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Contents

Private networks: trends and analysis of LTE-based and 5G-based networks

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The major 5G mobile network operators (MNOs) are currently focusing on applications based on consumer-oriented mobile broadband (MBB) services. However, the 5G standards are designed to support a variety of other applications. For example, the same technology that is used in major 5G mobile networks can be tailored to be used in private LTE/5G networks that address the complex and highly bespoke nature of the 5G services that enterprises and a range of sectors might be interested in.

Analysys Mason's Private LTE/5G networks tracker provides useful data on the range of private LTE/5G networks that are currently being deployed. In this article, we use this data to illustrate the trends in the use of private LTE networks and private 5G networks and explain these trends in terms of new 5G standards and spectrum availability.

What are private LTE/5G networks?

A private LTE/5G network is a cellular network that is built specifically for an individual enterprise. Such networks are most commonly deployed on a single site (for example, in a factory or a mine). Private LTE/5G networks can also be deployed to address wide-area network requirements such as a utility's need to monitor a transmission network. Private LTE/5G networks differ from public mobile networks; the latter are typically currently designed to support the wide-area network requirements of the consumer smartphone market.

There are several deployment models that can be used for private LTE/5G networks. Some of the key differences between these models are the type of spectrum used, the core network architecture and how the network is deployed (for example, by an MNO, specialist company, equipment vendor, system integrator or the user itself).

Private LTE/5G networks are often used to connect a diverse range of device types. Private 5G networks in particular are being used to wirelessly connect a large number of sensors and different device types and to provide wireless connections with performance that is comparable to that from fixed cabling. This is needed to maintain the high reliability and low latency that is required for real-time data analytics, image analysis and control-type applications.

The main users of private LTE networks are different to those of private 5G networks

Our latest data indicates that a growing variety of applications and sectors are using private networks. A wider range of vertical markets are using LTE-based private networks than 5G-based networks, largely because LTE technology has been available for longer (Figures 1 and 2).

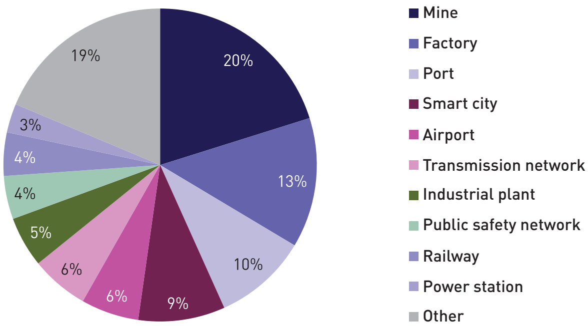

FIGURE 1: USERS OF LTE-BASED PRIVATE NETWORKS, WORLDWIDE, FROM DATA PUBLISHED IN JUNE 2021 [SOURCE: ANALYSYS MASON, 2021]

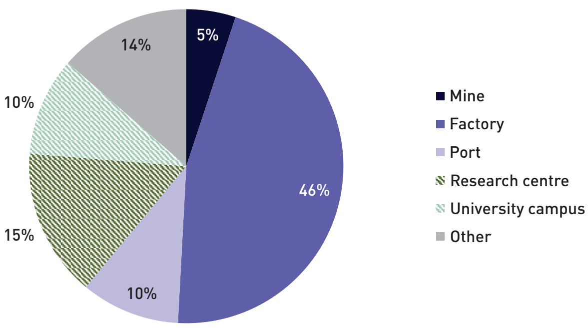

FIGURE 2: USERS OF 5G-BASED PRIVATE NETWORKS, WORLDWIDE, FROM DATA PUBLISHED IN JUNE 2021 [SOURCE: ANALYSYS MASON, 2021]

Nearly half of the 5G private networks that are currently listed in our tracker are deployed in factories. LTE-based private network use is more fragmented; the main users include factories, ports and mines.

5G networks support more-advanced applications than LTE networks

LTE-based private networks have mostly been used for MBB connectivity (for example, mobile workforce), industrial equipment connectivity and asset tracking, as shown in Figure 3. Private 5G networks are also being used for industrial equipment connectivity and asset tracking, but are additionally used in automatic guided vehicles (AGVs) (Figure 4). These applications use 5G's low-latency capabilities to enable real-time data capture, real-time process analysis and intelligent maintenance. Advanced applications can also make use of the new spectrum that is available for 5G networks that has wider contiguous channels and advanced antenna systems to provide the additional capacity and network performance needed for the most demanding applications.

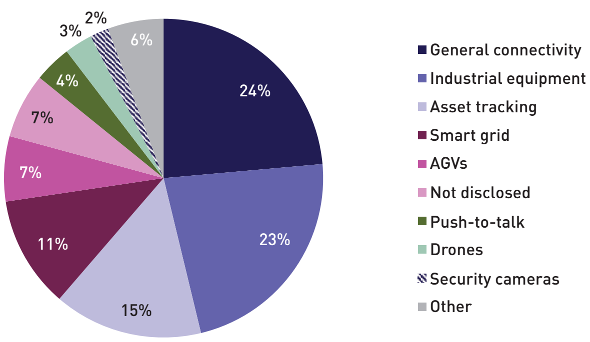

FIGURE 3: APPLICATIONS MOST COMMONLY SUPPORTED BY LTE-BASED PRIVATE NETWORKS, WORLDWIDE, FROM DATA PUBLISHED IN JUNE 2021 [SOURCE: ANALYSYS MASON, 2021]

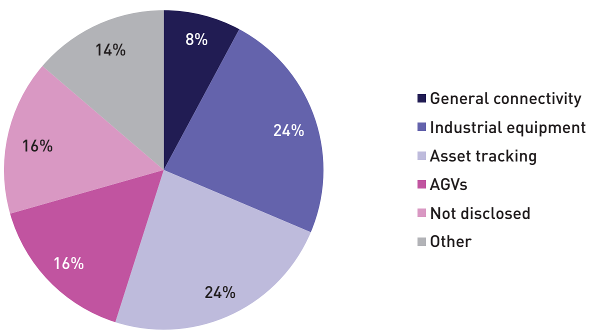

FIGURE 4: APPLICATIONS MOST COMMONLY SUPPORTED BY 5G-BASED PRIVATE NETWORKS, WORLDWIDE, FROM DATA PUBLISHED IN JUNE 2021 [SOURCE: ANALYSYS MASON, 2021]

New spectrum is enabling additional use cases for private 5G networks

Analysys Mason's Private LTE/5G networks tracker indicates that private LTE/5G networks use either licensed mobile spectrum, shared access spectrum (such as CBRS spectrum in the USA) or local access licences. The latter are becoming more prevalent with 5G now that specific bands for local 5G use have been made available in several markets. These bands vary between different countries, but prominent examples include the 3.7–3.8 GHz band in Germany, the 3.8–4.2 GHz band in the UK and the 2570–2620 MHz band in France.[1] CBRS spectrum in the 3.5 GHz band has been available for some time in the USA for use in both LTE and 5G private networks on a shared access basis.

Most of the systems listed in Analysys Mason's tracker are still reported to be using licensed mobile spectrum (that is, spectrum licensed to MNOs). However, a growing number of private 5G networks are making use of locally licensed spectrum that regulators have made available to support private network deployments (Figure 5).

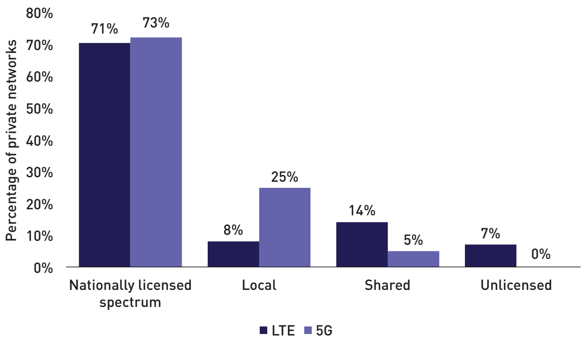

FIGURE 5: UTYPE OF SPECTRUM USED IN PRIVATE LTE/5G NETWORKS, WORLDWIDE, FROM DATA PUBLISHED IN JUNE 2021 [SOURCE: ANALYSYS MASON, 2021]

The bands that are typically used vary depending on the market in question. The most commonly used bands for LTE-based and 5G-based private networks are shown in Figure 6.

Region	LTE	5G
Europe	2.6 GHz and 3.5 GHz	3.7–3.8 GHz and 3.8–4.2 GHz
Americas	3.5 GHz (CBRS)	3.5 GHz and mmWave
Asia–Pacific	1800 MHz	28 GHz

FIGURE 6: MOST COMMONLY USED FREQUENCY BANDS FOR PRIVATE LTE AND 5G NETWORKS, BY REGION, WORLDWIDE, FROM DATA PUBLISHED IN JUNE 2021 [SOURCE: ANALYSYS MASON, 2021]

One benefit of the new 5G spectrum is that it is better-suited to low-latency applications that need wider channels. This means that more-demanding factory-based applications could be delivered over wireless 5G links instead of fixed cabling. The use of wireless technology may provide a range of benefits to users, such as greater scalability and flexibility to move or reconfigure machinery without the constraints of wired connections. These wider channels are principally available in spectrum bands in the 3.4–4.2 GHz frequency range, and are not available within the bands most commonly used for private LTE networks, such as 1800 MHz and 2.6 GHz.

MNOs are increasingly getting involved with private network deployments

MNOs are increasingly getting involved with the deployment of private 5G networks (either as network providers or delivery partners) due to the complexity of 5G technology and the demanding factory and industrial applications that 5G is being used to support. Indeed, for private LTE networks, the majority of systems are managed by network equipment providers (NEPs), whereas there is an equal split between the share of systems managed by NEPs and those managed by MNOs for private 5G networks (Figure 7).

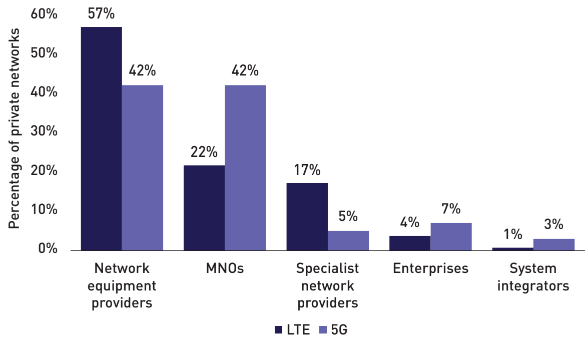

FIGURE 7: PROVIDERS FOR PRIVATE LTE AND 5G NETWORKS, WORLDWIDE, FROM DATA PUBLISHED IN JUNE 2021 [SOURCE: ANALYSYS MASON, 2021]

[1] The European 5G Observatory provides further details on the various approaches to private 5G network spectrum in Europe. European 5G Observatory (2020), 5G private licences spectrum in Europe. Available at: https://5gobservatory.eu/5g-private-licences-spectrum-in-europe/.

Questions?
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How to steer your digital transformation to success

Peter McMenemy, Managing Partner

The Covid-19 pandemic has shifted the way we do business and sped up the pace of digital transformation. More than half of products and services are now digitised, according to industry analysis.

Businesses big and small are reckoning with the new normal – and the sudden arrival of the future now. But rather than leaping in, it's important to plan an IT transformation carefully. "If you're going to invest in external expertise, it's essential to get them in as early as possible," says Peter McMenemy, managing partner and head of transformation at Analysys Mason, global leaders in telecoms, media and technology (TMT) management consulting.

Digital transformation programmes can easily go awry because of decisions made in the first six months of the programme. McMenemy compares it to steering a huge ship on a transatlantic voyage without a map. "You get into situations because you haven't taken the time upfront to answer some of the really big questions," he says. "Too often, organisations simply try to replicate what they already have in a new system, rather than defining what they want to be in the future and working towards that."

And it's vital to do so. "As soon as you've finished the initial roadmap and design, any change in direction you want to make after that is twice or three times as expensive as if you'd made it earlier on in the programme planning phases," he says. "The old adage: 'design hard, build easy' is a really appropriate one. Most people don't do that."

Analysys Mason's Transformation practice is currently supporting one of the biggest telecoms firms in western Europe through their business support systems (BSS) transformation – a five-year, billion-euro upgrade programme. Yet they're equally adept at working with startups that have spun off from large telcos, and also work across financial services and utility companies. The process is similar, whatever the sector: you need to be clear on your goals before you set off – and take big decisions early to set up the programme with flexibility to cope with challenges and problems that can arise.

"Businesses often focus only on the 'what' and 'when' in terms of systems and technology and don't put enough thought early on into the 'how'," says McMenemy.

McMenemy recommends trying to keep responsibility for transformation in-house as much as possible, rather than buying in expertise. "You want to have as many of your own permanent employees working on any transformation as possible," he says. "Ultimately, these are the people you want to be trained up and understanding how the system works. This way you can also manage the impact of the transformation on your people and their processes."

Outside vendors should be thought of as partners who can fill in gaps: McMenemy recommends setting up an outcomes-based contract with vendors where both parties are incentivised to work together fruitfully. "You're going to be spending years with these vendors putting in the lifeblood of your IT and software systems," he says. "Why on earth would you not want to treat them as a partner and also incentivise them to do a great job with potential financial upsides? You're going to be working with these companies for many years into the future."

By setting clear goals, and building strong relationships within and outside your company, it's possible to tackle even the trickiest challenges on your journey towards IT, digital or business transformations – and to avoid wrecking on the rocks along the way.

This article was published in The Times on 30 September 2021 in a special report on Digital Transformation.

Questions?

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Retail price caps: sometimes the cure is worse than the disease

James Allen, Partner

Once upon a time in the UK, there was a problem in retail energy markets. The retail operators were maximising profit by charging 'loyal' customers higher prices than those who actively engaged with the market. In other words, the 'default' tariff ('standard variable tariff') was not, in practice, subject to sufficient competitive pressure. Many of these customers were old or vulnerable. The UK government (under some political pressure because a temporary retail price cap was a popular policy of the main opposition party) introduced a retail price cap via its energy regulator Ofgem, with the aim of protecting customers on the 'default' tariff. Unfortunately, they did not 'all live happily ever after'.

The wholesale price of some energy inputs, notably methane, has recently increased sharply. This has caused major issues in the UK's retail gas market. Although the price cap recently rose 12%, many suppliers are now leaving the market. The UK government and regulator have not been prepared to adapt the price cap regime rapidly; their stated defence is that those whose business model is not viable should not be rescued (which is fair enough) but it is also true that the cap protects consumers from sharp price rises and that raising the cap even further in April will be unpopular.

Consequently, many of the more aggressive entrant retail suppliers are facing negative margins for that part of their input wholesale gas costs that they have not previously hedged. More suppliers are likely to go out of business, and, in addition, even some of those that are (or claim to be) fully hedged have decided to leave the market. Their customers are being rehomed with other suppliers by the government. This system may in turn break down, because those better-hedged suppliers may not have access to sufficient gas at hedged prices to be able to supply these new customers; there will be net costs from this process. We expect that the bill for the clean-up will be mutualised (that is, even customers of resilient and responsible suppliers will pay).

A regulated price that is below the efficient costs of production is (simply put) not good regulation: it will lead to the required goods not being produced.

The retail price cap was created to try to deal with a different problem. Its designers did not think that it would face a situation where massive spikes in the wholesale input prices would revise the costs of supply so sharply during the price control period that the cap went below the (current) efficient cost of supply.[1] Patently, unless wholesale prices fall significantly, the cap will have to rise sharply when it is next reset. So, given that it will have to rise, consumers will only be protected against price rises for a limited period. In the meantime, significant numbers of the smaller and more dynamic operators have ceased trading, which has restructured the retail market. Looking to the future, it will hardly be surprising if the level of competitiveness falls if the market becomes more concentrated, and attractive tariffs other than the default tariff become difficult to create, making it difficult for small players to grow by out-competing existing ones. This in turn may make it more difficult to use competition as a mechanism to assist in minimising the costs of the vital transition to net zero, at least in the short run.

Other solutions were available to address the original problem. For example, an explicit social tariff targeted at the poor and vulnerable would make that group less affected by any kind of loyalty penalty. Alternatively, an operator leaving the market has suggested that Ofgem could have used licence conditions to require that the suppliers' default tariff had to be their cheapest tariff; we note that this would have been a very bold move indeed, as it would have caused a very substantial change to the retail market.[2] While telecoms regulators have taken similar steps in the past, in relation to (for example) forcing retail calls to particular number ranges to be 'in-bundle' and the use of 'roam like at home' for international roaming in the EU, these decisions

were easier for regulators (or parliaments) to take because (unlike the gas default tariff) neither of these steps related to a large fraction of the entire market.

What conclusions can we draw?

- Even if there are many other similarities with the utilities sector, we are fortunate that retail telecoms is not beholden to a wholesale market where prices fluctuate substantially.
- While it is often unattractive for regulators to explicitly consider market structure (for example, "how many suppliers do we need?"), not placing strong requirements on operators' business models and financial resilience risks a worse outcome with high costs arising from operator failures passed on to innocent suppliers and customers.
- Regulatory remedies need careful design; political pressure does not help in this process.

[1] A past chief executive of Ofgem has said as much in a recent interview for the Financial Times.

[2] A previous UK government did consider restricting the number of tariffs offered as a means of providing improved transparency.

Questions?

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Healthtech in South-East Asia: COVID-19 activates a technology investment opportunity

Lisa Scott, Manager and Lim Chuan Wei, Partner

The healthtech industry in South-East Asia is set for rapid growth. COVID-19 has accelerated the demand for healthtech services such as virtual consultations and e-pharmacy. The sector is expected to attract investors that see opportunities in the technology-driven transformation of health service delivery. However, this industry is currently a fragmented ecosystem of start-ups; this article discusses the key success factors that will enable healthtech start-ups to gain economies of scale and attract investment.

Technology can transform how users access health services and products

Healthtech refers to health products and services that are delivered using technology and are accessed remotely (for example, via a smartphone or internet-connected PC). Some of the key benefits of healthtech include making health care resources and services more **accessible, convenient and affordable**. Key products offered by healthtech companies include virtual consultations, e-pharmacy, online booking of medical appointments, health insurance subscriptions and medical portals.

Healthtech is in its infancy in South-East Asia but strong growth is expected

Healthtech is in its infancy in many countries in South-East Asia; take-up of services such as virtual consultations and e-pharmacy is low. However, the COVID-19 era has accelerated growth in the sector.

Governments in the region have started to rely on healthtech to reduce the burden of COVID-19 on healthcare systems and to ensure that COVID-19 patients can receive care. For example, the government in Indonesia selected 11 healthtech companies to provide free virtual consultations and medicine delivery for COVID-19 patients with mild symptoms.[1] Governments in some countries are offering healthtech services in response to COVID-19, which could pave the way to them offering healthtech services in their public healthcare systems, as is the case in Thailand.[2]

Government adoption of healthtech services is just one driver for healthtech. Several other drivers will contribute to growth in the sector in South-East Asia, including:

- **rising levels of disposable income**, which could increase the volume of medical consultations, the take-up of private health insurance and expenditure on pharmaceuticals
- **increasing smartphone penetration and widespread mobile coverage**, which could drive the take-up of health services via online platforms

- **increasing awareness of healthtech services**, which will highlight the benefits of healthtech and encourage their adoption
- **an evolving ecosystem**, which could increase the availability of healthtech services as more companies launch healthtech services.

Healthtech companies should focus on customer acquisition

The competitive landscape of the healthtech market is still developing in South-East Asia and numerous regional and cross-border start-ups are emerging. By contrast, China's healthtech industry is relatively well developed and the market is dominated by three listed players (Alibaba Health, JD Health and Ping An Good Doctor).

We expect a 'survival-of-the-fittest' situation to play out in the next few years to determine which companies will gain a significant foothold in South-East Asia. Healthtech companies predominantly operate a B2C model: therefore, one of the key success factors to gain scale is the ability to attract and retain customers. Healthtech companies are doing this in several ways including:

- becoming a one-stop shop for all healthcare needs with the aim of increasing customer loyalty; for example, Alodokter in Indonesia offers a full suite of services[3]
- capitalising on the customer base of a subsidiary/partner/investor; for example, Good Doctor in Indonesia has expanded its pool of potential users by integrating its services in the Grab app[4]
- partnering with a government to offer COVID-19 services; for example, 11 healthtech companies are working with the government in Indonesia.

Another success factor for healthtech companies is to ensure a varied supply of registered healthcare professionals (doctors, nurses etc.) to provide virtual consultations and medical facilities (hospitals, clinics etc.) for in-person services and follow-up procedures such as tests. Increasing the supply of resources can help a healthtech provider to improve its competitiveness.

Finally, government policies and regulation will be important considerations for healthtech companies that want to expand into other countries because a favourable regulatory landscape is required to ensure that services such as e-pharmacy are legally permitted.

We expect investment activity to continue in the healthtech industry in South-East Asia as healthtech companies compete to gain market share.

Analysys Mason has conducted multiple due diligence exercises and market studies in the TMT space across Asia–Pacific. Our experience of working in the healthtech space gives us a strong understanding of the key challenges and success factors.

[1] For more information, see www.cnbcindonesia.com/tech/20210706130456-37-258677/11-link-telemedicine-buat-obat-gratis-pasien-covid-19-isoman.

[2] The largest public healthcare insurance scheme (Universal Coverage Scheme) in Thailand is offering virtual consultations. For more information, see https://eng.nhso.go.th/view/1/UCS_Presentations/EN-US.

[3] Available at Digital health platform Alodokter to improve public health services in Indonesia (biospectrumasia.com).

[4] Good Doctor is a joint-venture between Grab (leading ride-hailing app) and Ping An Good Doctor (a leading telehealth firm in China).

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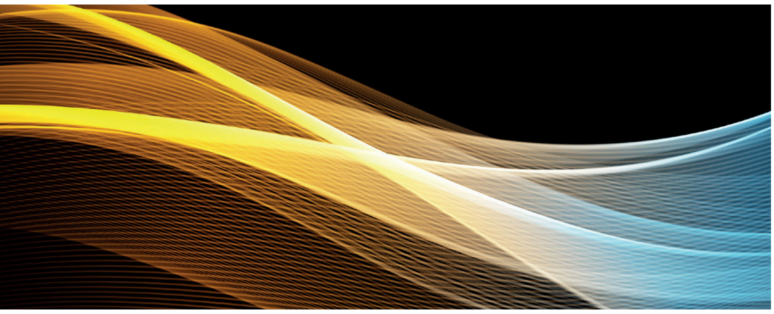
Waiting for dedicated spectrum for utilities' private networks could delay net zero ambitions

Ian Adkins, Principal and Janette Stewart, Partner



Telecoms solutions must evolve to meet the needs of smart utility systems

Many utilities worldwide have started working towards their goal of reaching net zero carbon emissions by transitioning to smart utility systems. However, this transition is complex. The telecoms solutions for some utility networks need to evolve to be able to communicate with millions of devices instead of just a few thousand devices. The range of applications within a smart system has also increased, and these applications have varying requirements. For example, some parts of the utility network only need to be monitored periodically, whereas other parts require near-instantaneous control. Introducing this range of requirements across the whole footprint of a utility network, as well as 'deeper' into the network itself (that is, closer to the customer premises), increases the complexity of the telecoms solutions required. The challenge to design suitable telecoms solutions is further exacerbated by uncertainties about which applications are needed because many are still undergoing trials and have yet to be proven at scale.

Analysys Mason is currently working with an energy utility to develop an evolution strategy to ensure that their telecoms solutions are capable of meeting the needs of eleven smart energy applications, some of which have yet to be proven in trials on the power network. The use of a dedicated private network (for example, using devices and infrastructure aligned to the 3GPP LTE specifications and deploying as a private LTE network) is viewed as the optimum solution, particularly in the context of having full control of the network and its level of resilience. However, access to spectrum to deploy a private LTE network at scale is a key barrier. Indeed, it may be many years before dedicated spectrum that is suitable for nationwide deployment becomes available, if at all. Alternative approaches for the case when nationally dedicated spectrum is not available, perhaps using a hybrid network approach with a combination of on-site and mobile public network assets, should therefore not be ruled out.

Certainly, the strategy needs to allow for the evolution of the telecoms solution so that it can adapt to an alternative option, if necessary. In this example, Analysys Mason is developing a cost model to help the energy utility understand the total cost of ownership (TCO) of different private and public network options.

Investment risk, governance and cost of delivery are important considerations

Utilities that wish to follow the private network approach using dedicated spectrum must consider how the market in any given jurisdiction will approach investments in private networks. The delivery of a private network comes with risks and obligations and, depending on the structure of the market (for example, the amount of sector competition and the geographic overlap/contiguity), governance may be a critical success factor. In the UK, for example, the geographic boundaries of utilities in each sector (electricity, gas and water) do not overlap. Dedicated spectrum for use by utilities in the UK is under consideration, but it is not clear how a private network might be delivered, who will invest to build it and how it will be managed. Furthermore, the TCO for a 15–20 commitment, for example, does not seem to have been established. These factors will play an important part in any decision to allocate dedicated spectrum, particularly when, as in the UK, the spectrum that the utilities are interested in is already in use by other parties. In other countries where dedicated spectrum has been successfully allocated to utilities (such as Poland, Germany and Ireland), the spectrum was not already in use or was relatively easy to free up.

Therefore, for countries such as the UK, robust analysis about the TCO of building private networks and the benefits that this provides, along with clarity about the delivery approach and commitment to invest, is essential to enable the successful award of spectrum that is dedicated for use by utilities.

Timely action is critical to achieving the status of 'net zero'

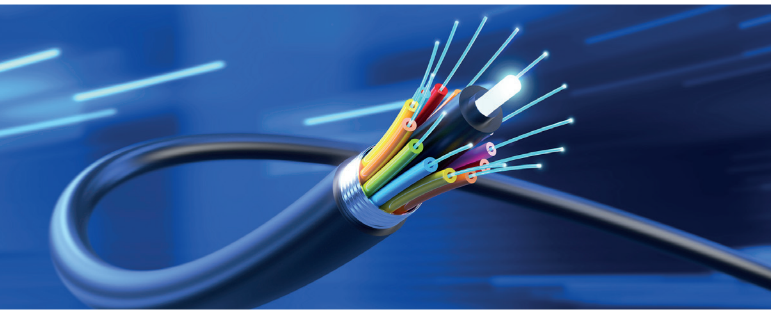
Mobile network operators' (MNOs') public networks are a key alternative to private networks with dedicated spectrum. MNOs argue that they can offer utilities solutions that have a long-term roadmap and use the spectrum more efficiently than private networks would. However, utilities are sceptical that acceptable levels of resilience would be provided. The opposing views of MNOs and utilities create tension, and regulators and policy makers have the challenging task of finding the right balance between the two positions. The enormity of the net zero goal means that it is vital that deliverable plans are put into action as soon as possible.

The challenges outlined in this article are important for utilities, national and regional governments, telecoms regulators, utilities regulators, fixed and mobile telecoms operators and investors. Analysys Mason has undertaken numerous telecoms options appraisals and has used our deep market insights and modelling experience to offer independent and pragmatic recommendations to resolve complex issues.

Questions? Please feel free to contact Ian Adkins, Principal at ian.adkins@analysysmason.com or Janette Stewart, Partner at janette.stewart@analysysmason.com

Data centres could tell us about the potential evolution of the submarine cable industry, and vice versa

Johann Adjovi, Partner



The submarine cable industry has been around for much longer than the data centre industry. Nonetheless, there are a number of similarities between the two.

- **High capital intensity**. Constructing a state-of-the-art, fully equipped, high-quality data centre (typically certified as Tier III or Tier IV by the Uptime Institute) of a decent size (5–30MW) normally costs between USD30 million and USD300 million. Building a state-of-the-art submarine cable network that is several thousands of kilometres in length with a capacity of multiple terabytes per second requires a similar investment.
- **Long lead times**. Data centres have lead times of 1–2 years, while cable projects take 1–4 years or longer. Proper capacity planning is required to start building ahead of demand.
- **Growing demand in a fast-changing environment**. The demand for digital services supported by submarine cable or data centre infrastructure is growing quickly. However, specific requirements are still relatively difficult to predict because new digital services are continually appearing and the relevant digital industries are still evolving and maturing, unlike for conventional transportation infrastructure for example.
- **Disruptive technological innovation still ongoing**. The technologies used for submarine cables built in 2021 are considerably enhanced compared to those used for submarine cables built at the turn of the century. Similarly, there have been considerable technological evolutions in the data centre space to push the power usage efficiency (PUE) ratio close to 1, while increasing the density and evolving architecture (from hardware to connectivity). Unit economics are still improving.

- **Attractiveness to telecoms operators and hyperscalers**. Many submarine cables were initially funded and deployed by telecoms operators, as were many data centres (though there were also non-operator providers). Hyperscalers have entered both industries in a major way: they first built their own data centres and are now building their own submarine cable capacity. Most hyperscalers and some telecoms operators see these digital infrastructure assets as essential to their business.

One possible difference between the submarine cable industry and the data centre industry is that the demand/supply characteristics of the former are cyclical. In the past 20 years, there have been periods during which there was a relative over-supply of submarine cable capacity. This deterred further investment into new submarine cable systems on the same routes in the short term, even though the demand for submarine cable capacity continued to grow. Notably, there was a period of very limited investment into incremental capacity (a 'low build-out period') between 2003 and 2008, after 10 years of heavy expenditure on deployments of new submarine cable capacity and after the burst of the internet bubble.

It is not yet clear if the data centre industry is about to go through the same trend. There is a strong momentum towards the deployment of top-tier data centres worldwide as public/private/hybrid clouds develop and gain traction and the demand for regional data centres grows. Indeed, many hyperscalers are considering opening new regions or availability zones in order to capture cloud revenue growth in new markets. Furthermore, relatively cheap financing for digital infrastructure projects is currently available. Markets in regions such as the Middle East are extremely buoyant and there are projects to deploy tens of megawatts of data centre capacity to cater for the demand of a population that is hungry for digital and cloud services. The same trend exists in Latin America and emerging Asia–Pacific. As such, there is a lot of capacity under construction. There is a real need for this newly deployed or soon-to-be deployed infrastructure, but there also needs to be the realisation that once an initial wave of supply has come into the market, demand will continue to grow only steadily, so there may come a point where deployments must be paused to allow the demand to catch-up with the significant increase in supply.

At the same time, the data centre industry is considering the concept of 'edge data centres'. Building many more, smaller, less-sophisticated data centres closer to end users could be the future of the data centre industry once the basic regional facilities have been established. These edge data centres will typically be built with the aim of lowering latency and thus enabling new interactive services such as online gaming and augmented reality.

There may be a parallel here in the submarine cable industry: some specialist users (such as those in financial high-speed trading markets) may demand the lowest possible latency, thereby requiring 'straight line' routing with new cables (or indeed chains of microwave towers for crossing sufficiently small bodies of water such as the English Channel). Alternatively, lower-capacity submarine cables could become relevant for minor routes that have historically been served by indirect routing as traffic (and more generally, trade) increases between Africa and South America, for example. Business models for such infrastructure will probably need to evolve in line with these market trends.

Analysys Mason has supported data centre providers, telecoms operators and financial institutions in the assessment of the investment case for submarine cables, data centres and cloud services, as well as the development of strategies in these spaces.

Questions?

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The economic impact of open and disaggregated technologies and the role of TIP

Sub-Saharan Africa could benefit significantly from open and disaggregated solutions, and stakeholders such as TIP can help unlock this potential

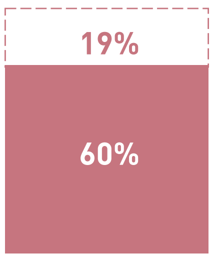
If widely adopted, open and disaggregated technologies will have a positive impact in Sub-Saharan Africa

SSA CONNECTIVITY LANDSCAPE	CURRENT SITUATION	IMPACT OPPORTUNITY
Existing coverage and connectivity levels	Large segments of the population lack access to internet connectivity compared to other regions	Connecting the unconnected / under-served enables economic activity, and can involve greenfield deployments of open and disaggregated solutions
Limitations of traditional solutions	Vendors operate in a challenging physical and commercial environment	Traditional solutions are less flexible and would not be able to easily improve connectivity further, giving open and disaggregated solutions time to develop
Need for the introduction of innovative solutions	Low opportunity cost of experimenting with new models in certain areas	Solutions like network-as-a-service (NaaS) and OpenWiFi are emerging, and could scale with optimised cost efficiency
Potential for home-grown companies to develop	Large operator groups would prefer partners to cover entire footprints	Local / regional systems integrators can expand into new countries, as well as adjacent parts of the value chain

Operators in the region are already deploying open and disaggregated solutions within their networks

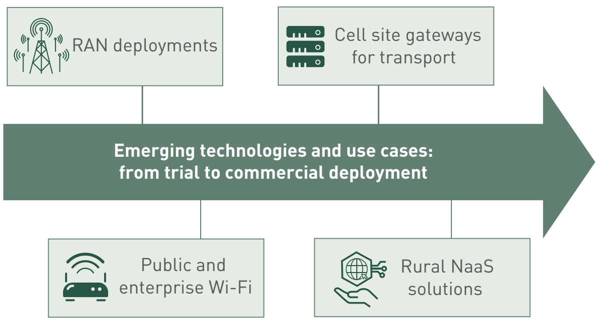
Operators have expressed interest in these technologies...

... and are deploying solutions that are ready today, while actively taking part in the design, incubation and trial of other solutions to accelerate their commercial viability



Share of mobile subscribers in Côte d'Ivoire, DRC, Kenya, Nigeria, South-Africa and Uganda

- Subscribers served by operators / groups with announced interest in disaggregated solutions
- Subscribers served by operators in larger groups with stated interest in other global regions



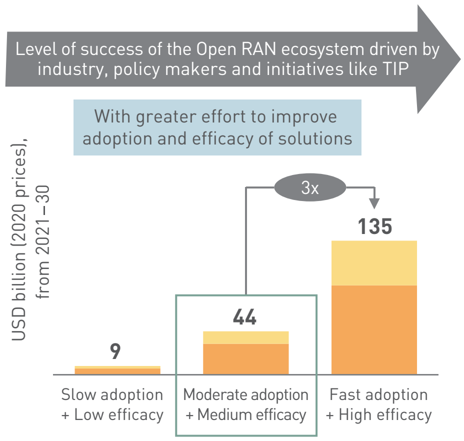
Download the full report at:

https://www.analysysmason.com/impact-of-open-and-disaggregated-technologies-and-tip/

Open RAN adoption in SSA might take time to reach scale,[1] but if accelerated, could generate outsized benefits for the region in terms of GDP gains[2]

Annual impact in 2030 (baseline estimate for SSA)

- **5.4 million** more unique mobile internet users
- **3.8 exabytes** more data traffic consumed
- **USD15 billion** in annual GDP gains, from wider benefits generated across society



Baseline estimate for SSA | GDP impact from mobile internet penetration | GDP impact from data usage

Stakeholders with aligned interests have different roles to play to overcome challenges, to unlock the full potential of open and disaggregated solutions for SSA

Barriers

- Challenging site economics and operations
- Ongoing use of legacy technologies by operators
- Need to develop systems integration expertise

Enablers

- Facilitative regulatory environment
- Involvement of local / regional industry groups
- Platforms for collaboration and testing
- Financing to develop region-specific solutions

Effects

- Supply chain diversity, with more regional companies involved
- Improved connectivity and access to services
- Faster growth and better socioeconomic outcomes

[1] Compared to the low-income country group in the global report, as well as India as discussed in the India report, SSA is expected to experience more gradual adoption of Open RAN solutions given initial barriers to take-up, but with more potential in the upside case if barriers are addressed effectively and efficiently. It should be noted that figures across the three reports are not completely comparable as more recent developments that have informed assumptions in the India and SSA reports would not have been taken into account during the global study earlier in 2021.

[2] Measured in USD billion (2020 prices), with estimate range developed based on a similar methodology used in the global and India reports, by adjusting efficacy and adoption parameters relative to the main SSA scenario estimate, with a wider variance shown for SSA than in the global or India reports.

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  We provide robust commercial and technical due diligence support for TMT debt and equity financing, M&A and IPO processes. We support the full M&A cycle from opportunity scouting through to post-merger integration.
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