



Virtual assistants, virtual networks

Introduction

Welcome to the 19th edition of *Inside Telecommunications*. Our regular sector review draws on EY's deep industry knowledge to provide unparalleled market intelligence on critical issues affecting the telecommunications sector worldwide.

Operators continue to expand their service propositions across different domains. TV and video services remain firmly at the forefront of telco growth strategies, with 47% of industry executives in our report *Digital Transformation for 2020 and beyond* citing them as a top driver of incremental revenues. As telco service offerings evolve, some are now moving into production of original content.

Smart home initiatives are also evolving in new directions. Digital assistants help provide an intuitive interface for a range of in-home capabilities, and telcos are striking partnerships with technology vendors while developing virtual assistants of their own.

On the technology side, network virtualization strategies are progressing, with tier-one carriers leading the way. A holistic mindset is vital: long-term transformation will hinge on the success of phased, incremental initiatives. In terms of the access network itself, operators recognize the potential of 5G, but low-power, wide-area networks, particularly

Narrowband Internet of Things (NB-IoT), are now a near-term priority for many.

Global telecom M&A activity in the first half of 2017 – 215 deals – was down from the previous year, which saw 273 deals in the first half of 2016. Regulatory scrutiny of in-market deals remains pronounced, yet consolidation is still a strong theme, as underlined by the merger of Vodafone India and Idea Cellular. At the same time, private equity firms are showing ever-greater interest in infrastructure assets, with a number of US\$1b+ acquisitions announced this year.

Against this backdrop, we hope you find this material useful. Please do not hesitate to share your feedback with me or any of my colleagues at EY.



Prashant K. Singhal

EY Global Telecommunications Leader

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Foreword



Adrian Baschnonga

Lead Analyst

EY Global Telecommunications

abaschnonga@uk.ey.com

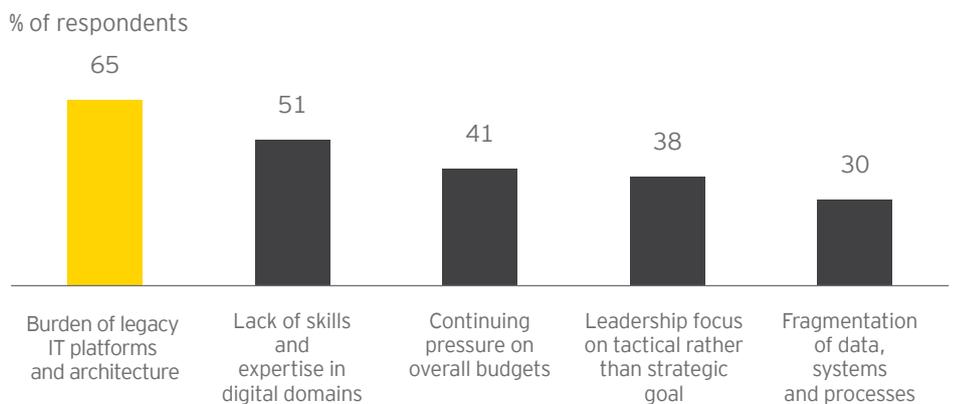
2017 was a generally encouraging year for the industry: initial indications suggest that global telecommunications revenue will have increased by 1% year-on-year, with capital expenditure easing over the same period.¹ However, many regions have been subject to headwinds, from the abolition of mobile roaming surcharges in Europe to ongoing price competition in India.

The effects of regulation and competition aside, there are other challenges that carriers must meet head on. In a recent EY survey of industry executives, *Digital transformation for 2020 and beyond*, digital business models and services rank highest as a strategic priority over the next three years, underlining the importance of new routes to data monetization if the industry is to capitalize on new growth opportunities across both consumer and enterprise segments.

The key question for operators is what it will take to develop these new business models. Our survey provides interesting findings in this regard – the burden of legacy IT and a lack of digital skills rank highest as barriers to transformation. At a time when many industry watchers are focused on the upcoming introduction of 5G, this is a reminder that an overhaul of people and processes is just as critical as a new round of infrastructure upgrades.

Figure 1: Operator views on barriers to transformation²

Question: what are the greatest barriers to your organization's digital transformation journey? (Please select three.)



In this edition of *Inside Telecommunications*, we also consider network virtualization initiatives, and how operators are faring in their multiyear migration to software-defined networks. While upgrades to low-power, wide-area networks, and in time 5G, will continue to drive the investment agenda, the injection of more software into the network and greater adoption of analytics allied to employee upskilling will do much to dictate the success of new business models.

Another key theme for the sector lies in the role of partnerships. As our research into content and smart home strategies shows, partnerships are playing an ever more important role as a route to value creation. The top 25 carriers by revenue worldwide struck nearly 100 strategic alliances in 2016 and had already surpassed that mark in the first nine months of 2017. Sensitizing partnerships to a fast-changing landscape of new use cases has never been more important.

¹"Telecom Revenue Growth Muted in 2017, IHS Markit Says," IHS Markit press release, 20 December 2017.

²*Digital transformation for 2020 and beyond: a global telecommunications study*, EYGM Limited, May 2017 (based on a survey of 39 telecom industry leaders worldwide).

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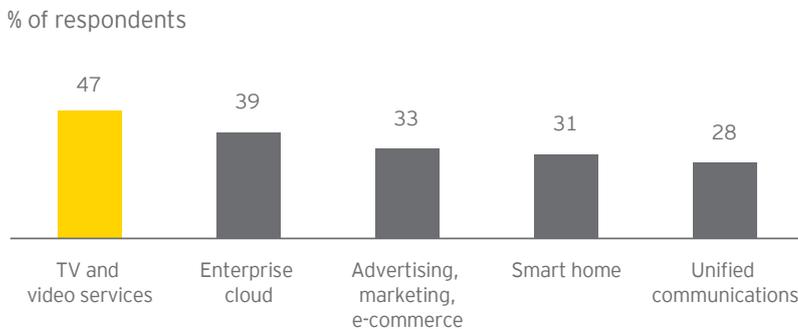
Service innovation

Operators overhaul TV and video packages as they move deeper into content

Telcos have long held ambitions to translate their heritage in connectivity into a winning position in a rapidly evolving content market. The ability to drive higher levels of loyalty through differentiated TV and video services is well-understood, and operators are now key players in pay-TV markets worldwide. Our most recent survey of telco industry executives shows that TV and video propositions are the most important new service domain for driving incremental revenue growth.

Figure 2: Leading digital services for operators³

Question: Which digital services represent the best opportunities for incremental revenue growth? (Please select three.)



This high level of confidence underlines how central TV propositions have been to building closer relationships with consumers and driving up higher levels of average revenue per user (ARPU). Yet this success breeds challenges of its own, from acquiring the premium content that supports higher-value services to overhauling packages to make the most of changing customer preferences.

User needs are increasingly shaped by over-the-top (OTT) providers that provide an intuitive and convenient experience, while viewing habits themselves are evolving in different directions as new forms of content consumption take hold. In this light, operators are under increasing pressure to adapt if they are to maintain their existing foothold.

New packages, new platforms

One key innovation in recent quarters has seen pay-TV providers overhaul their subscription models to provide more flexible packages. In the UK, Sky offers a contract-free bundle that allows users to choose different TV packages and combine them with broadband and phone packages on a rolling basis. In the Netherlands, satellite pay-TV newcomer Joyn is offering a low-cost mix of channels on a rolling monthly basis as part of a service aimed at those with second and holiday homes.

Carriers have also launched new streaming TV packages to cater for consumers' online watching preferences. AT&T's DirecTV Now service, launched in November 2016, provides access to cable channels without requiring a long-term commitment. Similar initiatives are apparent in the form of Dish Network's Sling TV and Sony's PlayStation Vue service.

Mobile-centric streaming services have also appeared, with the needs of younger users in mind. T-Mobile US' Bing On, launched two years ago, began the trend toward zero-rated video services delivered over cellular. In July, Three launched the UK's first zero-rated content package, offering a mix of TV channels as well as OTT video and music.

Integrated carriers are also using their mobile platforms to broaden addressable markets: AT&T's DirecTV Now service has been made available to AT&T mobile users who have certain packages, while UK-based BT has been providing subsidized BT Sport content on some of its mobile tariffs.

³ Digital transformation for 2020 and beyond: a global telecommunications study, EYGM Limited, May 2017 (findings based on survey of 39 telecom industry leaders worldwide).

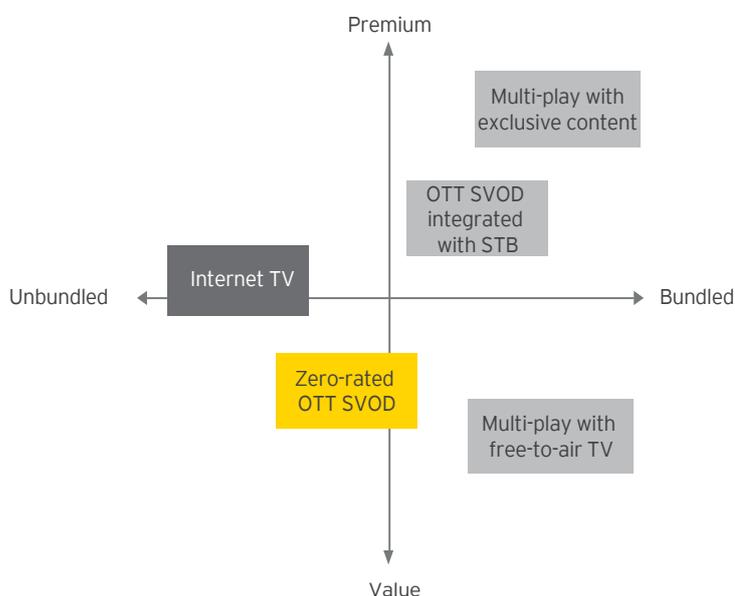


Telco-OTT partnerships on the rise

Meanwhile, alliances between network providers and paid online video services have increased dramatically in the last two years. On the network side, fixed and cable broadband providers are leveraging OTT services, often integrated with the set-top box or as part of a bundle offering, while mobile operators are also driving growth through partnerships. Asian telcos have been prominent in many deals struck over the last year, striking deals with a new breed of regional OTT providers such as iflix and Eros Now.

All told, this means that operator TV and video propositions are evolving in interrelated directions, with leading telcos widening their content propositions and distribution platforms, and adjusting pricing and packaging models in tandem. This has helped service providers achieve a number of aims, from increasing customer spend to boosting customer loyalty.

Figure 3: Operator TV and video strategies⁴



Anchor distribution platform:

■ Mobile ■ Internet ■ Fixed/cable/satellite broadband

Source: EY analysis

A broadening content investment agenda

The sheer range of packages, price points and distribution platforms – and the interplay between them – underlines how competitive the market has now become. This is reflected in escalating content investment costs. During the last 25 years, for example, the cost of broadcast rights for English Premier League soccer has risen thirtyfold as companies leverage live sports to win new subscribers and increase levels of loyalty.⁵

Competition between telcos and broadcasters for exclusive content rights has been rising in developed markets for many years and is increasingly apparent in emerging regions. In recent bidding for India cricket media rights, mobile operators emerged as front-runners. Meanwhile, exclusive sports content is moving firmly into focus for OTT video providers, too – in August, Amazon secured UK rights to show ATP World Tour tennis.

Beyond escalating competition for and spending on media rights, operators are also taking new steps into original content production itself. In July, Netherlands-based Altice acquired Portuguese Media Capital, which owns Portugal's largest content producer, Plural.⁶ In September, Deutsche Telekom announced the launch of in-house series *Germanized*, created in conjunction with partners Bavaria and TelFrance. Earlier this year, Endemol Netherlands supported a 10-part series for

⁴ SVOD refers to streaming video on demand; STB refers to set top box

⁵ "The Exploding Cost of Streaming Live Sports," Bloomberg, 11 November 2017.

⁶ "Altice Enters into an Agreement to Acquire Leading Portuguese Media Group Media Capital," Altice press release, 14 July 2017.

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Service innovation

Dutch telco KPN.

Navigating a more complex ecosystem

For operators, moving forward on multiple fronts demands a flexible strategy that can cater for a range of content investment positions, ecosystem relationships and customer propositions. Recent forays by telcos into original content asks questions of both existing content aggregation and resale endeavors, for example.

Looking ahead, partnerships require ongoing calibration. Marketing-centric alliances with OTT video providers are a good starting point for many, but greater value creation in the long term could lie in closer technical cooperation. Nevertheless, closer service integration could present risks – a poorly designed interface could actually undermine the customer experience instead of enhancing it.

In terms of technology as a whole, there is plenty to consider, both in terms of front-end and back-end improvements to support the customer experience and more efficient processes that can offset rising content acquisition and production costs.

Cloud DVRs will become more important as a differentiator in the internet TV space, while operating platforms will continue to benefit from injection with analytics and artificial intelligence capabilities. Closer cooperation with platform providers will also be key as pay-TV providers seek more modular technology stacks. Ensuring that technology gains feed into winning service propositions should be top of mind for operators as they refine their TV and video packages.

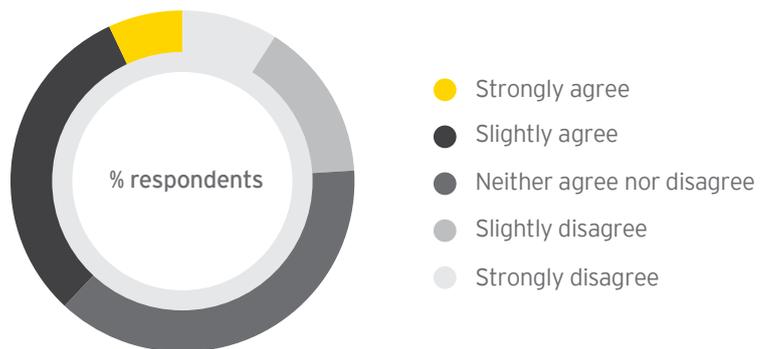
Virtual assistants reframe operator smart home strategies

Connected home services are becoming a more important element of strategies telcos are taking to diversify their residential offerings. The aim is clear: to build on the success of existing bundle propositions to gain further share of household spend. Confidence in the smart home opportunity is rising – in our survey of industry executives, 31% of respondents cited smart home services as a leading driver of incremental revenue growth, up from 17% in 2015.⁷

However, a number of service providers, from across the technology, media and entertainment, and telecommunications (TMT) industry and beyond, also have ambitions in the connected home. As the competitive landscape becomes more congested, AI assistants have emerged as a key route to forging closer connections with consumers. Their ability to simplify the user experience positions them as a central touch point for a range of home services. For their part, consumers are warming to the idea of a centralized ecosystem for in-home technology.

Figure 4: UK consumer attitudes to smart homes

Statement: It makes sense for all smart home devices to be controlled by a central ecosystem



Source: EY research (base: 2,500 UK broadband households)

⁷ Digital transformation for 2020 and beyond: a global telecommunications study, EYGM Limited, May 2017 (findings based on survey of 39 telecom industry leaders worldwide).

Operators are in the slipstream of innovation

AI-enabled smart speakers have been at the forefront of innovation in the home, with the likes of Amazon Echo and Google Home gaining popularity. Price points are on the way down, while AI assistance is now becoming a feature of TVs and tablets as well.

Leading technology players in the US and China continue to improve the functionality of their device assistants, whether in the form of interfaces, language support or hardware integration. Operators are keen to take advantage too.

In South Korea, SK Telecom's virtual assistant service, NUGU, leverages a Wi-Fi connected speaker and light. As of August 2017, a year after its launch, more than 150,000 units have been sold and an outdoor version of its AI speaker is also available.⁸ Earlier this year, KT Corp debuted an AI-based set-top box that provides a number of services, from TV and IoT appliance control to voice and video calls.

In Europe, Deutsche Telekom has integrated Amazon Echo and Echo Dot with its Qivicon smart home platform, enabling speaker control of the operator's Magenta range of services.⁹ Subsequently, the German carrier unveiled its own speaker-based home assistant. Meanwhile, Orange has launched Djingo, a virtual assistant that can be controlled by voice and text, which is set to launch in 2018. Key services enabled by the speaker include TV and IoT control.¹⁰

US-based Comcast also has virtual assistance as a feature of its Xfinity Home program. Through an app, users can control smart security products from Nest and August, with controlled lighting technology from Jasco and Sengled also available.¹¹

Build or partner – and prepare for new cases

Going forward, more telcos are likely to embrace virtual assistants as part of their smart home propositions. Partnerships will likely provide the principal route for many as operators look to capitalize on the appeal of established products from tech companies.

Some carriers may well strike a balance between internal development and new ecosystem relationships, but for players without an existing foothold in pay-TV or consumer IoT, tie-ups represent a speedy route into the connected home.

Yet all players should be wary of simply adding digital assistants to existing residential bundles. Providers with more complex bundles risk overwhelming customers instead of genuinely enhancing the appeal of their core services. Even proprietary approaches require time and investment at a time when the pace of innovation is only quickening.

In the years to come, operators should consider exactly where they can add value via virtual assistance. This may involve considering use cases based on motion and sound, rather than voice recognition per se. At the same time, we may see more fundamental shifts in assistance use cases themselves – health monitoring, for example, may take longer to mature but could represent a new frontier well beyond the home entertainment origins of current products.

⁸ "SK Telecom launches portable version of AI speaker," ZDNet, 18 August 2017.

⁹ "With Alexa, your home has a voice of its own," Deutsche Telekom press release, 15 February 2017.

¹⁰ "Djingo, your multi-service virtual assistant," Orange press release, 20 April 2017.

¹¹ "Comcast Makes It Easy for Customers to Manage Lighting Preferences Via Voice Commands," Comcast press release, 15 February 2017.

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Technology

Network virtualization begins to pick up pace

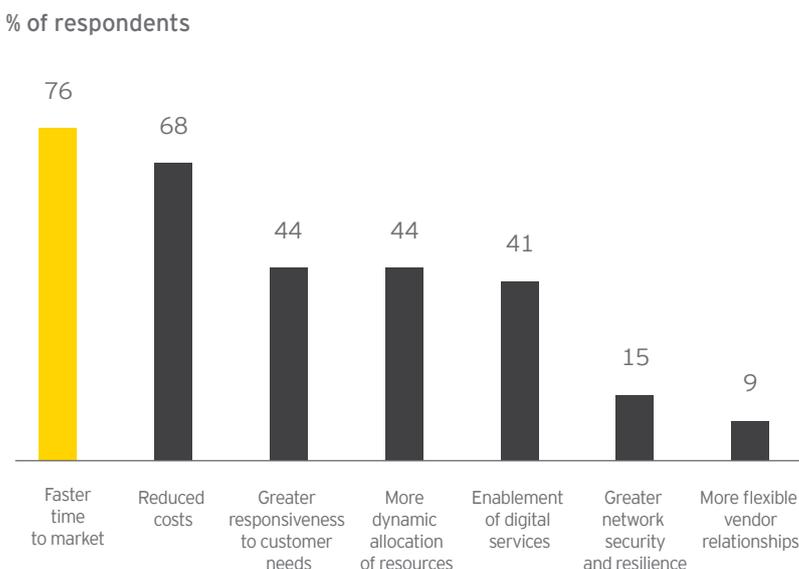
Virtualization of operator networks has been a significant theme for the telecommunications industry in recent years. Network functions virtualization and software-defined networks entered mainstream telco thinking four years ago, with a number of carrier announcements signaling the emergence of a new networking paradigm.

At the time, the rationale for moving to virtualized networks was clear: disruptive competition was on the rise and profitability was under pressure. The ability to decouple network functions and manage networks through software-based control promised more agile service creation at a lower cost, a compelling narrative for telcos.

These attributes remain very much intact. EY's recent survey of telecommunications leaders worldwide shows that executives believe virtualization can deliver a range of benefits, from lower costs to shortened product and service development timeframes.

Figure 5: Operator views on the impact of software-centric networks

Question: What will be the most significant impact of software-centric networks (e.g., network functions virtualization, or NFV) for your organization? (Please select three.)



Source: *Digital transformation for 2020 and beyond: a global telecommunications study*, EYGM Limited, May 2017 (survey based on interviews with 39 telecoms leaders worldwide).

Early adopters achieve incremental gains

Leading carriers are making steady progress as part of their multiyear migration to software-based networks. In 2014, AT&T revealed plans to control 75% of its network resources using virtualization technologies by 2020. By mid-2017, the US operator had virtualized 40% of its network functions and was on track to reach the 55% mark by the end of the year.¹²

Also in 2014, Telefónica announced plans to transform its network operations in Europe and Latin America as part of a project called Unica. Since then, the Spain-based carrier divided the project into two phases, with the second beginning last year. As things stand, virtualization of the core network is the priority ahead of the radio access network: the importance of an incremental approach here is clear.

Another European incumbent with network virtualization underway is Deutsche Telekom. Its Pan-Net project, designed to provide a decentralized platform serving customers from North to Southeastern Europe, has been in place in 2015. Since then, it has established a new company, Deutsche Telekom Pan-Net, s.r.o., to manage the process and has launched back-end data centers in Hungary and Poland, as well as a service operations center in Romania.¹³

Other carriers also have projects underway. Earlier this year, Telstra announced its Programmable Network initiative, designed to combine NFV and software-defined networking (SDN) capabilities, cloud platforms and data centers as one intelligent network platform.¹⁴ Meanwhile, Vodafone has had its group-wide Ocean project in place since 2015, initially deploying a software-defined wide area network (SD-WAN) to support higher bandwidth demand while also targeting end-to-end orchestration and centralization.¹⁵

¹² "The pan-European Network (Pan-Net)," Deutsche Telekom media release, 2017.

¹³ "Our vision for a new kind of network," Telstra Exchange, 15 May 2017.

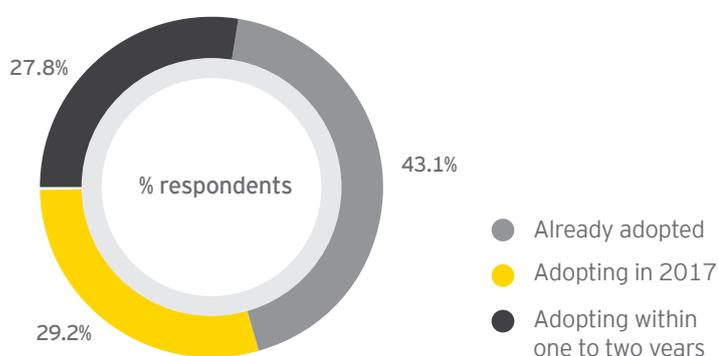
¹⁴ "Unlock the potential of networking," Vodafone's Gigabit Thinking blog.

¹⁵ "Bell Canada joins AT&T ECOMP collaboration targeting SDN," RCR Wireless News, 16 December 2016.



Figure 6: Tier-one operator adoption of NFV/SDN

% of operators



Source: Technology Business Research

Industry surveys suggest that nearly three-quarters of tier-one carriers will have begun their network virtualization journeys by the end of this year, and that all tier-one players will have made some headway by 2019.

Horizontal partnerships are coming into focus too. Last year, AT&T announced it would collaborate on open-source and standardization initiatives for software-defined networking, with Bell Canada subsequently joining this collaboration.¹⁶

Adapting to the deployment life cycle with the help of partners is essential

While the industry's shift to NFV and SDN is undeniable, operators are taking a circumspect approach to delivering on their multiyear visions. What is clear is that technology migration is but one factor informing success – complementary transformation of business processes, employee skills and culture are no less important.

Onboarding of virtual network functions can be problematic and poses additional challenges where several virtual functions are chained together to create a new series. The challenge for vendors is to provide more open interfaces to achieve a more consistent onboarding experience. This would do much to reassure carriers that large-scale deployments are feasible.

The alternative scenario would be that operators entrust single vendors with end-to-end deployment. This may go against the grain of the original vision for network functions virtualization, yet it is instructive to note that only 9% of telecommunications executives in our survey cite more flexible vendor relationships as a leading outcome of virtualization.

Increased vertical collaboration also has a key role to play. Cloud connectivity is now a vital piece of the jigsaw puzzle, with the potential to allow much faster service creation. To this end, carriers are striking partnerships with the likes of Amazon Web Services. Yet the overarching need for a cloud-based model requires new internal skill sets as well.

Ultimately, patience is essential. Early introductions of NFV have supported the creation of new services, but the injection of virtual functions into more traditional services will be necessarily more complex.

As hybrid networks that have some combination of physical and virtual networks become the norm, new analytics and AI capabilities will aid network management. For this to happen, service providers should take a holistic view of software-based networks and their relationship with other digital transformation initiatives.

NB-IoT networks move sharply into focus

Network migration strategies continue to evolve at pace. Large-scale 4G rollouts are complete, but many operators already have plans to conduct trials of pre-5G solutions. At the same time, policymakers are revisiting their assumptions around fiber network capabilities, with gigabit society plans implying a further round of fiber network upgrades.

Yet the push for higher network speeds masks an increasingly variegated picture of network road maps. Our survey of industry executives reveals that operators have a number of network technologies in their sights.

While 5G is positioned as the prime catalyst for Internet of Things (IoT) capabilities, the role of low-power, IoT networks will be just as important: they rank second to 5G networks in terms of perceived impact over the next five years.

¹⁶ "Bell Canada joins AT&T ECOMP collaboration targeting SDN," RCR Wireless News, 16 December 2016.

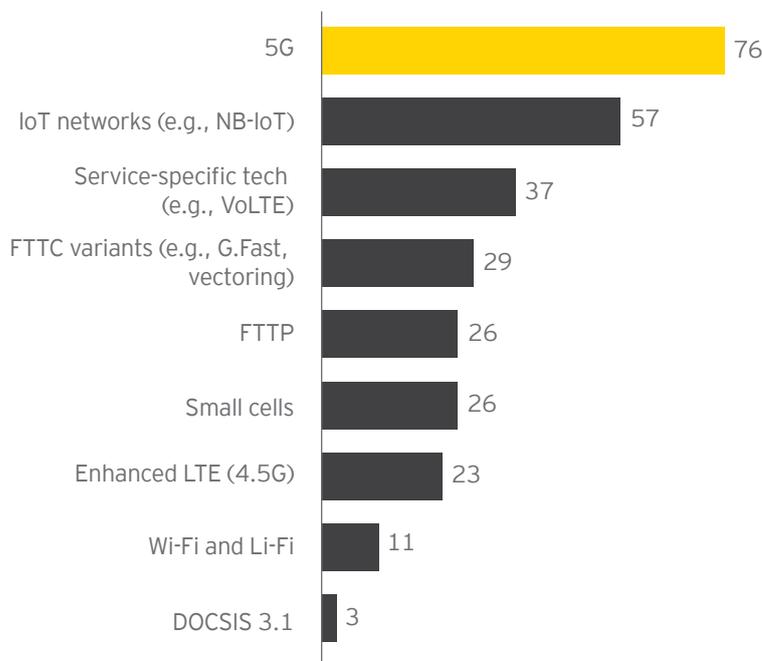
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Technology

Figure 7: Operator views on future impact of network access technologies

Question: Which network access technologies will have the greatest industry impact over the next five years? (Please select three.)

% of respondents



Source: *Digital transformation for 2020 and beyond: a global telecommunications study*, EYGM Limited, May 2017 (survey based on interviews with 39 telecoms leaders worldwide).

NB-IoT is rapidly gaining traction

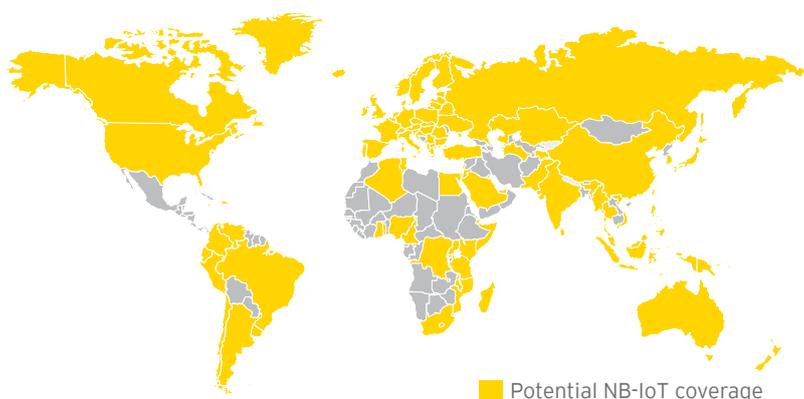
All types of low-power, wide-area (LPWA) networks share similar characteristics in the form of low cost, low battery consumption and wide area coverage, which positions them well to serve IoT use cases based on long-term monitoring requirements, where data traffic is low-volume and sporadic, yet large volumes of devices with long lifetimes are needed.

A range of technologies now exists, from Sigfox and LoRa that operate in unlicensed spectrum to 3GPP-standardized technologies, including EC-GSM-IoT and NB-IoT. The advantage of NB-IoT lies in its ability to provide low-cost machine-type communication across coverage areas that mimic existing 4G LTE networks. Their standardized status also positions them well to serve IoT use cases where regulation is important.

While the first LPWA networks in unlicensed bands launched five years ago, NB-IoT was only fully standardized last year. Since then, operators have warmed to its potential – there were more than 50 announcements of NB-IoT investments in 2016, more than any other LPWA technology.

The first commercial NB-IoT networks went live in Germany, the Netherlands and Spain in 2017, and broad support from the operator community positions it well to appear across all regions. The Groupe Spéciale Mobile Association (GSMA) NB-IoT Forum now counts 36 major operators among its members, with potential rollout extending to all regions worldwide.

Figure 8: Potential NB-IoT network coverage worldwide



Source: GSMA NB-IoT Forum

Looking ahead, pricing models for LPWA use cases, including NB-IoT, will reflect the low cost credentials of this new breed of infrastructure. Simple pricing plans positioned as much for small business customers as for larger corporates will come to the fore, with substantial potential for connectivity to be built into a managed service offering that delivers a specified level of service and business outcome to the customer.

While average revenue per device will look very low, compared with the traditional world of consumer mobile, the opportunity to grow endpoints is extensive, positioning NB-IoT and similar technologies to deliver attractive average revenue per kilobyte without a “saturation ceiling” coming into play.

Operators target flexible technology positions

While the merits of NB-IoT are clear – it can act as an overlay to existing LTE networks and take advantage of a strong supplier ecosystem – operator strategies regarding low-power networks are multifaceted. Many are investing in more than one LPWA technology, a signal enough that there is no single technology solution to cover the fast-changing world of LPWA network use cases.

Indeed, the likes of Telefónica, SK Telecom and NTT DoCoMo are investors in Sigfox, whose business model is based on licensing a single partner per country and where city-based rollouts underline a shift away from the traditional economics of national coverage. Meanwhile, a range of other companies, from energy companies to broadcast infrastructure owners, are also sizing up gains in the world of low-power IoT.

In the wider competitive ecosystem emerging around nascent use cases, it makes sense for many players to pursue a range of options. Another 3GPP standard, LTE-M, is also gaining support from US and European service providers. Going forward, the mix of low-power technologies used by operators may yet widen rather than contract.



3

Regulation

Regulators mull new frequency bands for 5G

5G services are top of mind across the industry, with operators, vendors and policymakers keen to tap the vast potential presented by the next iteration of mobile technology. A number of operators have announced trials against a backdrop of ongoing standardization initiatives, while governments are devising digital policies to take advantage of 5G's potential as a productivity driver.

However, the first commercial 5G services are not expected until 2020. Infrastructure and device capability aside, new spectrum will be required to support the range of services made available by 5G, from enhanced mobile broadband to autonomous driving and connected logistics.

More spectrum across more bands

An unprecedented range of frequency bands will be needed. 5G technology can operate above 6GHz, enabling a step-change in capacity. Yet if these new networks are to punch their weight in terms of nationwide coverage, low-band spectrum with long-range signal propagation is just as essential.

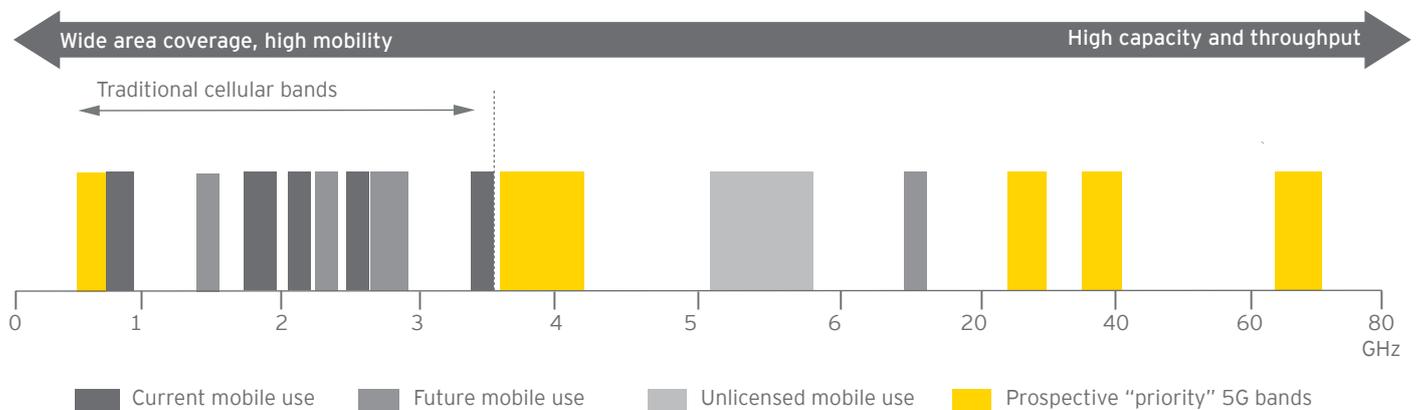
Ultimate selection of spectrum bands for 5G lies with the World Radiocommunication Conference, which will decide upon relevant bands in 2019. However, a number of bands are already in play on the back of previous decisions, and regulators are considering how existing spectrum frameworks can be adapted for 5G.

Given the unavoidable gap between spectrum planning at the national level and spectrum authorization at the regional and global level, potential for some measure of fragmentation exists, as was the case with 4G. Nevertheless, regulators are now taking a more inclusive approach to spectrum planning with 5G in mind.

Key frequencies in focus include low-frequency bands at 700MHz, mid-frequency bands at 3.4GHz to 3.8GHz – with consideration of additional "C-band" spectrum up to 4.2GHz – and a number of so-called "pioneer" bands at 24GHz and above.

Various countries have taken steps to include 5G in their spectrum release agenda. The US has been an early leader in spectrum planning, with plans to invest US\$400m over seven years in developing 5G technology. Accordingly, it will free up spectrum in the 28GHz, 37GHz to 40GHz, and 64GHz to 71GHz bands for 5G.

Figure 9: Current and future mobile spectrum bands worldwide



Source: EY analysis



In the longer term, the Federal Communications Commission (FCC) is also considering additional bands at 50 GHz and above 71 GHz, and operators also view 600 MHz spectrum auctioned in 2016 as part of their 5G plans. Canada has launched a consultation into high-frequency bands at 28 GHz and above.

The European Union (EU) has also identified a number of bands: low-bandwidth spectrum at 700 MHz, 3.4GHz to 3.8GHz, and the 26GHz “pioneer” band for ultra-dense, high-capacity networks. A common approach across Member States is vital to support cross-border 5G use cases such as autonomous driving. At the same time, the EU has struck research partnerships with China, South Korea and Japan, which include collaboration on spectrum planning.

China has had an IMT-2020 Promotion Group in place since 2013, with 5G development and overseas cooperation among its stated aims. More recently, the Government has been assessing spectrum bands and is working to liberalize the 700MHz and 3.4GHz to 3.6GHz bands.

Mid- and low-frequency bands in focus

This year has seen regulators advance new plans regarding mid-frequency spectrum, ranging from 3.4GHz to 4.2GHz. These bands have advantages in that they are widely available and can deliver higher bandwidth than lower frequencies. This positions them well to serve a number of new use cases, from virtual reality (VR) to the industrial Internet of Things.

Some European countries have auctioned or plan to auction 3.4GHz to 3.8GHz frequencies, including France, Hungary, Portugal, Spain and the UK. Elsewhere, operators in Australia, China and the US are conducting trials of new services with the support of equipment vendors in the 3.5GHz band.

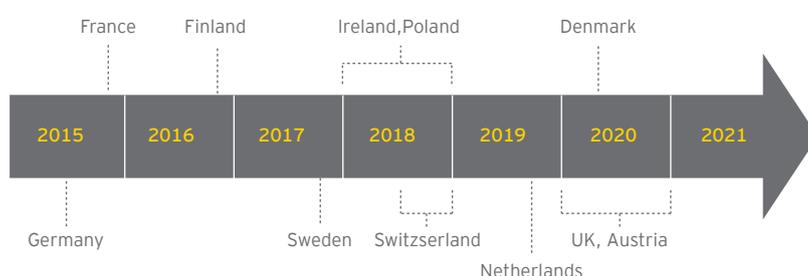
Some regulators are also mulling use of 3.7GHz to 4.2GHz for 5G, although so-called “C-band” spectrum is already used by governments and the satellite industry, and would require a change in use or some measure of sharing.

The 1.4GHz band would also be suitable for 5G services and could serve as an interim solution for early rollouts until other bands become available. While some European countries are freeing up this band – supported by a European Commission (EC) decision to align it for mobile use – no networks have been deployed as yet. The relatively small portion of spectrum available may hinder its appeal as a frequency for 5G.

One band that presents both opportunities and challenges is 700MHz. It has long been in the sights of policymakers because of its suitability for national coverage, having been identified by the International Telecommunication Union (ITU) for use in the Americas and Asia-Pacific since 2007. More recently, it has been repurposed for mobile in Europe and Africa, although efforts to clear it of legacy broadcasting use are ongoing.

The EC has tasked Member States with reassigning the band by 2020, with national road maps in place by 2018. However, auction timelines vary considerably across the EU, and some markets may not meet proposed deadlines. While a deadline extension is an option, the potential for discrepancies underlines the difficulty of delivering a coordinated approach.

Figure 10: 700MHz auction timeline in selected European countries



Source: EY analysis

3

Regulation

Challenges relating to the allocation and auction of 700MHz spectrum are not confined to Europe. South Korean regulator KCC has targeted low-frequency spectrum to support the 5G rollout for the 2018 Winter Olympics Games. Yet high auction pricing meant that frequencies remained unsold, a situation that echoed India's 2016 700MHz auction, where high reserve prices dampened operator interest.

The way forward: a holistic approach to spectrum management

Regulators face a number of considerations as they isolate airwaves for 5G deployments. Adapting existing spectrum release frameworks to cater for 5G services should be top of mind. This is apparent in the 3.5GHz band, where regulators in the US and Australia are planning to alter licensing regimes with respect to license periods, while also considering spectrum sharing and license-exempt use.

This kind of approach will help provide operators with greater certainty around their investments. Meanwhile, spectrum policies and rules must be sensitive to an ever-wider ecosystem of users, both within and beyond the mobile industry.

Ultimately, the sheer range of frequencies envisaged for 5G may require a less linear approach to spectrum release. Striking a balance between the simultaneous auction of multiple bands and phased spectrum release of key frequencies will be important. In time, there will also be opportunities to refarm 2G spectrum for 5G.

Beyond deliberations and decisions about spectrum, there are other issues to contend with if migration to 5G is to succeed. For one, operator demand for fiber backhaul is likely to rise substantially in a 5G world. Ensuring that wider regulatory frameworks can cater for a new cycle of fiber demand from mobile operators may prove just as important as ensuring enough spectrum comes to market.

Operators prepare for a new era of EU data protection and privacy

Overhaul of the EU's data protection framework has been a long time in the offing. Back in 2012, the European Commission proposed a far-reaching reform of the EU's 1995 data privacy rules in order to strengthen citizens' digital rights.

At a time when consumers are ever more concerned about their digital footprint and the integrity of their personal data, the EU's ambition was to create a unified framework – without the need for accompanying national laws – to ensure that companies are more transparent about the type of data they collect on individuals, how that data is retained or used, and when personal information is exposed in a breach.

In April last year, the European Parliament voted to approve the General Data Protection Regulation (GDPR), slating its introduction for May 2018. Companies that violate the new data protection rules may risk fines of up to €20m or 4% of global annual revenue, depending on whichever is higher. Data protection officers must also be in place for organizations that process a large amount of sensitive, personal data.

The move toward a new data protection environment is also prompting legislative reform in related areas, such as data privacy. Earlier this year, the EU proposed an update of existing ePrivacy rules (ePR) to create greater consistency in the treatment of technology and telecoms providers; strengthen rules regarding metadata, cookies and consent; and open up new business opportunities for companies that handle data.

Operators weigh up changing regulatory imperatives

Levels of regulatory certainty remain a cause for concern in the telecoms industry. In a joint statement, GSMA and the European Telecommunications Network Operators' Association (ETNO) have recommended modifying the ePR to provide operators with greater flexibility to use data responsibly, highlighting areas where further alignment with GDPR is necessary and stressing the need to avoid an overreliance on consent.¹⁷

¹⁷ "The Proposed European ePrivacy Regulation," GSMA and ETNO Joint Position, June 2017.

Operators remain circumspect on the challenges and opportunities that result from upcoming data protection reform. A recent survey from Varonis Systems reveals that immediate impacts in terms of costs and complexity are top of mind among executives in the telecoms industry.¹⁸

TMT companies are keen to highlight that GDPR itself does not reduce cybersecurity risks – an important consideration given high-profile data breaches in recent years. There is also noticeable concern that data protection reform may harm the very innovation it is designed to encourage.

Figure 11: Operator views of business challenges resulting from EU GDPR

Question: What do you anticipate will be the business drawbacks to your organization from EU GDPR?

% of respondents



Source: Varonis Systems, Inc. (survey of 500 IT decision-makers in France, Germany, the United Kingdom and the United States)

Building a long-term blueprint for trust

Recent reactions to the ePR proposal highlight how regulatory ambitions are fundamentally challenging, because they aim to protect end users while encouraging product innovation. Creating new services is often an experimental process, yet trust is a vital ingredient of enduring customer relationships.

Going forward, operators should pay heed to both the operational and strategic implications of GDPR and ePR. This is vital given that consumers have historically shown lower levels of trust in TMT companies, compared with other industries.

The ability to differentiate service propositions based on consent-based attributes is only becoming more important. Better communications with customers can help ensure that new routes to create value through data – through analytics and machine learning – do not undermine levels of trust.

Depersonalizing information assets and building flexibility into new business models will be essential. This will only become more important as the Internet of Things spurs the development of more partner-centric industry ecosystems that cater for a range of data-led use cases.

On a practical level, the new data protection landscape places much more emphasis on transparency and accountability. In this light, the ability to demonstrate the rationale and processes underpinning compliant data management practices – on a recurring basis – should also be top of mind.

Effective data collection and management should figure at the heart of existing transformation programs that center on the overhaul of legacy technology, systems and processes. Many carriers have created new leadership positions to enhance data management and protection. How these roles interrelate with other parts of the organization will require ongoing calibration.

Proactive, engaged and consultative organizations are best placed to thrive under the new regulatory framework. For this to happen, better dialogue with customers, stakeholders and industry peers will all play a vital role.

18 "One Year Out: Views on GDPR," Varonis Systems, May 2017

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M&A

Introduction

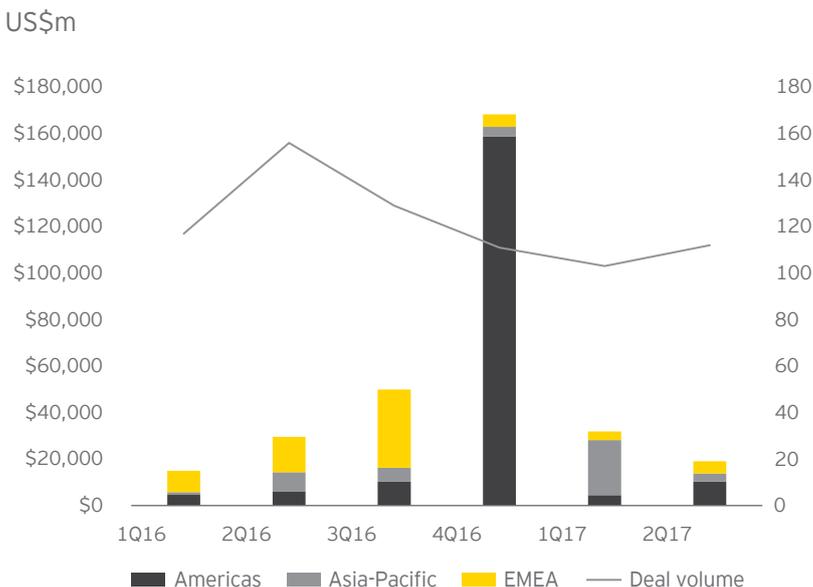
Global telecom M&A activity in the first half of 2017 remained subdued with 215 deals, compared with 273 deals in the first half of 2016 and 240 deals in the second half of 2016. The decline can be seen as a result of macroeconomic pressures and regulatory uncertainty in some markets, coupled with tightened regulations in China on outbound deals.

Total deal value improved to US\$50.1b, compared with US\$44.7b over the same period last year. In-border deals continue to dominate global M&A activity, driven by both consolidation and operator efforts to add adjacent capabilities within existing markets.

Western Europe was at the forefront of dealmaking during the first half of 2017. As a target region, it accounted for 39% of the total deals, followed by the North America region with 25% of the deals, the majority of which were announced in the US. The UK and the Netherlands were the leading target countries for M&A in the Western Europe region, with 18 and 12 deals, respectively. Example deals include:

- ▶ Three UK's acquisition of UK Broadband to increase its presence in the market, specifically by growing spectrum capacity.¹⁹
- ▶ Netherland-based KPN's purchase of DearBytes – a cybersecurity company, in a move to strengthen its security services to business customers.²⁰

Figure 12: Global telecommunications M&A deal value and volume



Source: S&P Capital IQ

Private equity target infrastructure assets

Private equity (PE) players are making greater inroads into the telecoms sector, targeting infrastructure assets. As a result, private equity firms, investment funds and individual investors were involved in 5 of the top 20 deals in the first half of 2017. An EY survey of industry executives suggests that 20% of operators see private equity driving increased competition for assets.²¹

In May 2017, RCN Telecom – backed by TPG Capital – acquired Wave Broadband, a gigabit fiber and broadband services company. US-based Wave had announced more than 1,000 fiber construction projects underway as of September 2016. Following completion of the US\$2.36m deal, RCN plans to combine Wave with RCN and Grande Communications Networks to create the sixth largest cable operator in the US and a leading service provider in next-generation, high-speed data services.²²

European investment firm EQT Partners made two significant deals in 2017. In February, it announced the acquisition of Lumos Networks, a US-based fiber optic network company. The US\$950m deal gives EQT a foothold in the US. In June, EQT made an offer to acquire DGC One, a Swedish internet service provider. EQT sees significant cooperation opportunities between DGC and EQT's majority-owned fiber-based communication provider IP-Only.

In February, Telefónica agreed to sell up to 40% of its towers and masts company Telxius to KKR for US\$1.36b. Telxius owns and operates a large portfolio of 16,000 telecom towers in five countries as well as an international network of 65,000km of submarine fiber optic cables.²⁴ In September last year, Telefónica also initiated a listing process of Telxius, which it later canceled, citing weak investor demand.

¹⁹ "Three UK reaches agreement to acquire UK Broadband Limited," Three UK press release, 2017.

²⁰ "KPN acquires cyber security company DearBytes," KPN Corporate, 5 January 2017.

²¹ *Global Capital Confidence Barometer*, 17th edition, EYGM Limited, December 2017.



In May, Deutsche Telekom Capital Partners and Swiss Life Asset Managers in consortium with tower company Cellnex Telecom announced a deal to acquire full ownership of Sunrise Communications. Sunrise Communications through its subsidiary Swiss Towers owns and operates 2,239 sites in Switzerland.

In April, Swedish investment company Kinnevik, the largest shareholder in Tele2, acquired an 18.5% stake in local cable and telecoms company Com Hem. The acquirer expects the US\$420m deal to complement its existing mobile and media holdings.²⁵

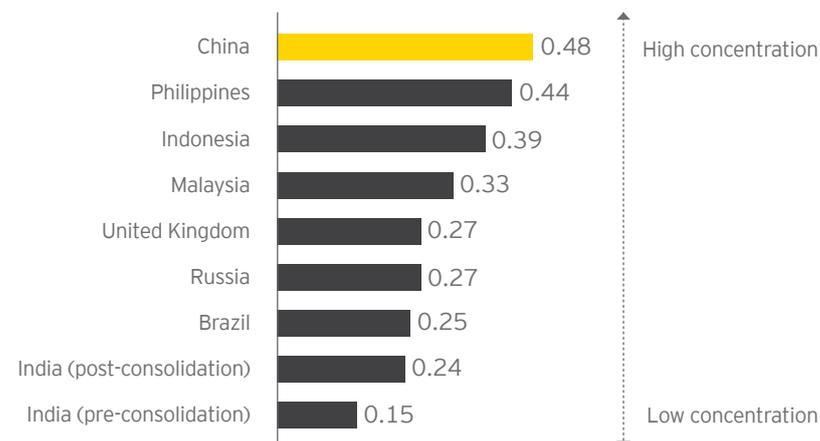
Mobile consolidation underway in India

The Indian mobile market is highly fragmented, with the Herfindahl-Hirschman Index (HHI) – a measure of market concentration – reflecting a historically congested sector in which 7 of the 11 telecom players have less than 10% subscriber market share.

However, mobile operator M&A announced this year is set to bring India further into line with other countries in terms of market concentration. Following the completion of two consolidation deals, the HHI for India is expected to rise from 0.15 to 0.24 via a seven-player market. Even so, India will remain below the other countries in the BRIC group – Brazil, Russia and China – in market concentration terms.

Figure 13: Market concentration comparison in selected mobile markets

Herfindahl-Hirschman Index (HHI)



Source: EY analysis

In March, Idea Cellular and Vodafone India agreed to merge their businesses in a US\$23b deal, the largest in the sector during the first half of 2017. According to the proposed deal structure, Vodafone will own a 45.1% stake in the merged entity, while Idea's parent Aditya Birla Group will have 26% shareholding after paying US\$579m in cash for a 4.9% stake. The remaining 28.9% will be held by public shareholders.²⁶

The combined entity with its scale and synergies will create a new market leader, with more than 400 million subscribers and 41% revenue market share. The merged entity expects to extract US\$10b worth of synergies benefits in net present value terms and an estimated US\$2.1b of savings by the fourth year of deal completion.²⁷ The merger comes at a time when the Indian mobile market has been heavily disrupted by the arrival of Reliance Jio Infocomm and its free voice and data offers.

Bharti Airtel has also been active this year, seeking consolidation opportunities of its own. In February, Airtel announced plans to take ownership of Telenor India, which would give the company additional spectrum of 43.4MHz in 1,800MHz band – strengthening its footprint in the country as well as eliminating a smaller rival.

In March, Bharti Airtel acquired the 4G business of Tikona Digital Networks, including its broadband wireless access spectrum and 350 cellular sites in five telecom circles. The deal will primarily help Airtel to strengthen its 4G portfolio in these circles. The Indian mobile operator is also ramping up its exposure to adjacent markets, having acquired Seynse, a FinTech start-up, in February.

22 "RCN, Grande and Wave Broadband Join Forces," RCN press release, 22 May 2017.

23 "EQT offer values Swedish telco DGC One at 2.3 bln SEK," Reuters, 7 June 2017.

24 "Telefónica agrees the sale of up to 40% of Telxius to KKR for 1,275 million euros," Telefónica press release, 20 February 2017.

25 "Kinnevik acquires 18.5% in Com Hem," Kinnevik press release, 27 April 2017.

26 "Merger of Vodafone India and Idea: creating the largest telecoms operator in India," Vodafone press release, 20 March 2017.

27 "Merger of Vodafone India and Idea: creating the largest telecoms operator in India," Vodafone press release, 20 March 2017.

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M&A

North American telcos seek more spectrum

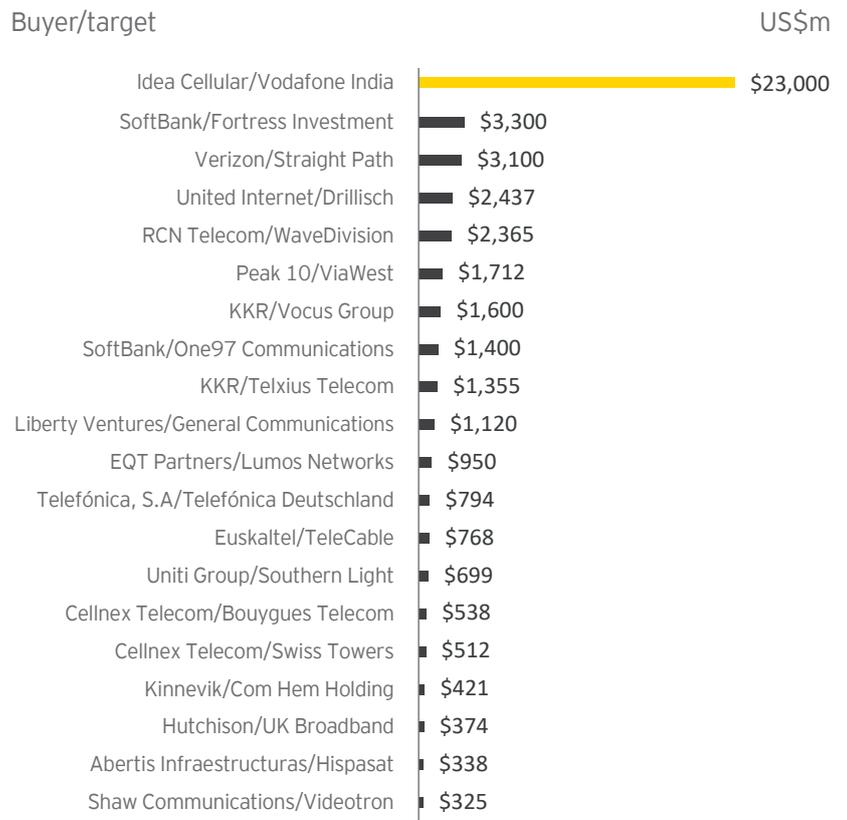
The North American market witnessed two major spectrum deals in the second quarter of 2017. In May, Verizon acquired Straight Path Communications for US\$3.1b. Straight Path is one of the largest holders of millimeter wave spectrum. It holds valuable spectrum in the high-frequency bands of 28GHz and 39AMHz, aiding Verizon's 5G deployment plans.²⁸

Meanwhile, the Federal Communications Commission (FCC) held a 600MHz incentive spectrum auction in April. T-Mobile US spent US\$8b to acquire low-band spectrum, while Dish Network and its bidding partners spent US\$6.2b. Comcast was the third-largest bidder, acquiring 73 licenses for US\$1.7b.²⁹

In Canada, Shaw Communications acquired 700MHz and 2,500MHz spectrum in seven regional markets from Vidéotron's parent Quebecor Media. The deal allows Shaw to improve its wireless experience and offer converged network solutions.³⁰ The asset sale will enable Videotron to continue investing in its 4G network and the rollout of its 5G network and to upgrade its Internet Protocol wireline network.

At the same time, Shaw announced it had sold its cloud business ViaWest Inc. for US\$1.7b to US-based Peak 10, Inc., and expects US\$740m in cash proceeds, more than covering the cost of the spectrum purchase.

Figure 14: Top 20 announced telecommunications M&A worldwide, 1H2017



Source: S&P Capital IQ

²⁸ "Verizon to acquire Straight Path spectrum to accelerate 5G deployment," Verizon press release, 11 May 2017.

²⁹ "Top 10 bidders in the FCC's 600 MHz forward incentive auction," RCR Wireless, 14 April 2017.

³⁰ "Shaw Communications Inc. announces acquisition of 700 MHz and 2500 MHz wireless spectrum licences from Quebecor Media Inc.," Shaw press release, 13 June 2017.



Contacts

Prashant Singhal

EY Global Telecommunications Leader

prashant.singhal@in.ey.com

Holger Forst

EY Global Telecommunications Assurance Leader

holger.forst@de.ey.com

Axel Majert

EY Global Telecommunications Transaction Advisory
Services Leader

axel.majert@es.ey.com

Amit Sachdeva

EY Global Telecommunications Advisory Leader

amit.sachdeva@in.ey.com

Bart van Droogenbroek

EY Global Telecommunications Tax Leader

bart.van.droogenbroek@lu.ey.com

Adrian Baschnonga

EY Global Telecommunications Lead Analyst

adrian.baschnonga@uk.ey.com

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