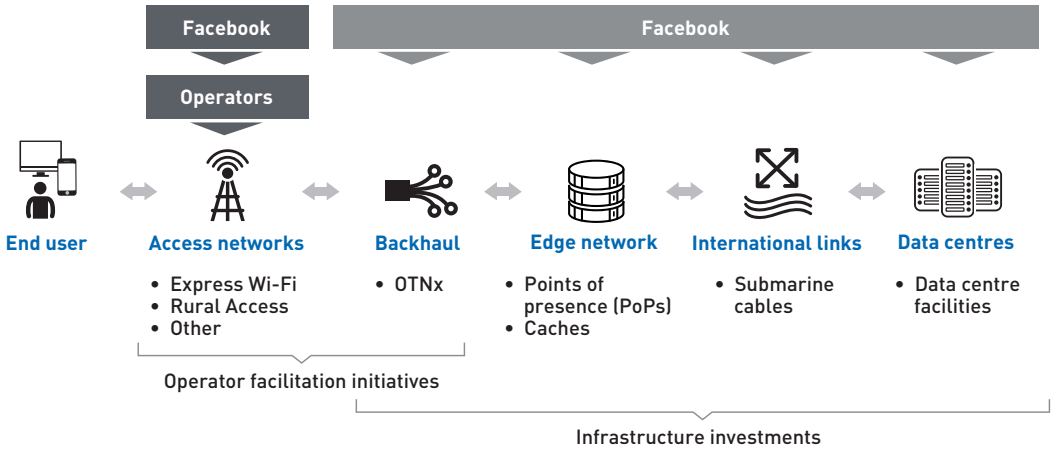
Availability
Broadband networks (e.g. 3G) are only available to 71% of the population

Relevance
All but five countries in sub-Saharan Africa rank in the lowest quartile on local and relevant content

Affordability
1GB of monthly data accounts for ~8% of average income (vs 2% UN target)

Readiness
38% of adults lack literacy skills and many are not familiar with digital technologies

To address these barriers, Facebook is investing in initiatives across the entire connectivity value chain



These initiatives generate economic impact in sub-Saharan Africa through improving connectivity outcomes in the region

Initiative	Express Wi-Fi[2]	Fibre backhaul	Edge networks and submarine cables
Connectivity impact	Launched in 7 countries in sub-Saharan Africa	4 million people covered with 3G+ service in Uganda and Nigeria	Facebook apps are estimated to account for ~20% of total Internet traffic in the region, and 70% of Facebook traffic is served from within the region
Economic impact, 2020-2024[1]	USD0.3 million	USD3.9 billion	USD53.4 billion

Total 2020-2024 economic impact: USD57.6 billion

[1] Economic impact denotes cumulative nominal GDP impact of Facebook's initiatives over 2020-2024; we note that this includes only the effects that could be quantified
[2] Express Wi-Fi is an operator facilitation initiative, i.e. infrastructure deployment is carried out by local partners; Facebook does not deploy or operate access networks

Questions?
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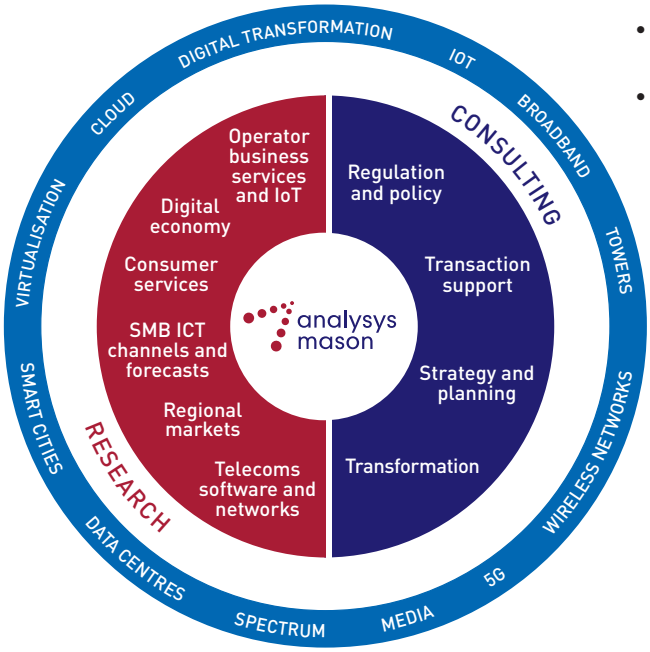
Analysys Mason's consulting and research are uniquely positioned

Analysys Mason is the global specialist adviser on telecoms, media and technology (TMT). Since 1985, Analysys Mason has played an influential role in key industry milestones and helping 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.

See what clients have to say about working with us: www.analysysmason.com/client-testimonials



About our services

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 they can thrive in these demanding conditions.

Consulting

- We deliver tangible benefits to clients across the telecoms industry
- 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 new technology brings.

Research

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

"Analysys Mason is the global specialist adviser on telecoms, media and technology (TMT). Since 1985, Analysys Mason has played an influential role in key industry milestones and helping 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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