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Global leaders in TMT management consulting

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Cloud-based network services could reduce enterprise carbon emissions

Andrew Daly, Principal

How can businesses reduce their carbon emissions? One approach is to consider turning off some of their network equipment and replacing it with a cloud alternative. We have just published our new report for Cloudflare on the carbon savings of cloud-based enterprise network functions. If enterprises were to replace some 'on-premises' functions with a cloud-based equivalent, it may be possible to reduce the associated energy-related annual carbon emissions by 78–96%, depending on the size of the enterprise.

The enterprise network functions in the scope of the analysis include a broad range of security, management and optimisation functions, including: network firewall, intrusion detection system (IDS), intrusion prevention system (IPS), virtual private network (VPN) concentrator, load balancing, wide area network (WAN) optimisation, software-defined WAN (SD-WAN), secure web gateway (SWG), web application firewall (WAF), and distributed denial of service (DDoS) mitigation. Functions such as routing and switching are likely to have to remain on-premises, and so are not included in the analysis.

Enterprises often deploy these network functions on their own premises or in data centres as dedicated pieces of equipment, which are consuming power 24 hours a day, 7 days a week, despite mostly being required only in office hours. By contrast, cloud functions used shared servers, which aggregate the demand from thousands of businesses. As demand from one business falls away, demand from another picks up, and cloud servers are expected, at least in principle, to make more efficient use of the electricity required to provide those network functions.

The results for a typical large enterprise moving some enterprise network functions to the cloud are shown in Figure 1.

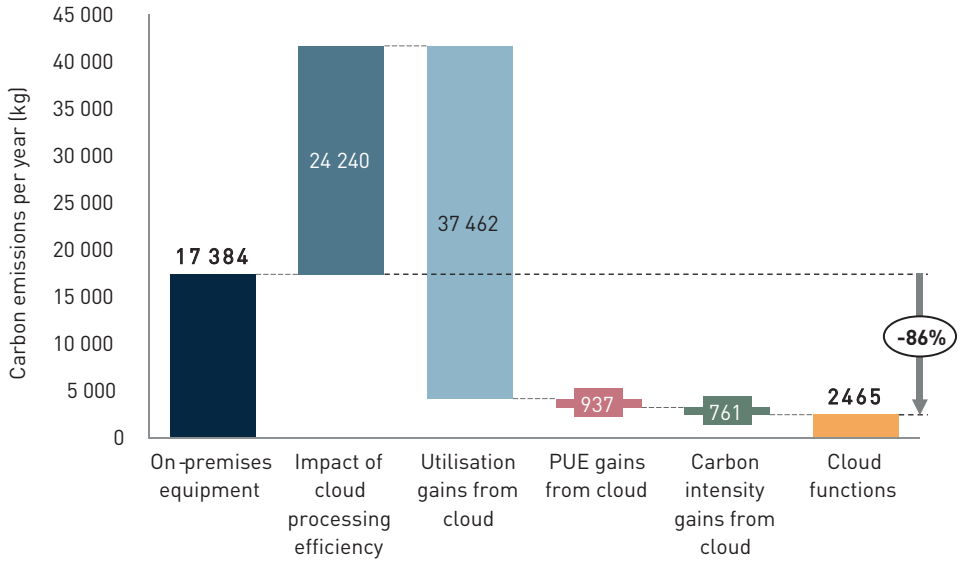


Figure 1: Breakdown of potential carbon savings from moving enterprise network functions from on-premises to Cloudflare products, large enterprise scenario (Source: Analysys Mason, 2023)

Most of the reduction in carbon emissions is attributed to the much higher utilisation of the cloud servers relative to on-premises devices. However, the analysis also revealed a trade-off between those utilisation gains, and a lower processing efficiency of cloud servers. This is a consequence of cloud servers being general-purpose hardware, whereas on-premises equipment tends to be designed for a specific function. However, the processing inefficiency is more than compensated for by the gains from higher utilisation.

We also calculated carbon savings from the increased power efficiency of cloud data centres (compared to on-premises facilities). And finally, we accounted for differences in the carbon intensity (kilograms of carbon per unit of electricity generated) in the local electricity generation grid used by an average data centre vs. the local grid used by an average on-premises location.

How we came to these conclusions

Understanding and measuring how the transition from 'on-premises' to cloud can reduce emissions is challenging. The relationship between energy use and carbon emissions must be calculated robustly, and must include concepts such as the 'power usage effectiveness' (PUE) of the on-premises server room or data centre, along with the carbon intensity of electricity generation from the relevant local grid.

However, there are even more complex issues associated with making a fair comparison between the typical power consumption of physical on-premises equipment (which are typically dedicated to a single enterprise) relative to cloud-based servers, which are used by thousands of different customers.

Our analysis used a combination of desk research, industry intelligence and information provided by Cloudflare. Information on the on-premises network functions was sourced from datasheets published by equipment vendors. The input assumptions for the cloud functions were sourced primarily from Cloudflare. We worked closely with a wide range of Cloudflare's business functions to create an innovative approach to attributing the shared central processing unit (CPU) resources to individual functions, and then allocating this to units of service provided to customers.

Stakeholders in the TMT industry have a growing need to put numbers on the carbon impact of enterprise activities

Against a backdrop of rising energy costs and growing scrutiny of greenhouse gas (GHG) emissions, businesses are looking to cut energy use and to demonstrate the sustainability of their operations.

Regulatory authorities are turning up the pressure. In 2022, the US Securities and Exchange Commission (SEC) and the European Commission (EC) announced changes to sustainability reporting for companies. From around 2024, some companies will have to start providing new information on sustainability activities related to Scope 1 and Scope 2 emissions in their financial and management reports. In addition, the Science Based Targets initiative (SBTi) provides a voluntary framework for organisations to set targets to reduce the carbon impact of their operations.

Analyses such as that described above can contribute usefully to the discussion of how enterprises can reduce their carbon emissions, but the analysis could be developed further. Every organisation will have a unique combination of legacy network equipment and cloud functions. In addition, further work is required to go beyond the Scope 2 emissions considered in the study, to explore how enterprises can reduce their Scope 3 emissions too (that is, those carbon emissions that are attributable to the wider value chain).

Analysys Mason can help organisations to estimate the carbon impact of networks. Such organisations include those that are looking to understand the impact of their internal networks, and network providers that are looking to showcase the impact of their solutions. In addition to calculating the emissions that are attributable to electricity use, we have unrivalled knowledge of the telecoms, media and technology (TMT) sector enabling us to independently assess how the evolution of networks can contribute to a more sustainable future for all.

Questions? Please contact Andrew Daly at web_enquiries@analysysmason.com

“ Against a backdrop of rising energy costs and growing scrutiny of greenhouse gas (GHG) emissions, businesses are looking to cut energy use and to demonstrate the sustainability of their operations.

In-house energy service companies: the best of all possible worlds for Towerco organic growth

Alessandro Ravagnolo, Partner and Alex Pericleous, Principal

The physical components found within a mobile site can be conveniently categorised into three main groups: active, passive and energy-related.

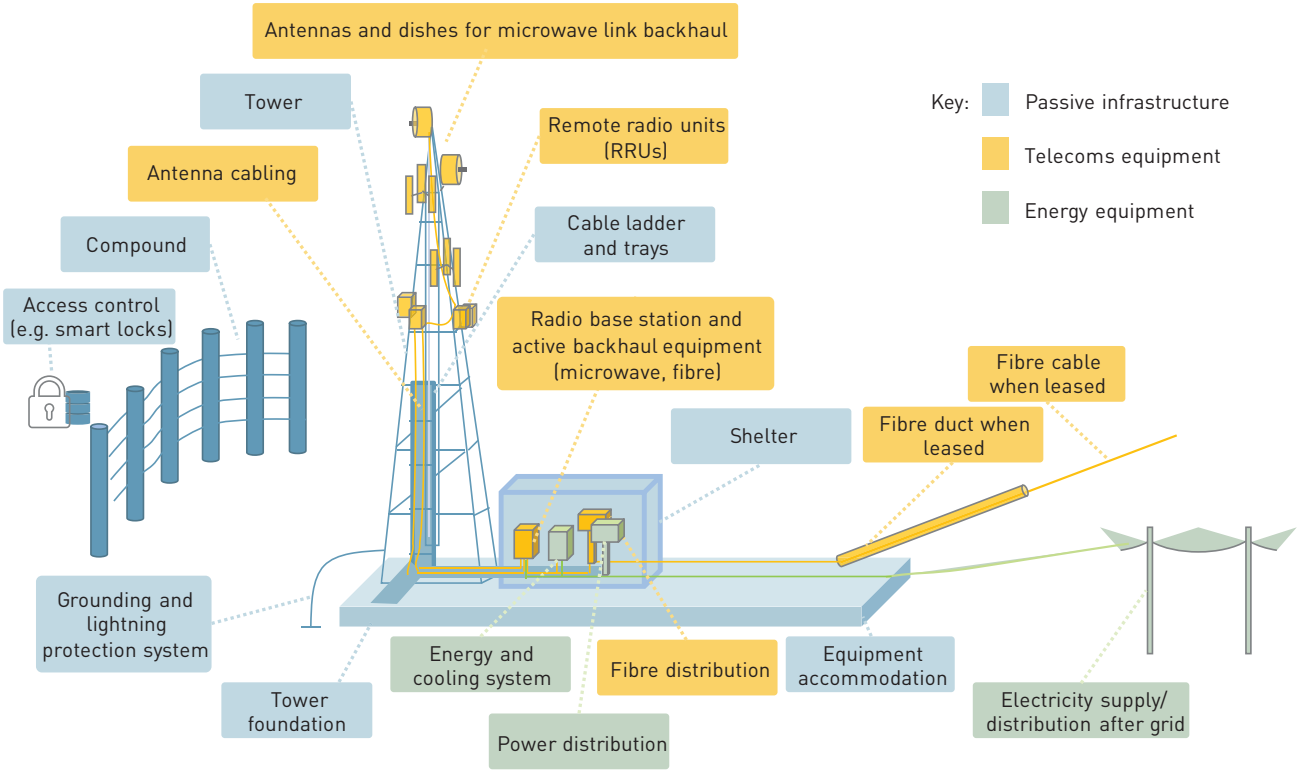


Figure 1: Mobile site components [Source: Analysys Mason, 2023]

The active part of the network is typically owned directly by mobile network operators (MNOs)[1]. Conversely, the ownership and responsibility for passive infrastructure and energy-related equipment (both of which can more readily be shared between co-locating MNOs) has progressively shifted towards third-party tower companies (Towercos). In emerging markets, where power management is complicated by the absence of widespread and dependable electricity grids, most of the tower sale and lease-back (SLB) arrangements have encompassed both passive and energy components.

Putting aside financial and deleveraging considerations, MNOs are progressively demonstrating a greater inclination towards outsourcing power management (and associated equipment). This preference could be attributed to the intricate nature of power supply and management, which is more remote to existing MNO skillsets than passive asset management, and necessitates different monitoring systems and dedicated resources especially when power is self-generated, is shared between multiple consumers (that is, different co-located MNOs) or is the target of cost and usage reductions.

In recent years, specialised energy service companies (ESCOs) have been established and expanded in emerging markets, particularly in Africa. These entities dedicate themselves solely to supplying power, and overseeing power equipment and the associated operations and maintenance (O&M) duties, without getting involved in passive infrastructure. Notable ESCOs include Aktivco, Applied Solar Technologies, Biswal, Distributed Power Africa, Energy Vision, ESCOTEL, GreenWish Partners, IPT Powertech and Voltalia.

As the use of ESCOs gains traction, there can be an interplay between Towercos and ESCOs. Central to these discussions is the optimal approach to delivering power as a service (PaaS): either through a unified Towerco–ESCO entity (T-ESCO) or as an independent energy service company (I-ESCO) (Figure 2).

	Electricity sourcing (incl. self-generation)	Power asset ownership	Power O&M	Electricity consumption
Vertically-integrated MNO	MNO	MNO	MNO	MNO
TowerCo Pass-Through (TowerCo)	MNO	TowerCo	TowerCo	MNO
TowerCo ESCO (T-ESCO)	T-ESCO	T-ESCO	T-ESCO	MNO
Independent ESCO (I-ESCO)	I-ESCO	TowerCo / MNO /I-ESCO	T-ESCO	MNO

Figure 2: Power business models at telecoms tower sites [Source: Analysys Mason, 2023]

Towercos perceive power management as an integral facet of their growth strategy and core operations

Towercos should include PaaS in their operational scope for three reasons.

- **Experience and familiarity.** Much of the complexity associated with running a Towerco in emerging markets originates from the management of power equipment. This includes refuelling, uptime monitoring, maintenance, security and end-of-life equipment replacement. Given the historical context of SLB deals, Towercos have amassed significant expertise in this space. This service is incremental to the passive infrastructure sharing and Towercos see it as increasing the value they provide to their MNO clients.
- **Organic growth avenue.** PaaS is seen as an important route to organic growth for Towercos. Notably, energy is a significant cost for MNOs; it accounts for approximately 15% of network opex. As these networks expand, increasing coverage and undergoing technological upgrades, energy demand will grow. This is especially challenging in countries where power infrastructure is limited and energy is scarce. Towercos can seize the opportunity to leverage mobile network operator investments as well as make their own investments to meet the escalating demand. Several MNOs and Towercos have already committed substantial capital to upgrade their power infrastructure.
- **Operational and commercial synergies.** The integration of PaaS offers a confluence of operational and commercial synergies. Operationally, it enables the integration of network operations centre (NOC) monitoring, site visits, supplier management and asset oversight. From a commercial standpoint, Towercos can present themselves as comprehensive solution providers, catering to various aspects of MNOs' needs.

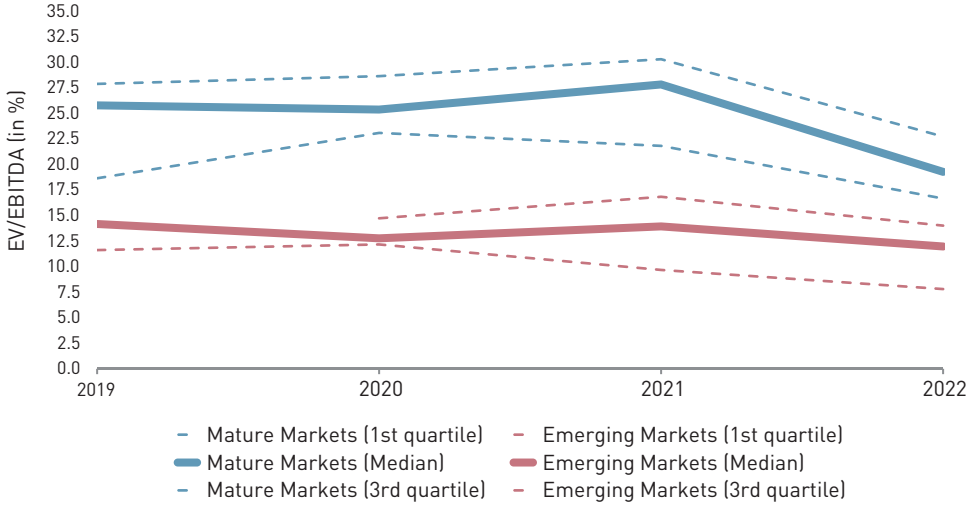
These arguments form a compelling case for African Towercos seeking to develop their own PaaS offerings.

[1] For more information, see Analysys Mason's Polkomtel Infrastruktura's deal with Cellnex marks the emergence of the mobile NetCo model and Neutral host models could create opportunities for investors in rural areas.

[2] For more information, see the GSMA's "Green Power for Mobile", 2014.

Nonetheless, financial markets may incentivise the segregation of PaaS from tower colocation services

Institutional investors and Towerco executives may have different views. Towercos in emerging markets have consistently been undervalued by public markets relative to their counterparts in developed regions (Figure 3).



Note: Mature market Towercos: American Tower, Crown Castle, Cellnex Telecom, Inwit, Rai Way, SBA Communications Corp, Vantage Towers. Emerging market Towercos: GTL Infrastructure, Helios Towers, IHS Holding, Indus Towers, PT Dayamitra Telekomunikasi, Tower Bersama Infrastructure.

Figure 3: Towercos EV/EBITDA [Source: Analysys Mason, 2023]

Discussions with investors have identified several factors beyond country risk premium that may be contributing to the lower trading multiples of emerging market Towercos. Exposure to power emerges as a key factor. PaaS is not universally perceived as an infrastructure-grade investment due to the susceptibility to energy cost fluctuations, shorter contract durations, heightened operational risks, abbreviated equipment lifespan, and elevated refresh capital expenditure and operating costs.
In essence, infrastructure investors associate greater risk with PaaS when contrasted with tower colocation. As a result, they may not be willing to attribute the same valuation multiples to this part of the business. Consequently, some investors gravitate toward Towercos that emphasise PaaS to a lesser extent.

Could the establishment of captive ESCOs offer a solution?

Towercos that offer power-related services to MNOs (that is, T-ESCOs) should contemplate segregating their PaaS operations into distinct entities while retaining operational and financial control, effectively creating captive ESCOs. This strategic move entails straightforward financial benefits. T-ESCOs can clearly explain the relative revenue and margin contributions of both services (colocation and energy), aiming for enhanced valuation.

Additionally, this approach may attract minority investors experienced in energy-related ventures. The captive nature of the newly formed ESCO would still enable T-ESCOs to capitalise on the strategic and operational advantages of offering both services seamlessly. Transparency regarding pricing allocation between the two business units could yield long-term benefits, including better risk management, enhanced operational accountability and improved relationship with MNOs. Moreover, potential strategic benefits abound, such as expanding PaaS offerings beyond the existing portfolio of owned sites (including MNO-owned sites and smaller Towercos lacking this capability), fostering experimentation and innovation, and ultimately out-competing I-ESCOs.

However, the complexity in successfully delivering this captive ESCO should not be underestimated, as T-ESCOs must ensure that the two distinct entities have the appropriate incentives to drive both cost (for example, maintenance and supplier management) and revenue synergies (for example, commercial negotiations). In some cases, re-negotiation of master service agreements with tenants might be necessary, as these agreements may not currently consistently differentiate commercial terms for energy and site colocation.

Conclusion

Towercos should consider the separation of their ESCO business into dedicated special-purpose vehicles to maximise value creation and visibility on returns on investments of the whole company for their shareholders. This is especially true for Towercos operating in emerging markets, but there are merits in considering this option in developed markets as well. Management should not underestimate the cultural and implementation complexity of such strategy and must clearly identify the rules of engagement between the ESCO and the Towerco entities through a master service agreement that ensure a full alignment of interested between the business units.

Analysys Mason is the partner of choice of Towercos and investors targeting the sector. We offer actionable (and analytical) advice supporting key commercial, technical and operational decisions. The combination of our in-house strategy, operational and technical expertise with our unrivalled knowledge of the Towerco market (150 projects in the last 4 years) make us an ideal partner for Towercos developing their future growth strategies.

Questions? Please contact Alessandro Ravagnolo or Alex Pericleous at web_enquiries@analysysmason.com

Scandinavian regulators lead the way in applying SMP regulation to localised fibre networks

Christopher Ryder, Principal and James Allen, Partner

Scandinavian countries have achieved significant FTTH deployment and service penetration (FTTH/FTTB subscribers/all households and business premises), thanks to both governmental and utility company efforts.

- **In Denmark,** fibre deployment has been pioneered by Denmark's regional electricity utility network companies, which have collectively pushed fibre to become the largest fixed access technology in 2019, reaching 43% penetration by 2022.
- **In Norway,** Telenor, the fixed incumbent, has trailed behind the local utility providers in terms of fibre deployment. Many of the local utility networks have banded together under a common platform (Altibox) to offer vertically integrated services, pushing fibre penetration to 59% by 2022.
- **In Sweden,** a governmental push in the early 2000s led to the formation of municipal networks (often as a part of the local, municipality-owned utility provider). The municipal networks today collectively account for more than half of all FTTH subscriptions in Sweden and are present in two-thirds of Sweden's municipalities, with most operating an open-access wholesale model. Fibre penetration had reached 70% by 2022.

Recent regulatory developments

- Although the Scandinavian FTTH fixed-access markets are different, their respective national regulatory authorities (NRAs) all seem to be arriving at similar conclusions, as follows.
- In these countries, copper network services (including VDSL) are not a substitute for FTTH (or in some cases HFC cable) services. Fixed-wireless access (FWA) has been included in the market definition in Norway.
- There are smaller (sub-national) geographic markets for these ultrafast broadband services. The size of the sub-markets analysed by each of the NRAs has been pragmatic, and linked to the areas in which networks have been rolled out in those countries.
- In some, but not all, of these geographic submarkets there is an operator with a high local wholesale market share, and this operator has significant market power (SMP); in other areas, no operator has SMP (typically this situation arises from head-to-head competition via multiple, parallel, infrastructures).
- SMP operators are then subject either to ex-ante regulatory remedies or negotiated commitments.

Country	Date of decision	Scope of relevant market analysed	Size of geographical markets analysed	Findings of SMP	Remedies and commitments
Denmark	2020	High-speed wholesale broadband market (FTTH/HFC cable)	21 regions (electricity distribution utility areas)	Yes, in 13 regions	Either (lighter remedies if wholesale-only)
Sweden	June 2023	Separate wholesale local access FTTH markets for single dwelling units (SDUs) and multi-dwelling units (MDUs)	Municipal (or sub-municipal) based on FTTH network footprints (~180 networks)	MDU FTTH market found to be competitive	Not yet determined
Norway	June 2023	One common wholesale access market including HFC, FTTH and FWA services	22 regions	Yes, in 12 of 22 regions	Not yet determined

Figure 1: Recent regulatory developments related to fibre deployments, by country [Source: Analysys Mason, 2023]

While Denmark has completed its process (see our previous article 3b or not 3b: ex-ante regulation of wholesale FTTH in Denmark), Norway and Sweden are at intermediate stages.

We note that in many ways these approaches mean that the FTTH market across much of Scandinavia is looking more like Finland's history of many regional telecoms monopolies, which has led to it being a forerunner in applying localised market definitions (see our article, *FTTH/FTTB in the EU: why and how local monopolies may get regulated* (2020).

Conclusion

While there will be regions with multiple parallel infrastructures in which regulation of wholesale broadband will be unnecessary, it is entirely possible that in other EU/EFTA countries there will also be regions (typically, where there is no overbuild) in which specific FTTH providers have a high local market share. Should other European consumers behave in the same ways, and NRAs follow the more mature Scandinavian fibre markets in terms of sub-national market definitions, the kinds of access network price controls that were previously only applied to incumbents may in future be applied to FTTH altnets, in cases where they have SMP in local areas. Alternatively, commitments may have to be negotiated, which will have a similar effect.

Investors and operators should therefore not be surprised if this kind of success (high local market shares) leads to regulatory remedies in the medium term. While these constraints on pricing power need to be borne in mind by investors, they are not necessarily a red flag: even if there were price controls these would allow a fair return and it has long been noted that the more profitable parts of major telcos (e.g. in terms of return on capital employed (ROCE)) are their regulated arms.

The implications for the local networks that are on the receiving end of the regulation is clear: wholesale access is likely to be required, increasing retail competition. This may require operators to adapt. In April 2023, Altibox of Norway announced it is examining options for allowing third-party access to its network. For Sweden's many small municipal networks, increasing regulation and retail competition is likely to increase interest in consolidating to achieve economies of scale.

Questions? Please contact Christopher Ryder or James Allen at web_enquiries@analysysmason.com

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National broadband plans: shared objectives but different approaches to public intervention

Ian Adkins, Principal

The development and roll-out of national broadband plans (NBPs) is ongoing in countries around the world. Their degree of progress varies. They typically require well-designed public intervention schemes with significant public subsidies to achieve ubiquitous coverage, particularly in rural areas and other hard-to-reach locations.

Through our experience of designing and implementing a number of these schemes for governments, as well as helping network operators to bid for subsidy funding, Analysys Mason has observed that the intervention approach can differ considerably. Governments should address several critical factors, each of which will help to improve the chances of success for NBP schemes. Specifically:

- it is essential for prospective operators to understand how the scheme will be delivered and what their obligations will be
- the future sustainability of the solution is of critical importance.

Educating the market

To make a successful bid for a subsidy scheme, operators need to understand the nature and scope of the project, and the nature of any risk to which they will be exposed. As Analysys Mason has seen, there is no one size to fit all NBP schemes. There is a significant difference between a whole-country approach, encapsulating a single project and provider, and a multiple-project approach in which management could ultimately be devolved down to a local level. These approaches each bring their own requirements when it comes to management oversight.

- In **Ireland,** the NBP strategy has been to manage it as a single contract and subsidy is distributed to one party, albeit with the project divided into deployment areas.
- In **the UK,** the NBP currently has three pre-defined tiers of project size, with subsidy controlled centrally. Success depends on bidders at each tier understanding their obligations. The government has worked closely with the market on project specification. Having participated in this discussion at a granular level, interested investors are able to bid with a comprehensive knowledge of scope, expectations and risk.

Other countries have adopted a significantly more fragmented approach. In this case, much will depend on whether subsidy is defined for projects in advance, or if it is up to local public bodies or even communities to bid for subsidy. In a 'free-for-all' scenario, there is a risk that at the national level, the scheme will be impossible to manage and will fail to achieve the overall objectives – for example, it could lead to inconsistent solutions and gaps in coverage (a 'postcode lottery').

However, if the market is well versed in the government's objectives and approach, and knows the competencies that will be needed, investors will be in a much stronger position to bid successfully – and to deliver networks that meet NBP goals (that is, networks that are sustainable over the long term without requiring additional subsidy, thereby helping to achieve value for public money).

Attracting the market

Educating the market is also a matter of making it attractive to potential investors. A scheme that consists of multiple projects (such as that in the UK) has attracted a good number of interested parties, with many of them proving to be well-funded new operators. A single-project approach on the other hand will, by definition, require organisations with extensive investment backing because of its scope and scale, as was the case in Ireland.

Analysys Mason has seen how a shared risk approach can both incentivise and assure the market, although the extent of risk for the government also needs to be taken into account, for example if a government is liable for contract assumptions that are breached during implementation. It is also important that public bodies clarify their primary aim; typically, this is investing in support of a policy objective (to achieve national broadband delivery), rather than aiming to be a network operator. As in all aspects of NBP public funding, this clarity is important in achieving outcomes that deliver value for money.

Any scheme also has to assure operators that subsidy will not be allocated to locations where broadband capability already exists, bringing with it a risk of subsidy of overbuild. The technical specifications and mapping of existing and planned coverage are critical elements in this aspect, but mapping of existing and planned coverage can be a contentious issue. Analysys Mason has significant experience of defining NBP technical specifications and mapping requirements, as well as analysing network coverage claims.

Determining the appropriate degree of prescription

Ultimately, a subsidy scheme must be viable in all respects appropriate to the scope of the project, delivering value for public money and meeting the objectives of the NBP. It is in the interest of everyone – government, potential investors, operators and the public – that the scheme should be as clearly defined as possible.

Every type of subsidy scheme has potential advantages and disadvantages, and a key part of a government's approach should be in determining the necessary degree of prescription for the project. Ireland and the UK have both adopted a centrally, clearly prescribed approach. Analysys Mason has seen how effectively this clear definition can help to attract investment and achieve high-quality bids.

Analysys Mason has significant experience in supporting government bodies (national, regional, local) to design, deliver and monitor these schemes to ensure value for money and help achieve long-term sustainability of solutions. We also have experience of supporting investors and operators to successfully bid for funding subsidies in these schemes. If you are a government, operator or investor, and interested in support on a NBP scheme please contact Ian Adkins, Principal.

Questions? Please contact Ian Adkins, Principal at web_enquiries@analysysmason.com

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Preparing for the Digital Services Act: a survey of internet-based services and platforms in Norway

Harald Wium Lie, Partner

In light of the new EU Digital Services Act (DSA), Analysys Mason conducted a survey of internet-based services and platforms in Norway on behalf of the Norwegian Communications Authority (Nkom).

Online platforms can have a significant influence on users and their decision-making patterns. Some online platforms with large economies of scale and scope offer mass-market services that are chiefly provided by one or more of the global 'hyperscalers' (for example, Alphabet, Amazon, Apple, ebay, Meta, Microsoft, X etc). Partly as a response to this, the EU has adopted the DSA and the Digital Markets Act (DMA). The DSA will be applicable to all digital services in the EU from 1 January 2024. Through the European Economic Agreement (EEA), Norway is included in most EU legislation and will be subject to the DSA.

The DSA

The DSA is a targeted set of mandatory rules that apply to providers of intermediary services with a substantial connection to the EU. It includes different provisions for different categories of intermediary services. The purpose of the DSA is to give better protection to internet users, establish transparency and accountability, and provide a single, uniform framework across the EEA, creating rules for a "safe, predictable and trusted online environment that facilitates innovation and in which fundamental rights [...] are effectively protected."

Types of intermediary services in the DSA

According to the DSA, an intermediary service is a service that is provided remotely, via electronic means and at the specific request of one user (as opposed to being disseminated to many users simultaneously and without prior request). The DSA divides intermediary services into three broad categories: mere conduit, caching and hosting services. Under hosting, the DSA also distinguishes between (non-disseminating) hosting services, online platforms and very large online platforms (VLOPs).

- **Mere conduit services** are intermediary services that transmit or deliver information to recipients of the service without any alteration or modification of the transmitted content and without involvement in the communication between the senders and receivers (for example, internet service providers (ISPs)).
- **Caching services** are intermediary services that transmit or deliver information to recipients of the service while engaging in automatic, intermediary and temporary storage of that information for efficiency-related purposes (for example, content delivery networks (CDNs)).
- **Hosting services** are intermediary services that store information provided by, and at the request of, a recipient of the service. Online platforms and VLOPs are two additional types of hosting services to which additional obligations apply. Examples of hosting services include web hosting services, cloud computing services and email services.
- **Online platforms** are hosting services that, at the request of a recipient of the service, store and disseminate information to the public (for example, online search engines, online marketplaces, app stores, social media platforms and collaborative economy platforms).
- **VLOPs,** which include 'very large online search engines' (VLOSEs), are online platforms that have more than 45 million average monthly active service users in the EU or more than 10% of the population. Examples include Google Maps, Google Search, Snapchat, TikTok and YouTube.

> We found no single data source that could identify all relevant companies, and we do not believe that such a source exists.

Method used in Analysys Mason's survey

We found no single data source that could identify all relevant companies, and we do not believe that such a source exists. Instead, we based our Norwegian survey for Nkom on 21 data sources to identify DSA subjects. These data sources were used to investigate the most popular websites and applications. In addition, we used a manual, bottom-up approach combined with several expert interviews. However, surveying the market using this approach does not ensure a collectively exhaustive list of services that are subject to the DSA. Moreover, the final database contained many duplicate values for services identified through different sources. For instance, the online marketplace Finn.no was identified through seven different sources.

We created a database of 1565 internet-based services that target Norwegian users. These services were mapped into 34 service classes and five DSA categories. For each service, we also collected data on 12 other attributes such as company registration number and the size of the active user base.

When assigning a DSA category to each service identified, we used the main feature of that service. For instance, we only assigned one category to Facebook, namely VLOP.

Findings from the survey

Of the 1565 services we considered, the largest DSA category by number is **mere conduit** with 423 services, followed by **online platform** with 250 services, and **hosting** with 213 services. Also, we found 587 services that we do not believe are subject to DSA.

The classification of intermediary services according to the DSA definitions was not a trivial task, for several reasons. Firstly, we identified a large number of services as non-intermediary services partly because we used a large number of data sources, which contained many services outside the scope of the DSA. Secondly, some service categories were more difficult to identify than others. While **mere conduit** and **caching** services were relatively straightforward, but the task of collecting data on intermediary services proved harder for **hosting** services. Specific category-specific comments are as follows.

- We found **mere conduits** to consist of one large group of services, namely those from ISPs, on which data was readily available from Nkom.
- Likewise, we found the largest group of **caching** services to be content delivery network (CDNs).
- **Hosting** services were more heterogeneous: the **hosting** and **online platform** service categories were not dominated by a particular type of service. As such, mapping out the **hosting** services category was done using a significantly larger number of sources.
- The DSA highlights in Recital 29 that an intermediary service can be provided in isolation, or as a part of another type of intermediary service or simultaneously with other intermediary services. In other words, one part of an internet-based service's offering may be classified as an intermediary service and thus be affected by the DSA while another part of that same service may not be. For instance, private groups on Facebook, which require an invitation to join, may not be subject to the **online platform** obligations that other parts of Facebook are, because the "dissemination to the public" requirement probably does not hold in these closed groups. Such considerations further complicated the survey work.
- Finally, **online platform** services that are ancillary to the main service may not merit an **online platform** designation. For instance, comments sections on newspaper sites are ancillary to the primary service (publication of news), and may thus not merit an **online platform** designation. We interpret this to also apply to online stores with user-written reviews under their products. However, a question then arises as to when an ancillary service stops being ancillary. If reviews sections are a critical part of an online store's sales strategy, such sections may merit an **online platform** designation after all.

Although we surveyed more than 1500 services, we may not have discovered all applicable services in Norway. This is especially true for online platform services, which often have no physical (infrastructural) footprint in a country and are as such less bound by national borders. In any case, this leading-edge survey establishes a valid starting point for further study of the digital services market.

Questions? Please contact Harald Wium Lie at web_enquiries@analysysmason.com

SpaceX is betting on open IoT standards

Jiachen Zhang , Research Analyst and
Alan Crisp Senior Analyst

SpaceX made its first-ever acquisition in August 2021 when it purchased Swarm Technologies, a start-up known for its early adoption of proprietary ultra-narrowband satellite IoT solutions; a move that signalled SpaceX's intention to expand its capabilities and diversify its offerings to cater to a broader range of customers. However, Swarm's announcement in July 2023 that it would cease selling new devices has raised eyebrows. Swarm's decision appears to be directly linked to its parent company's intention to shift the focus of its IoT strategy towards the direct-to-device/cell (D2D/C) market.

Why is this worth noting? In other verticals – specifically broadband access, enterprise, mobility, and government – that are using the Starlink offering, SpaceX is offering proprietary solutions, which has enabled it to scale rapidly. However, it would appear that integrating with telcos in the IoT market requires a different approach for achieving scale and success.

The move is not surprising to NSR, as this shift in direction towards standards-based solutions from proprietary ones aligns with the trend that was outlined in our recently released report, *M2M and IoT via satellite, 14th edition* report, that the number of in-service IoT units using 5G and standard-based protocols (for example, LoRa) is expected to grow rapidly in the next 10 years, reaching 39.3 million by 2032, out of a total market of 57.7 million devices (Figure 1).

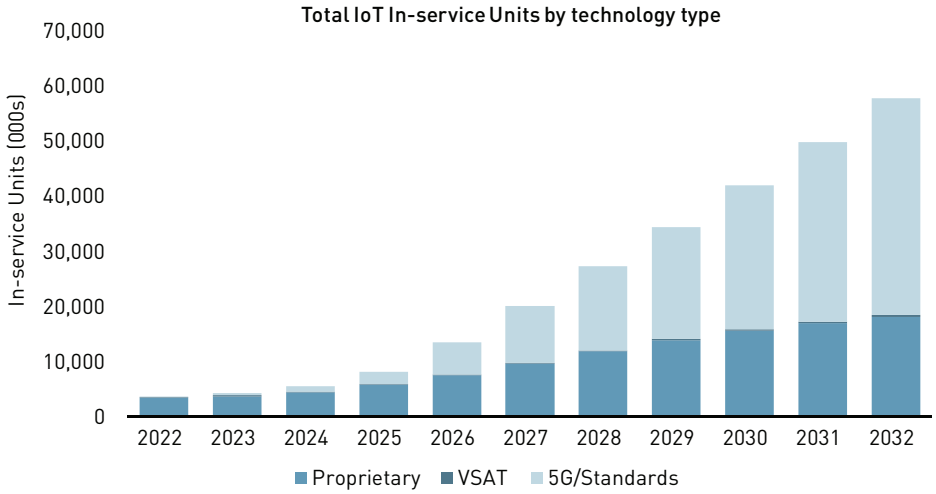

Figure 1: IoT in-service units by technology type, worldwide, 2022–2032 [Source: Analysys Mason, 2023]

The satellite direct-to-device ecosystem is taking shape ... gradually

3GPP Release 17's inclusion of non-terrestrial networks opens the door for direct-to-cell development, allowing IoT devices to communicate with satellite networks directly. Chipset manufacturers are working to integrate standards; for example, Mediatek has demonstrated its 3GPP NTN technology, and Qualcomm has launched new 3GPP modems. In March 2023, the FCC unveiled a proposed satellite direct-to-device regulatory framework, which will facilitate partnerships and collaboration between satellite operators and telecoms operators (telcos), as well as establish ground rules for market players. All these advances will promote the development and growth of the D2D ecosystem.

To seize the opportunities presented by this shift towards standardization, SpaceX has been forming partnerships with terrestrial network operators worldwide. Some recent examples include its partnership with T-Mobile to broaden coverage in the USA, and Optus for D2C coverage across Australia. These future integrations have primarily been marketed as opportunities for consumers to request emergency assistance and send text messages back and forth, but such partnerships are also ideal for narrowband IoT applications; these applications have a clear short-term value proposition for enterprises that crave 100% visibility on mobile assets.

One exciting prospect that could arise from SpaceX's D2C vision is its potential to connect a wide array of devices and allow roaming to satellite networks, especially those that are mobile, moving in and out of terrestrial network coverage, like passenger vehicles. Elon Musk is known for his ambitious goals and SpaceX's D2D initiatives could pave the way for connecting Tesla cars. Musk has previously noted that Tesla vehicles will not be line-fit to connect to the Starlink service, this was in the context of high-speed flat panel antenna connectivity – a much more expensive service to integrate into vehicles. Musk has since commented that SpaceX's narrowband D2D initiative is much more suited to Tesla vehicles.

However, it is important to note that these partnerships will take time to actually implement. Bigger satellites are needed for this service, which in turn will need to be delivered by SpaceX's larger Starship launch vehicle – the same one that was destroyed after a failed test flight in April this year. Consequently, SpaceX has not yet set a date for the satellite-to-cell service to be trialled, but it is likely to occur some time in 2024. In the meantime, other proprietary services are already moving in.

Proprietary solutions still have their place in the IoT ecosystem

From a technical perspective, there is no definitive conclusion as to which protocol strategy is better – using proprietary systems, 3GPP standards, or other standards-based systems such as LoRa. All have their advantages and disadvantages.

Proprietary protocols, whether deployed on small satellite constellations, or using leased mobile satellite service (MSS) capacity, do provide some advantages over standards-based protocols according to operators, which are mainly related to efficiencies and costs. Satellites can use highly efficient proprietary waveforms to handle billions of sensors on a single footprint, and therefore offer better economies of scale than current 3GPP standards.

This is in part due to the overhead in satellite-to-cellular and cellular-to-satellite hand-off on 5G 3GPP systems, which needs to be considered carefully, otherwise the data overhead could overwhelm networks. While 3GPP Release 17 improves this significantly, more needs to be done to make this a more seamless process. Some satellite operators are therefore already going beyond Release 17 in order to improve efficiency, and it is likely that such improvements will be incorporated into future releases.

For end users, deploying proprietary systems makes most sense when there is no terrestrial connectivity available (or it is just not needed), because the greater spectrum efficiency can potentially reduce the price down to single-digit dollars per year in some use cases.

For standards-based IoT solutions though, operators will need to strike a balance between backward compatibility and performance and regulatory certainty. Collaborative network planning and integration are also essential to ensure seamless integration of networks. If stakeholders come together and co-operate in ecosystems based on standards, this could maximise synergies between terrestrial and non-terrestrial networks. If this occurs, and more roaming agreements come into place, a high-growth scenario for the broader satellite IoT market could occur, resulting in almost 140 million in-service units in 2032 (Figure 2).

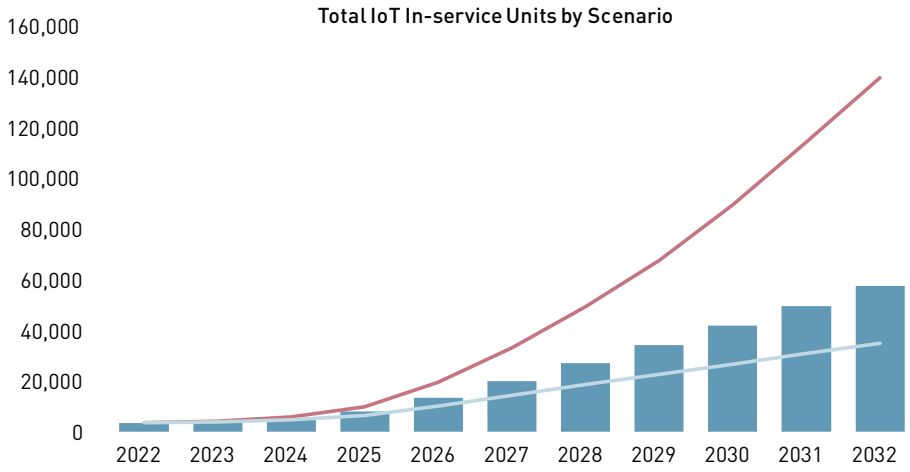

Figure 2: IoT in-service units by scenario, worldwide, 2022–2032 [Source: Analysys Mason, 2023]

Other uncertainties will challenge business models including the revenue split between satellite operators, MNOs, IoT service providers, and other value-chain members. Any regulations and policies will also introduce elements of uncertainty.

Bottom line

SpaceX's move towards standards-based IoT solutions in the direct-to-device market reflects the industry's shifting landscape from proprietary solutions to standardization. This strategic move should position SpaceX to take advantage of the rapidly growing direct-to-device IoT market of the future while aligning with industry standards and trends. SpaceX should be well-positioned to play a pivotal role in the direct-to-device market by forming partnerships, leveraging standards and capitalizing on decreasing device prices.

Although a lot of uncertainties remain in the D2D market, going by the open standards route would simplify telco integration and increase market penetration. At the moment, proprietary solutions have the edge; but 5G standards will begin to outpace growth and market penetration by 2028 and this will continue in the long term. This market development is still 4 years away, but SpaceX is making a bet today that open standards will win over proprietary systems.

Questions? Please contact Jiachen Zhang or Alan Crisp at web_enquiries@analysysmason.com

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