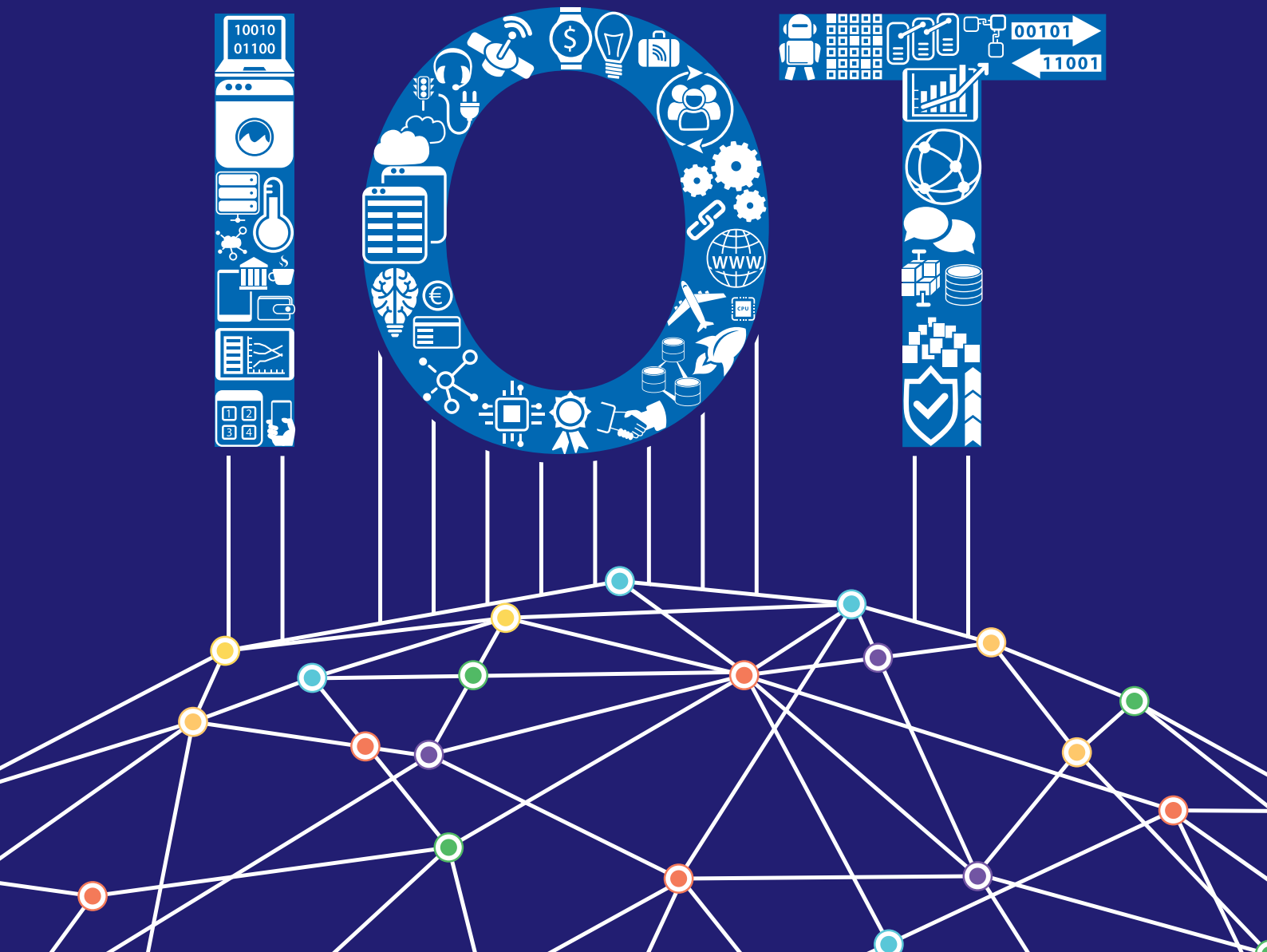
VOLUME III

analysys mason

INTERNET OF THINGS (IOT)

OPPORTUNITIES FOR TELECOMS OPERATORS



Contents

Introduction

With connectivity only representing a small share of the IoT opportunity, for many telecoms operators the focus is on how to play a role in other parts of the value chain

Welcome to our third collection of articles exploring how telecoms operators can make the most of the IoT opportunity.

The articles we included here, written by a mix of our analysts and consultants, gives you a flavour of our thinking on IoT and what it means for operators. Analysys Mason helps clients in all geographies and parts of the value chain to develop their approach to IoT. Our assignments range from rapid reviews of existing plans to full strategy development.

While much attention for telecoms operators understandably remains on connectivity for IoT, as we discuss in these pieces, connectivity revenue only represents a small share of the IoT opportunity. Furthermore, relative to the core business, connectivity for IoT is low in value; only 3% of mobile revenues according to our 2025 forecast. As well as discussing connectivity, these articles provide suggestions for how operators can position themselves in other parts of the value chain.

The articles featured in the brochure cover the following topics:

- Four operator approaches for IoT as the market opens up. We argue that operators should position themselves for how the value chain will look as the market matures and not how it looks today.
- IoT will have little impact on revenue for most mobile operators. We explore the value of IoT connectivity relative to both the operator's core business and to the broader IoT market.
- Operators are racing to enable IoT applications, but a winning approach is yet to emerge. This piece outlines how operators can differentiate their IoT platforms.
- Successful deployment of NB-IoT will depend on spectrum choices. We examine the different deployment options for NB-IoT, and their advantages and downsides.
- IoT Scorecard 2017: China Mobile and Vodafone excel in strategy and execution in emerging Asia–Pacific. Based on the strategies of the most successful operators, we provide some suggestions for best practice.
- IoT: Seven areas for regulators and policy makers to consider. This article explores the regulatory and policy issues that need to be addressed for IoT to grow

We hope that you find this collection of articles useful. We welcome feedback and encourage you to contact the authors directly if you would like to discuss any of the points raised, or are looking to understand how a specific issue or trend will affect your business.

We look forward to working with you.

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Four operator approaches for IoT as the market opens up

> "The breaking down of the IoT value chain could create new opportunities for telecoms operators"

TOM REBBECK
Research Director

AT&T owned the full value chain for its telecoms network during the company's first few decades. Bell Labs did research and development (including pure research[1]), Western Electric manufactured equipment for both the network and end users, while AT&T itself managed the network and customers.[2] Later technological developments meant that the telecoms network no longer needed full vertical integration and AT&T opened up to external suppliers. This pattern is common to new technologies: full vertical integration is initially required, but standards then develop, specialist players emerge and the value chain breaks down into its component parts. Television sets, computers and other technologies have followed a similar development path.

This process has now begun in IoT. Companies selling early IoT solutions often wrote the software, specified the hardware, supported customers and even built the network. (For example, Telensa undertook many of these roles for its smart city solutions.) However, this model is increasingly breaking down. An IoT solutions provider can now buy off-the-shelf hardware, develop applications using standard enablement platforms and sell through channel partners, due to a combination of standardisation and the increasing maturity of the technology.

A more-open value chain creates opportunities for operators, but also for other players

This breaking down of the IoT value chain could create new opportunities for operators. Each operator can focus on the activities (such as security or device management)that fit best within its current business and for which it has differentiators, rather than facing the choice of providing either only connectivity or full end-to-end solutions for different verticals.

Figure 1 summarises some of the activities in the IoT value chain. Each operator needs to map the component activities to assess the size of

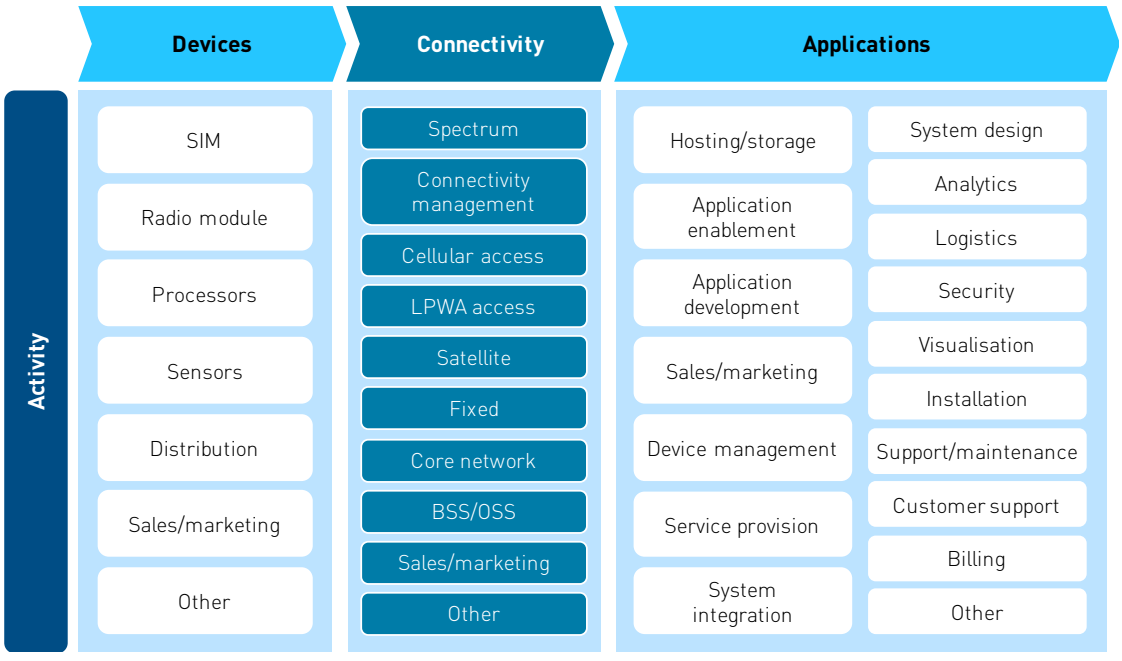
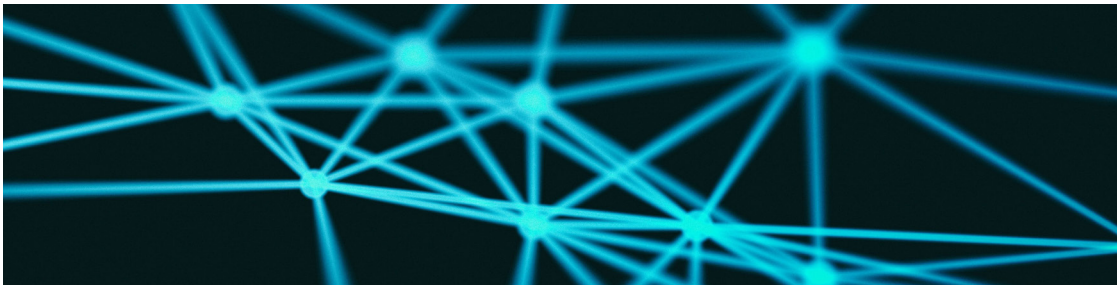


FIGURE 1: SIMPLIFIED MAPPING OF ACTIVITIES WITHIN THE IOT VALUE CHAIN
[SOURCE: ANALYSYS MASON, 2017]



opportunities and identify the roles that it can play. This is inevitably a complex exercise, as the value chain will differ for each application within a vertical market. For example, the value chain for embedded connectivity in a car differs from that for a pay-as-you-drive insurance proposition, even though both are 'connected car' solutions.

Operators have four possible approaches to IoT

We believe that operators should explore four approaches to IoT using this framework, as discussed in more detail in our recent report *Operator approaches to IoT: from connectivity to platforms and full solutions.*[3]

- **Connectivity.** This forms the basis of most operator IoT solutions and operators must ensure that they are well-placed to provide a range of connectivity options, such as NB-IoT. We forecast that the total value chain for IoT solutions supported by traditional cellular and LPWA connectivity will be worth USD200 billion worldwide in 2025, of which connectivity will represent around USD27 billion (14%).
- **Generic platform.** An operator provides basic tools and capabilities (such as device management) that developers can use to create IoT solutions. This approach could increase the addressable market for an operator to around USD20 billion in 2025 – 10% of the total.
- **Vertical-specific platform.** An operator offers platforms or capabilities tailored to a specific vertical market, such as healthcare. The size of the addressable market depends on the application area, but it could be worth as much as USD10 billion – 6% of the addressable market.
- **End-to-end solution.** An operator offers all components of a solution. The addressable market size again varies according to the application area, but this could be as much as USD19 billion (or 10% of the opportunity), which is the value of fleet management alone.

Connectivity builds on operators' current business, but end-to-end solutions require operators to fundamentally change their operations, with implications ranging from sales commissions to organisational structure. The end-to-end approach may be justified for the largest vertical markets (such as fleet management), but not across multiple sectors, as it will be difficult to exploit synergies between these or with a platform offering. For example, the expertise gained in supporting fleet managers will be of little benefit in launching a healthcare solution.

In contrast, operators using the generic or vertical-specific platform approaches can focus on areas where their offerings have the strongest differentiators or on capabilities that are common across multiple applications.

The risk in providing capabilities is that operators will be competing against a range of providers. Operators should question their role in selling any capability for which they do not have a strong differentiator. Possible differentiators for operators to explore could include local hosting (for low latency and to meet any data sovereignty requirements), local language sales and support, and bundles (for example, of approved hardware, connectivity and security), which simplify the buying process for customers.

Operators also need to consider how to sell these capabilities. Currently, the process of selling IoT solutions for many operators involves a complex consulting engagement to understand a client's requirements and to advise on the available options. This level of effort may be warranted for major contracts, but most operators are not able to provide this sort of support for many IoT customers. Each IoT solution cannot require a full consulting project, if the technology is to reach the billions of connections that are forecast. Operators should instead explore new ways of advertising, selling and supporting their capabilities, as AT&T is doing with M2X and Flow. Operators can keep the cost of sales and support low by providing developers with tools, typically via APIs. This reduction in costs is essential for solutions where the revenue per device will often be under USD10 per year.

Operators will need to work hard to justify their presence in services other than connectivity

The development of the original telecoms network gradually eroded the role of AT&T in the value chain, but developments in IoT will result in the opposite trend. It is becoming easier for AT&T and other telecoms operators to play larger roles in IoT, but they will need to work hard to justify their presence in the market.

Questions?
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[1] AT&T even grew germanium crystals as part of its quest to develop solid state transistors.

[2] For an excellent overview of AT&T's early research and development work, see Jon Gertner's The Idea Factory: Bell Labs and the Great Age of American Innovation, Penguin (London, 2012).

[3] http://www.analysysmason.com/Research/Content/Reports/Operator-approaches-IoT-Jan107-RDME0/

IoT will have little impact on revenue for most mobile operators

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> "Most operators are not well-positioned to capitalise on the IoT opportunity."

IoT has become a persistent theme in telecoms industry conversations. Few strategy plans for operators do not mention IoT, and for some operators (including, Orange, Verizon and Vodafone), IoT is of central importance. This focus is understandable: although the worldwide mobile telecoms industry is only forecast to grow at a 1% CAGR between 2016 and 2025, Analysys Mason has calculated that revenue from IoT solutions enabled by mobile operators (that is, the total spend – including devices, applications and connectivity – on devices that use a wide area connection) will exceed USD200 billion in 2025, representing a CAGR of 18%. This is equivalent to 22% of the total spend on mobile services worldwide (USD888 billion) for the same year.

However, IoT connectivity revenue will only reach USD28 billion by 2025, representing just 3% of worldwide mobile telecoms revenue. If IoT is to become a new growth area within the telecoms industry, it will need to contribute significantly more revenue to the overall business than connectivity alone can generate.

Operators will need to adopt new strategies to win a share of the USD173 billion spend on devices and applications

While connectivity represents just a small proportion of the total spend on IoT solutions enabled by mobile operators, by 2025, revenue from application development and enablement will represent USD123 billion, and hardware will account for USD50 billion. Mobile operators are seeking additional incremental value by offering other components. However, this may present challenges because mobile operators do not typically have the skills required to build a viable proposition. To capture a larger share of hardware or application revenue, mobile operators should consider the following strategies.

- **Create an independent entity to target the IoT opportunity.** An IoT business unit should be able to make decisions independently of the legacy business.
- Its performance metrics should be commensurate with a new growth area, and it should be granted a fair degree of autonomy to make its own investment decisions. Investment in hardware and application services should be focused on growing the IoT business and should not be hindered by legacy business considerations (for example, Bouygues Telecom and Vodacom have demonstrated how operators can use separate units to develop IoT solutions).[1]
- **Leverage in-house capabilities to build IoT enablers and applications.** Operators need to build platforms and enablers to operate in new areas of the value chain. Some operators have separate R&D and ICT divisions that focus on developing new capabilities and solutions that target specific industry sectors. For example, Deutsche Telekom's ICT business, T-Systems, developed a healthcare platform (e-Health Connect), which supports IoT applications such as remote patient monitoring. In addition, Verizon has developed ThingSpace, and Indosat has developed NexThing to build the developer ecosystem to support their initiatives.

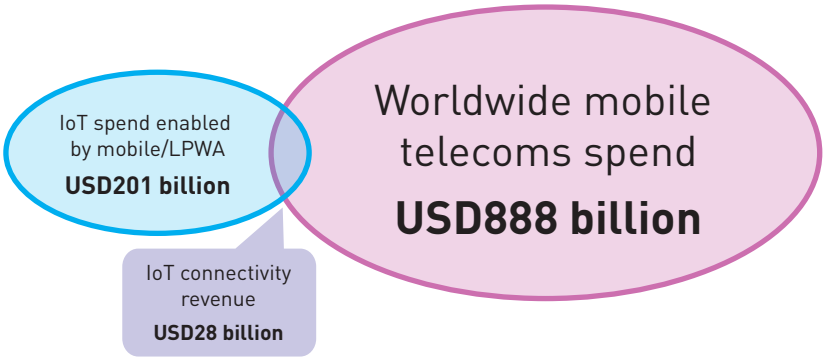

FIGURE 1: TOTAL VALUE OF IOT REVENUE ADDRESSABLE BY MOBILE OPERATORS (MOBILE AND LPWA), TOTAL MOBILE TELECOMS SPEND AND IOT CONNECTIVITY REVENUE, 2025 [SOURCE: ANALYSYS MASON]

- **Foster partnerships to bring IoT propositions to market.** Not all mobile operators have all the skills required or in-house expertise to develop hardware and application solutions. Even those operators with an established IT division (such as Deutsche Telkom) will depend on partnerships for certain components. Most operators will need to build partnerships to enter new areas of the value chain, either in capabilities such as application enablement platforms or by bringing end-to-end solutions to market.
- **Make bold moves in investment and acquisition.** Mobile operators have been relatively cautious in terms of acquisition in the IoT space. There have been a couple of major exceptions: Vodafone acquired Cobra to compete in every part of the automotive IoT value chain. Similarly, Verizon has made a spate of high-profile acquisitions totalling USD3.5 billion to compete in fleet management. On a smaller scale, Telia has invested in Springworks to enable its connected car platform, and it recently acquired Fältcom to compete in smart-city applications.

Most operators are not well-positioned to capitalise on the IoT opportunity

IoT currently represents only a small share of operator revenue – even for those operators with a large IoT business. For example, Vodafone reported that IoT accounted for only 1.3% of its revenue in 3Q 2016, and Verizon reported that IoT accounted for only 0.8% of its revenue in 4Q 2016. For IoT to grow to a sizeable share of revenue – that is, 10% or above – and be considered an important driver for growth, operators will need to capture some of the USD123 billion application revenue or USD50 billion hardware revenue that we have forecasted for 2025. Addressing these areas of the value chain will require significant investment and carries a higher risk of failure. EBIT margins which are relatively high for connectivity at around 10% will likely be lower in these areas. However, if operators want to remain visible in IoT and develop strong revenue streams, they will need to increase their appetite for risk and invest accordingly.

Analysys Mason has produced extensive research on the role of operators in IoT as part of its IoT and M2M Services programme. Our reports include *Operator approaches to IoT: from connectivity to platforms and full solutions*, as well as a comprehensive forecast on the total addressable IoT market for operators published in the *DataHub* and summarised in our report *IoT value chain revenue: worldwide trends and forecasts 2016–2025*[2]. We have also undertaken a number of projects for telecoms operators to develop their approach to IoT, including one-day strategy workshops and full strategy reviews.

Questions?
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[1] For more information, see Analysys Mason's Mobile payments in emerging markets – beyond m-pesa. Available at: www.analysysmason.com/About-Us/News/Newsletter/mobile-payments-in- emerging-markets-Jan17/

[2] http://www.analysysmason.com/Research/Content/Reports/IoT-value-chain-Feb2017-RDME0

Operators are racing to enable IoT applications, but a winning approach is yet to emerge

AHMED ALI
Senior Analyst

> "Operators need to differentiate their platform services with key strengths such as connectivity and local support in order to compete with large players, including Amazon and Microsoft."

Operators are eager to move up the IoT value chain and get involved in the application enablement process to capture a share of this market. However, because this is a new area for operators, they are taking different approaches to entering this space. Several operators with large domestic markets have created in-house application enablement solutions. Examples include AT&T's 'M2X' and 'Flow' solutions, and SK Telecom's 'ThingPlug' initiative. Other operators (particularly those in Europe such as Deutsche Telekom, Telefónica and Vodafone) have partnered with platform vendors such as Cumulocity and PTC ThingWorx. Each operator's approach to enablement has its merits, but operators face strong competition from big platform players such as Amazon and Microsoft and, therefore, they need to work on differentiating their solutions and go-to-market strategies.

Application enablement platforms enhance operators' IoT services in various ways

IoT application enablement platforms (AEPs) offer a set of tools that simplify the process of building IoT solutions by enterprises and developers. The exact capabilities vary depending on the technology provider and its targeted customers, but most solutions support features such as analytics, data integration tools and run-time environments. Most technology providers offer a horizontal platform that supports a large choice of common development tools and functions.

Region	ThingWorx	Cumulocity	Telit	Carriots	SAP Plat.One	Proprietary
Latin America and North America	• Rogers • Sprint					• AT&T • Verizon
Asia–Pacific	• NTT Docomo • Telkomsel	• Telstra				• China Mobile • KT • SK Telekom
Europe	• Elisa • Portugal Telecom • Tele2 • Telefónica • Telenor Connexion • Vodafone	• Deutsche Telekom • EE • Sonera	• Proximus • Swisscom • Tele2	• Orange	• BT • Telecom Italia	
Middle East and Africa	• Etisalat	• Etisalat				

FIGURE 1: SELECTED AEP PROVIDERS AND THEIR CUSTOMER OPERATORS
[SOURCE: ANALYSYS MASON, 2017]

Operators that are aiming to expand their IoT services and explore new business cases beyond connectivity and device management are using AEPs in ways that reflect their individual strengths and the level of confidence within their own IoT markets. An operator can leverage an AEP in one or more of the following ways.

- **Platform for internal solutions.** Use the platform internally for developing applications as part of a pre-packaged complete end-to-end IoT solution.
- **Platform plus services.** Offer an AEP as part of a complete advanced platform for business customers that want to develop their own applications and be supported by integration and consulting services.
- **Platform for developers.** Provide an open platform of tools, often available as APIs, that developers can access. This can be augmented with application certification processes and a marketplace that developers can use to publish/promote the apps they have developed.

Major operators are deploying AEPs, but regional disparities are evident

The largest operators in developed markets in Asia–Pacific, Europe and North America are already implementing application enablement and development features within their IoT platforms and services (see Figure 1). European operators have primarily opted to use external vendor solutions, while large operators in Asia and North America have decided to implement in-house platforms. PTC ThingWorx is, by far, the leading vendor, having secured more than 10 operator partners including Telefónica and Vodafone.

Developing an internal platform should enable an operator to win a greater share of revenue. This strategy requires operators to have access to a large pool of IoT developers, a willingness to invest, and a confidence about their position in the IoT market. Good examples of this include China Mobile, SK Telekom and Verizon, which are amongst the largest IoT players within their local markets. In line with this strategy, these operators' AEP services compete directly with other platform vendors (for example, from Amazon or GE), but the operators believe they have the scale to do so.

However, European operators see value in leveraging external vendor solutions to speed their market growth and to reach out to a wider audience. These operators, including Orange and Vodafone, while also managing large-scale IoT operations, are spread across multiple countries in varying stages of development with varied business requirements. Such operators tend to offer platform services and use partner solutions to extend their own resources and capabilities. Figure 2 summarises the arguments for building or buying an AEP.

Operators need to be prepared for strong competition within the AEP market

A partnership between a third-party AEP and an operator should be mutually beneficial. AEPs require recognition and a wide user base in the developer community, and operators can help provide this. In return, the broad platform exposure will empower operators' own platform offerings and supported services. Furthermore, operators that use the same platform (for example, ThingWorx) can combine efforts to drive the platform's adoption.

The main competitors for operators and their partner vendors are the large cloud providers such as AWS, Azure and Google, which are making strong moves into the IoT AEP market. These cloud providers are poised to acquire a large segment of customers and will therefore impact AEP market dynamics, thanks to their strong relationships within the enterprise market. For an operator, having an AEP is not enough; there needs to be a clear strategy on what to do with it and how to differentiate the operator's offerings from large global players. Connectivity, local support and customised services are areas where operators have influence and these elements can be bundled to together to create more-attractive solutions.

Questions?
Please feel free to contact Ahmed Ali, Senior Analyst, at ahmed.ali@analysysmason.com

	Advantages	Disadvantages
Buy platform	• Less investment needed • Traction already exists • Quick to market and operator can focus on its strengths • Less commitment needed.	• Less control • Lower share of revenue • Platform might require optimisation for operators.
Build platform	• Greater share of revenue • More control • Platform can be optimised for operator use cases (or services that need a SIM).	• Lots of investment needed with long-term commitment • Gaining traction can be challenging and can be slow to market • Not a core business.

FIGURE 2: ADVANTAGES AND DISADVANTAGES OF BUYING OR BUILDING AN AEP
[SOURCE: ANALYSYS MASON, 2017]

Successful deployment of NB-IoT will depend on spectrum choices

JANETTE STEWART
Principal

> "The fast pace of NB-IoT standardisation during 2016 suggests there is demand for its commercial deployment."

Standardisation of "narrowband IoT" (NB-IoT) occurred rapidly during 2016, and major mobile operators such as Deutsche Telekom and Vodafone are planning wide-scale roll-out. This article discusses the spectrum options for NB-IoT and their commercial implications. Noting that there are three options for deployment – namely in-band deployment alongside LTE traffic, 'guard-band' deployment at the edges of existing LTE carriers, and use of separately assigned spectrum – the article discusses the trade-offs involved and the factors determining the best deployment choice.

The speed at which the industry has standardised NB-IoT suggests strong demand for the new technology

The rapidly developing Internet of Things (IoT) market is being enabled by various wireless technologies. A recent addition to this already crowded market is narrowband-IoT (NB-IoT). This modified version of the established 4G (LTE) technology uses narrower channels (i.e. 200kHz compared to 10MHz for LTE use).

The fast pace of NB-IoT standardisation during 2016 suggests there is demand for its commercial deployment, to address a wide array of IoT uses over cellular networks. There are similarities between some of these uses and those being associated with Fifth Generation (5G) services. However, NB-IoT provides an immediate solution for mobile operators to create successful IoT businesses well before 5G becomes a commercial reality.

The three deployment options for NB-IoT RANs have performance implications, both for IoT deployment and for MBB

From the perspective of the radio access network (RAN) there are three NB-IoT deployment options.

- Two of these options are suitable for deployment in spectrum that has already been licensed:
  - an *'in-band'* option, where NB-IoT is deployed within existing LTE spectrum used for mobile broadband (MBB) services
  - a *'guard-band'* option using spectrum at the channel edges of existing LTE carriers (where roll-off from spectral emissions creates 'in-band guard bands', which can be used without taking capacity from the main LTE traffic carriers)
- The third option is to deploy NB-IoT *using a separate assignment of spectrum* (i.e. 'standalone' deployment), and different LTE frequency carriers from those assigned to mobile operators for MBB use.

To date, regulators have not assigned separate frequencies for NB-IoT, although this approach is available. For example, it would be possible to assign IoT spectrum from the 700MHz band (so-called '2×3MHz', from 733–736MHz and 788–791MHz). This 2×3MHz spectrum is adjacent to the main MBB-focused 700MHz band plan (as shown in Figure 1 below[1]) and so would have no impact on the amount of spectrum available for MBB.

There appear to be various advantages of using separately assigned spectrum rather than an in-band deployment. For example, operators could deploy IoT services without taking up spectrum resource and/or affecting the quality of service of MBB services. Similarly, although the guard-band solution uses less MBB capacity than the in-band deployment option, it is unlikely the guard-band solution can offer the same

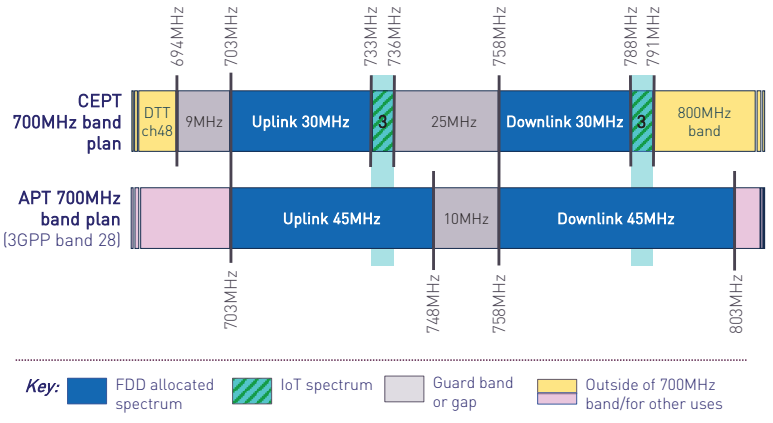

FIGURE 1: 700MHZ BAND PLANS FOR EUROPE AND ASIA , HIGHLIGHTING THE 2×3MHZ SPECTRUM ASSIGNMENT SUITABLE FOR IOT [SOURCE: ANALYSYS MASON, 2017]

levels of performance as when using separately assigned spectrum, due to more limited prospects for optimising site placement, coverage and capacity for the IoT traffic.

There could also be other benefits from using separate spectrum, including the possibility of optimising RANs to provide superior indoor coverage. There might also be device upsides, such as a reduction in power consumption from having better indoor coverage. Some IoT use cases require high levels of network availability due to the nature of traffic being carried (e.g. applications within the healthcare sector, or connections to/from vehicles). Separately assigned spectrum could provide more reliable connections for these situations, whilst also leveraging existing sites and network assets (e.g. billing and security).

If NB-IoT take-up is strong and MBB capacity demand continues to grow, major operators' plans for in-band deployment could compromise network performance

Despite the performance compromises noted above, Vodafone's plans to offer NB-IoT services in markets across Europe involve using its existing 800MHz spectrum. Vodafone has indicated that this is because its 800MHz LTE RAN is ready to support NB-IoT (i.e. most sites can be software upgraded and current systems can be updated quickly without needing extensive additional infrastructure)[2]. One of the key benefits for Vodafone is likely to be speed to

market. However, given the rapid increase in MBB traffic reported recently, and forecasts of continued strong growth (see Figure 2), it could be challenging to support IoT and MBB traffic within the same carriers without compromising network performance.

Vodafone's spectrum portfolio (including 2.6GHz spectrum and sub-1GHz bands such as 900MHz) might help to reduce any impact on network performance. However, other mobile operators with smaller spectrum holdings may be less able to mitigate this effect.

Industry sources point to key benefits of NB-IoT being quality of service and the possibility of re-using LTE infrastructure (e.g. sites, backhaul and core network capabilities). LTE infrastructure can be re-used whether deploying within existing LTE MBB spectrum or in separately assigned carrier(s). However, quality of service depends on the spectrum being used – the possibility of mobile operators capturing a significant share of IoT traffic is important in this regard, since as traffic levels grow the quality of service for both IoT and MBB will decline (unless separate spectrum is available).

Regulators currently appear unconvinced about the need to assign separate spectrum for IoT

The lack of harmonised spectrum for NB-IoT suggests that regulators are unconvinced about a market need for separately assigned spectrum. If separate spectrum were to be made available several policy questions could arise, such as: How many separate networks can be supported in 2×3MHz? How many networks are required? Are there competition implications for the MBB market?

With no regionally or globally harmonised solution for separately assigned spectrum, it seems likely that early deployments will follow Vodafone's model of in-band deployment. Ultimately, the success or otherwise of these early launches of NB-IoT using capacity from LTE carriers could determine whether further dedicated spectrum is needed.

Questions?
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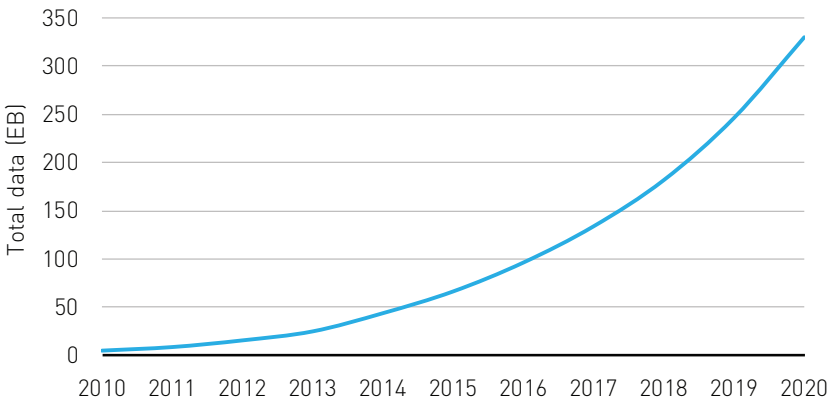

FIGURE 2: FORECAST GROWTH IN WORLDWIDE MOBILE DATA TRAFFIC, EXCLUDING IOT [SOURCE: ANALYSYS MASON, 2017]

[1] ECC Decision (15)01 includes the 2×3MHz IoT spectrum as an option; see http://www.erodocdb.dk/doks/doccategoryECC.aspx?doccatid=1

[2] See http://www.vodafone.com/content/index/what/technology-blog/enabling-iot.html

IoT Scorecard 2017: China Mobile and Vodafone excel in strategy and execution in emerging Asia–Pacific

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SHERRIE HUANG
Senior Analyst

> "Analysys Mason's 'IoT Scorecard 2017' for EMAP does not rank CSPs based on size alone; instead, we assess how the market pioneers have established successful IoT businesses to achieve scale and examine their best practices."

Analysys Mason has identified in its IoT Scorecard 2017[1] two telecoms operators in emerging Asia–Pacific that have excelled in this area: China Mobile and Vodafone. China Mobile topped the overall pioneer ranking, thanks to its heavy investment in network technologies, IoT capabilities, as well as its presence in multiple sectors and a dedicated IoT business unit to drive growth. Vodafone is also a pioneer due to its advanced vision and strategy, extensive international coverage and partnerships, which it leverages in the region to facilitate inbound and outbound IoT services. This article summarises these operators' strengths and best practices, which may serve as a guide for other operators seeking to build an IoT business.

Best practice, not size, defines the IoT pioneers in emerging Asia–Pacific

It would be easy to assume that the region's IoT market pioneers were identified according to their size. Both China Mobile and Vodafone enjoy significant scale in the IoT market. However, Analysys Mason's IoT Scorecard 2017 does not rank based on size alone. Instead, we assess how the market pioneers have established successful IoT businesses to achieve this scale and examine the best practices that they have developed to succeed. These best practices can serve as a guide for other operators just starting out in the market or at an early phase of implementing their IoT strategy. The IoT Scorecard 2017 focused on six key categories on which operators in emerging Asia–Pacific were ranked: strategy and vision, structure and organisation, ecosystem and partnership, market status and size, network status and technology, and capabilities and portfolio.

Independent IoT business units, as well as active engagement in network and technology development, support market success

Important areas where both leading operators excelled include the following.

Structure and organisation: Both China Mobile and Vodafone scored highly in their structure and organisation for delivering IoT services. To enhance their chances of success, operators worldwide need to have an IoT division that operates with a high level of independence, but is

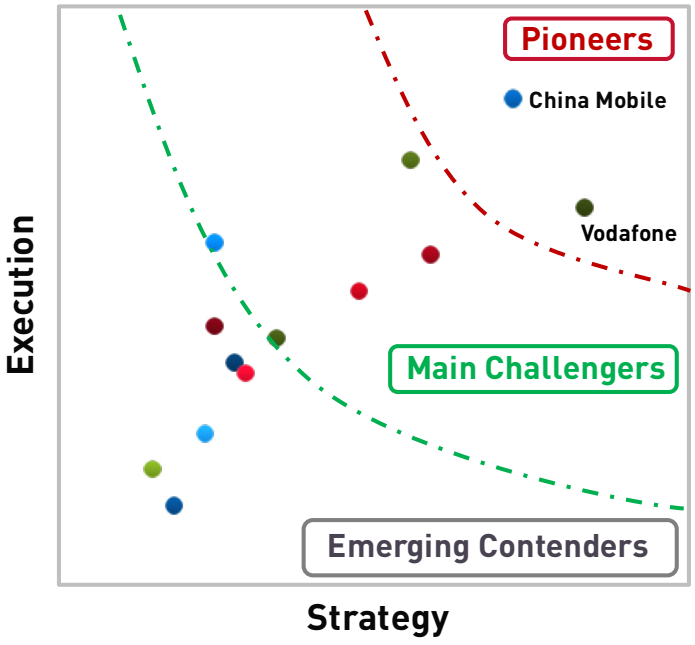

FIGURE 1: CHINA MOBILE'S AND VODAFONE'S RANKING FOR ANALYSYS MASON'S IOT SCORECARD 2017, EMERGING ASIA–PACIFIC. [SOURCE: ANALYSYS MASON, 2017]

still able to leverage the resources and brand of the core business. China Mobile established an independent IoT business unit in September 2012 – China Mobile IoT subsidiary – in order to grow its IoT business. Its primary role is to innovate and consolidate resource across the IoT value chain.[2] Similarly, Vodafone IoT benefits from a high degree of autonomy, despite being part of Vodafone's Group Enterprise. It exerts sufficient influence within the group to ensure that IoT is represented in network investment decisions (for example, in NB-IoT). Moreover, Vodafone Automotive operates as a separate business unit, which is dedicated to building this new growth area. Both companies have demonstrated that success in this segment depends on a relatively independent business unit that focuses on new business opportunities separate from legacy business considerations. Other operators are adopting this best practice. For example, Indosat Indonesia has had a separate IoT operating division since 2013, and Reliance India launched a separate IoT business unit, UNLIMIT, in November 2016.

Network status and technology: While most of the operators surveyed have a strong portfolio of cellular technologies, China Mobile and Vodafone stand out as pioneers, thanks to the bold moves that they have made to support IoT-specific wide-area networks. China Mobile has conducted outdoor trials of NB-IoT with Huawei and ZTE and is a NB-IoT Forum member. It is also trialling LTE-M with Ericsson and Qualcomm. Vodafone has been at the forefront of promoting NB-IoT standards and is preparing to launch the technology commercially in several of its European markets. It is working to build the ecosystem and to establish the technology as a worldwide standard. Both operators have made significant investments in backing their preferred standards and building support from other operators and players, such as module manufacturers and application developers instrumental to the IoT ecosystem. Both China Mobile and Vodafone have led the way in ensuring that wide-area cellular networks remain relevant to IoT. Other operators in the region have run trials of LPWA technologies, but have been less active in building the case for LPWA.

Both operators ranked highly in other criteria. For example, Vodafone has invested significantly in building partnerships with other players that are active in building their IoT businesses in the region. Finally, China Mobile has invested in enabling capabilities such as its OneNet platform.

Operators have different approaches and start points for entering the IoT market, but the same best practices lead to success

China Mobile and Vodafone have taken quite different approaches to building their IoT businesses. China Mobile has typically focused on the domestic market (unsurprisingly, given the size of the opportunity), while Vodafone has pursued opportunities that require international mobility and enable it to leverage its global footprint. However, their strategies start to converge as they focus on delivering IoT services into and out of the emerging Asia–Pacific region for local and global companies alike. Both have made significant investments in developing IoT best practices across a range of criteria and leveraged these to build successful IoT businesses in emerging Asia–Pacific.

Questions?
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[1] http://www.analysysmason.com/Research/Content/Reports/IoT-scorecard-EMAP-Mar2017-RDME0

[2] More information available at: http://www.51lian.cn/html/2012/qiye_1205/35944.html (Chinese version).

IoT: Seven areas for regulators and policy makers to consider

TOM REBBECK
Research Director

"Governments are active participants, as well as rule makers, for IoT."

The potential for IoT to have a positive economic, societal, and environmental impact worldwide is substantial, but its development also raises new questions to be addressed by regulators and policy makers. The need to protect consumers, and to help them understand how their data is being used, must be balanced against the need to ensure that the potential of the IoT market is not stifled.

Governments are not neutral actors in IoT

Governments are active participants, as well as rule makers, for IoT, with government policy driving some of the largest IoT projects worldwide. For example, the European Union is aiming for 80% of electricity meters to be smart meters by 2020, and in the USA, Recovery Act funding supported smart grid initiatives. Governments are also supporting the deployment of vehicle accident alert systems (such as the European Commission's initiative, eCall), and providing funding for smart cities and more general IoT innovation.[1]

Governments need to be wary of the potentially negative consequences of their involvement. For example, one operator suspended its plan to build a large-scale LPWA network after the national government suggested that it would instead fund a similar system to support smart city services. However, after 18 months with no development of the promised government network, the country in question still has no LPWA connectivity.

Seven key areas of interest for regulators

We have identified seven key areas of interest for regulators reviewing IoT (see Figure 1).

Policy makers need to consider existing rules when exploring IoT regulation

We believe that four broad factors should be considered when reviewing regulation and policy for IoT:

- Although IoT development raises some new concerns, many issues will already be covered by existing regulation, making new rules unnecessary. For example, privacy concerns have been raised about drones that can take videos or photographs, with some attempts to ban drone photography.[2] Most countries already have legislation on photography, which means that additional rules are not needed.
- Current and planned regulation may be too stringent for IoT, and could threaten innovation. The need to relax existing rules has been recognised in both Japan and Korea.
- IoT requires regulatory certainty due to the long-term nature of investments. A 15-year lifetime for an IoT device will not be uncommon. For such commitments, the firms involved will want to have confidence in the regulation. For example, the rules governing permanent roaming[3] are unclear in many countries and this may dissuade IoT companies from using it.

- Finally, IoT is a global business, which limits the impact that any single national government can have over many aspects, including IoT standards. While it may not be desirable or possible for governments to decide upon standards, they do have influence.[4]

Analysys Mason has over 30 years of experience supporting telecoms regulators and policy makers, and in recent years has supported several organisations on the topics discussed above.

Questions?
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Issue	Regulatory and policy considerations
Device and service security	• New rules may impact multiple regulators (for example, healthcare devices may require involvement from telecoms and healthcare regulators). • Few countries will have the clout to mandate security standards alone.
Data privacy and ownership	• Issues around data ownership could involve device manufacturers, application providers, and network operators, and affect multiple regulatory bodies.
Network security and resilience	• New services (such as healthcare and energy) may require increased levels of security and resilience. • Multiple government bodies beyond communications regulators may be involved in regulation.
Data sovereignty and residence	• Governments considering restrictions on the transfer of IoT data will need to balance the benefits against potential consequences. IoT organisations may choose not to launch a service if rules appear too restrictive, or require substantial local investment.
Allocation of scarce resources (including spectrum and numbering)	• Most IoT applications will be low bandwidth and will not require additional network capacity.[5] • Some applications (for instance, healthcare) may benefit from dedicated spectrum, such as that proposed for 2 x 3Mhz in the 700MHz band, to support higher quality-of-service levels. • Regulators may also need to clarify rules about existing spectrum usage.[6] • A number of countries, including the Netherlands, Norway and Spain, have released new number ranges for M2M services. • When addressing the allocation of resources, governments can encourage the use of IPv6 by encouraging its use by the public sector, as Belgium has done.
Roaming and network switching	• Many (if not most) IoT companies would prefer flexibility when it comes to which option to use for connected services worldwide (for example, a choice between using a local physical SIM, a global roaming SIM or an eSIM). • Rules surrounding eSIMs and permanent roaming are often unclear, creating avoidable uncertainty.
IoT standards	• The absence of globally accepted IoT standards is a barrier that may be delaying IoT deployment. • Regulators and governments should consider how they can support the development of standards.[7]

FIGURE 1: KEY ISSUES IN IOT REGULATION [SOURCE: ANALYSYS MASON, 2016]

[1] For example, the UK government has committed GBP40 million to projects such as IoTUK, a national programme that supports the development and adoption of IoT in the UK.

[2] In 2013, US state of New Hampshire's government unsuccessfully attempted to introduce a bill to ban "images of a person's residence to be taken from the air." Available at: http://www.modelaircraft.org/gov/statebills/NHHB619.pdf

[3] Permanent roaming is where a SIM from one country is installed permanently in a device that originates in another country. For example, in Ireland, the lottery terminals use SIM cards from Telefónica Spain.

[4] In the UK, the government is providing support, including funding, for the development of the Hypercat standard.

[5] Analysys Mason forecasts that IoT devices will represent 3% of total global cellular traffic in 2020. See Analysys Mason's Wireless network data traffic: worldwide trends and forecasts 2015–2020. Available at: www.analysysmason.com/Research/Content/Reports/Wireless-Network-Traffic-Jan2016-RDTN0.

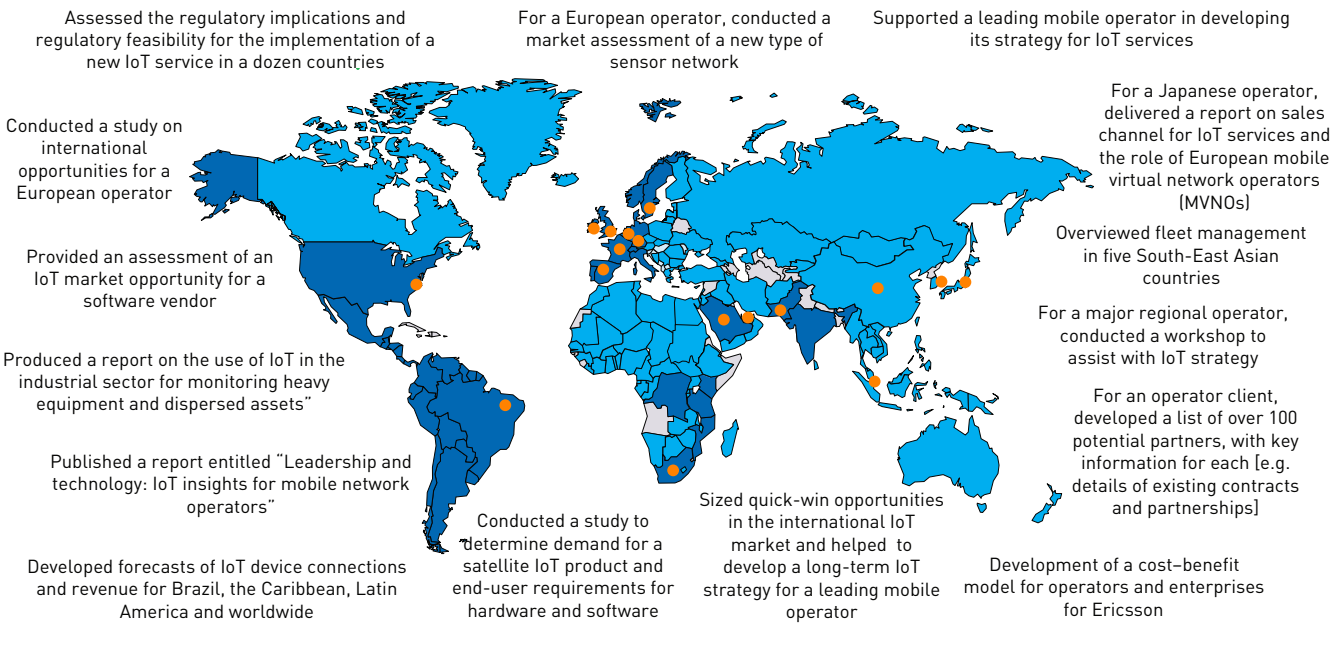
[6] For example, in March 2016, Ofcom clarified that certain VHF bands could be used for IoT applications. See article: Ofcom (London, UK, 23 March 2016), VHF radio spectrum for the Internet of Things. Available at: http://stakeholders.ofcom.org.uk/binaries/consultations/radio-spectrum-internet-of-things/statement/vhf-iot-statement.pdf.

[7] RAND Europe recently published its report Accelerating the Internet of Things in the UK, which explores some of these topics. Available at: https://www.rand.org/randeurope/research/projects/accelerating-internet-of-things-uk.html.

Analysys Mason's expertise in IoT

Our specialist consultants and analysts deliver maximum value to our clients, whatever their challenge and wherever they are in the world

Our expertise in IoT is built on projects performed in multiple regions



Examples of recent IoT client projects, by geography

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

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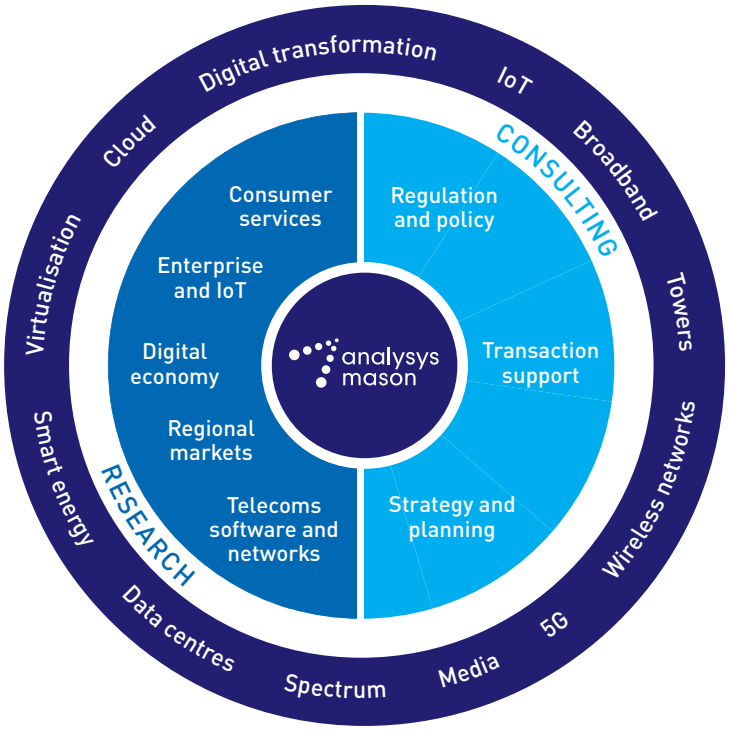
- We offer detailed insight into the software, infrastructure and technology delivering those services
- Clients benefit from regular and timely intelligence, and direct access to analysts



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