MOBILE
EUROPE

Special promotion:

EXFO

Transforming network performance for a 5G world

Contents

Editor's Picks

Features

Full Spectrum

06

10

31

Welcome

Sports show the way for 5G ahead of Barcelona bonanza

There is only one thing on the mind of the telecoms industry in the New Year and that is the annual sojourn to Barcelona and Mobile World Congress. Despite its last week in February date being set in stone, the event is beginning to creep ever earlier, with countless pre-briefings, on top of the showcases and press events in Spain. There is clearly too much news at present.

No wonder, given the march to 5G is louder and louder. With countless breakthroughs and "firsts", from connected cars to automated factories, robotics to logistics, it will be a challenge to sift through the sheer volume of announcements. We take a look at two of the much vaunted use cases for 5G, virtual and augmented reality, this issue and explore just how much operators can take advantage of it.

Barcelona won't be the only venue for 5G trials this year. By the time this issue is published, the Winter Olympics in South Korea will be underway. Already a market that pushes the envelope with what connectivity can do, Korean telcos will use the event for yet more set-piece demonstrations.

Then there's Russia and this summer's football World Cup. I spoke to MTS's Chief Technology Officer Andrei Ushatsky this issue for our show-piece interview and he says an operator's challenge is twofold for such an event – the first is ensuring the current network is fit for purpose and can cope with the strain; the second is taking advantage of it for demonstrations of new kinds of technology.

We also publish the results of our annual reader survey, which shows operators are optimistic, but not complacent, about the work it has done to date over 5G. Interestingly though, respondents identified 5G New Radio as the most overhyped technology. Down to announcement fatigue, I'm sure.

We also take a look at how operators are using network testing as another string to their bow. Just who can we trust amid the increasing number of internal and external testing companies? Do their claims even matter anymore?

Light-hearted cynicism above aside, I am very much looking forward to Congress this year. It's always fascinating to meet technology specialists from across the industry and talk the future of telecoms. I'm excited to hear just how true MWC's slogan of "Creating a better future" will be.

Enjoy the issue,
Graeme Neill

Creating a Better Future

GSMA MOBILE WORLD CONGRESS™

BARCELONA 26 FEB-1 MAR 2018

#MWC18

Mobile now connects more than two-thirds of the world's population.

It fuels innovation and revolutionises industries; creating exciting opportunities in communities around the world while providing lifelines of hope and reducing inequality.

Join us in Barcelona for MWC 2018 to discover how mobile is Creating a Better Future... Today.

AN EVENT OF
MOBILE WORLD CAPITAL™ BARCELONA

WWW.MOBILEWORLDCONGRESS.COM

MTS CTO:
sharing is caring ahead of World Cup celebration

As CTO in one of Europe's standout markets, **Andrei Ushatsky** has deployment challenges a-plenty in a complex country and with a World Cup looming. He talks to **Graeme Neill**

W ith more than 10.5 million people celebrating in Moscow for 2018's week long New Year celebrations, you can tell Russians take this holiday seriously. It's a serious business for Russian operators too. Within its Moscow region, housing some five million subscribers, MTS's mobile data traffic was an astonishing 45,000GB during the first hour of 2018 alone, 2.3 times that of the previous year's first 60 minutes. To put it another way, you could have streamed a 4K video from January through to November by using the same amount of data.

Telecoms has been following the habits of New Year revellers for some time by simultaneously reflecting upon its past and looking ahead to the future. Depending on which part of the business you speak to, telecoms executives will either enthuse about the upcoming opportunities or fret whether they can adapt quickly enough to what lies ahead.

Andrei Ushatsky is the man MTS has tasked with bridging the old and new worlds. An MTS lifer, he joined more than 20 years ago as an engineer, working his way up through the company via Director of Operations and Maintenance and CTO of MTS Russia before becoming CTO and CIO of the Group. He is succinct when asked about the challenges MTS, and fellow operators, face within Russia. "It's explosive growth of traffic, ever growing expectations and demands for speed and quality for that transmission," he says.

That may be so but Russia is an outlier in the European telecoms market. On one hand, this summer's football World Cup has provided a neat platform for 5G investment and demonstrations that has operators in other European markets envious. On the other, Russia amounts to one of the most complex markets in telecoms, stretching across 11 time zones and more than 17 million square kilometres. No easy task and one that requires an approach different to that of other markets.

Namely network sharing. MTS's own LTE network covers about 50 percent of Russia's population of roughly 144 million – potential customer numbers most operators would kill for, but one that underlines how much of a challenge building a network is. Ushatsky notes, with textbook understatement, that Russia is a "tough" market that requires new kinds of thinking. He says: "The most important thing is to choose the right strategy for network and IT... We have the same trends for traffic growth, data speeds and latency but there can be some limitations in investment."

The bulk of MTS's network sharing is with VEON, and launched in 2014. Work is ongoing at jointly building out LTE across 41 regions in Russia, covering some 50 million people. The agreement not only includes the sharing of core network and sites, but also combining both operators' spectrum in the 2.6GHz band. Ushatsky says: "This allows us to not only economise on our spending, but build out more efficiently with the larger spectrum band." A deal with MegaFon is a more basic partnership, he adds, covering infrastructure sharing across towers, fibre optic networks, as well as a network sharing agreement in Moscow's subway.

Ushatsky accepts these projects are not without their downsides, with "parity in quality" between those sharing potentially a drag on financial performance, especially in a market with as low ARPU as Russia's – MTS's sits at around €4, which he says reflects the high churn of SIM-only deals. Nevertheless, it's a competitive market, with Moscow government figures suggesting 1GB of data costs around a third of what it does in Barcelona or London.

He admits that success is more a question of pricing and services offered in those areas it shares with VEON. "There's a SLA with our partner for the quality KPIs," he says. "In those regions we can say we have the same quality. But of course we have the possibility to build additional individual sites. If one operator wants to have bigger coverage, it's possible." However, he is quick to add that MegaFon is MTS's main competitor in Russia, not VEON.

Moscow's subway network aside, there are few places where these companies play nice and he is keen to note that while the network sharing project with VEON covers roughly half of Russia's population, it goes nowhere near large-scale deployments in major population centres like Moscow or St Petersburg. And network sharing is not the only answer to the coverage problem. MTS boosted its capabilities in the Urals region of western Russia by buying regional telco Bashkortostan Cellular Communication.

Pitch perfect

Russia's mobile networks are set to be strained like never before at this summer's World Cup, as more than three million fans are set to attend matches and five million to visit designated fan zones as they seek to catch a glimpse of Neymar, Ronaldo or Ozil in action.

MTS and its rivals had been given a glimpse of what to expect during the 2014 Winter Olympics in Sochi; dense mobile activity but ones with spikes as crowds react to what they are watching. Ushatsky is perhaps more aligned to the Winter Olympics than the World Cup – he plays ice hockey in his spare time – and he notes Sochi caused as much as a four times spike in the number of roamers onto its network.

But he adds that the World Cup is six weeks longer, across 12 cities, and will attract much higher crowds. He says: "The stadiums, in which the matches will be played, are active stadiums that often hold tens of thousands of fans, but we don't feel that we are not prepared to handle the traffic." The operator will largely use distributed antenna systems to meet demand.

He adds: "However, it is the World Cup, so we are expanding our LTE network in general, preparing it for increased loads, optimising the availability and quality of services at sites that will be used during the World Cup – sports facilities, fan zones, airports and railway stations, hotels, cultural and historical zones, etc.

"At many facilities where access is more difficult, such as stadiums or airports, we are working in partnership with other operators, based on sharing infrastructure cooperation. In preparing the network, we provide support for all GSM technologies used today."

Then there's 5G. For some years, Russian operators have been talking up the competition as a launchpad for next generation technology. MTS has been working with Ericsson since 2015 on demos and is also partnering with Nokia. Ushatsky is coy about what fans can expect from the World Cup, casually throwing robots, virtual reality and connected cars into the mix. When pressed on the specifics, he declines to comment further. The race to be first is one powered by secrets, it seems.

What events such as a World Cup or Olympic Games can afford an operator is justification to loosen the purse-strings, given the PR coup that such a sporting content can offer. Deutsche Telekom Group CTO Bruno Jacobfeuerborn recently remarked that massive infrastructure investment requires "massive events". Ushatsky demurs when asked if the World Cup has made his in-tray that bit easier to deal with. He says: "We have a multi-year budget cycle, and we have long been investing in networks to accommodate both the natural growth of the market, as well as opportunities tied to events like the World Cup. Over the past year, in Russia, usage has nearly doubled, so our organic growth has overall been a greater driver of our interest in investment than something like the World Cup."

The business case for 5G

While Ushatsky is coy about what we can expect from MTS this summer, he is more forthcoming about how he sees 5G panning out. With

Playing nice: MTS's Ushatsky sees network sharing as essential to connect a country of Russia's uniquity

debate set to dominate this year's Mobile World Congress, MTS's CTO says he feels it will serve largely as a network for mission critical IoT services, less consumer and more enterprise focussed.

He jokes that while penetration of mobile services among consumers is "about 170 percent" in Russia, there is a considerable gap when it comes to mobility and its adoption by a wide range of different services. He says: "5G is a good opportunity to increase the [enterprise] subscriber base and provide services to machines and some industries and so on."

MTS is of the camp that believes 5G will launch in 2020, with it hitting a mainstream across Russia from around 2025 onwards. This will coincide with wider plans the operator has to evolve beyond traditional telecoms through the likes of its bank. However, at this stage it is still

> ## " Over the past year in Russia, usage has nearly doubled

in discussions with the country's regulator about frequencies and rules for rolling out the technology. Ushatsky adds: "It's difficult to calculate business cases at the moment because we have no clear understanding of how much we have to invest in 5G. But we understand that LTE-Advanced will support a lot of services for 5G.

"In our strategy we are planning to implement 5G in some particular areas, some hotspots for some industries. We are not planning to have

Best feet forward: Brazil's Neymar is just one of the stars that will shine at this year's World Cup. MTS will have joint responsibility in connecting in stadiums

the same coverage that LTE has. It will be an evolution for us and we understand that it's a good way for our network to support LTE."

It's unsurprising to hear that the IoT will serve as a bridge for MTS between LTE and 5G with a €400 million network improvement project underway. It launched that in October last year as it looked to improve its 2G, 3G and LTE networks, as well as make them ready for LTE-M and NB-IoT.

> ## " Operators have to be courageous to launch services that meet customer needs

The operator is focussed on the main LPWAN technologies, albeit with an intriguing spin on one. NB-IoT is the initial point of interest with work underway with all of MTS's network equipment suppliers – Ericsson, Nokia, Samsung, Huawei and Cisco. In December, the operator launched a NB-IoT focussed Open Lab in Moscow, which Ushatsky says has two goals: "To provide the environment to trial tech solutions for our providers and to demonstrate IoT solutions and their implementation for potential consumers."

2018 will see the trials and deployment of LTE-M technology, which MTS's CTO says will complement its NB-IoT offering. He says: "We plan to test and begin to implement LTE-M technology on our network

this year. LTE-M solutions can be used where the capabilities of NB-IoT solutions are not sufficient (for example, where speed up to 1MBps is required), but the cost of the device, battery life, and service availability is critical, for example, in smart home solutions, connected cars, telematics."

Intriguingly, he floats the possibility of adding the unlicensed LoRa into the mix, or rather a derivative of it. He says the operator is viewing with interest attempts by Russian companies to produce "LoRa like" technologies, but declines to name them. He adds: "While our main strategy is to develop 3GPP IoT technologies (such as NB-IoT, LTE-M), we try to analyse all alternative technologies for their possible application for individual projects. We have not made the final choice yet."

However, he notes Russian telcos in general have a challenge on their hands to kickstart the IoT market. He says: "It's difficult to answer because from one side we have a big share of M2M market in Russia but this market is underdeveloped at the moment. The market is not mature and the problem is that other industries do not understand the business case at the moment. But from the other side, that's a great opportunity for us to grow our revenue in the future."

He laughs, replying "of course" when asked if operators are doing enough, pointing out the labs and a new IoT platform. But he is confident things can change quickly. He says it is pointless for MTS to have a five-year plan in place given the speed of evolution (instead, it has a three-year one). He adds: "For example, compare radio services 100 years ago, where it achieved penetration of 50 million people during 50 years. Pokemon Go achieved that in 19 days. Speed of penetration of services is very fast and of course operators have to be courageous to launch services that meet the expectations of our clients."

CTO Spotlight:

Kim Larsen
CTIO,
Magyar Telekom

What is the biggest issue you are currently thinking about?

It is what I like to call "the New Digital Transformation". Why "new"? One may argue that most, if not all, companies are already digitised and have been so for many years. However, most of our work and processes remain largely manual. The New Digital Transformation is a push for a much higher degree of intelligent automation across our technology landscape and customer facing functions.

With that follows a rethinking of how we do IT. We clearly need to "untelconise" ourselves and not do what we did before. The huge telco investments into IT transformation, without having much to show for it other than mega projects that carry on indefinitely, should be a thing of the past.

We need to decouple backend systems from the frontend via what you may think of as a digital engine or advanced API manager. We need to transform IT and technology in general with normal budgets. Thus we untelconise ourselves.

Who has been the most influential person on your career?

Without a shadow of doubt Dr. Bruno Jacobfeuerborn, Deutsche Telekom Group CTO. I learned from him that you need a strong competent team around you and that as a leader you need to be able to manage difficult, demanding people, as is so common among the very best and smartest people you can get your hands on.

What's the most important thing you have learned professionally?

Follow your passion, be curious and keep learning.

Magyar recently rolled out a NB-IoT network in Budapest. What does that technology offer you that others cannot?

Our ambition is to provide the best experience and innovate for our customers. Thus it was very natural for us to extend our network with NB-IoT. With NB-IoT we can enable smart city projects and it is a central building block of what we call the smart universe.

But it will also bring great convenience to our homes and everyday life. Our solutions are not limited to verticals and public institutions, but will also address the requirements of our wider customers.

Given your recent testing of 5G New Radio, what single use case are you excited about next generation technology bringing?

In my opinion we will see 5G first deployed in industrial applications, think manufacturing plants, logistics centers, campuses, etc…, substituting Wi-Fi by providing industrial strength security, responsiveness and of course wireless speed. I also see 5G as an alternative to Fibre to the Home, particularly in rural areas.

But for wide-scale 5G deployments we have a couple of challenges to solve first. LTE will be with us for many years to come. The really good news is that you can largely do with LTE what we dream of with 5G. With some limitations of course!

What is your biggest professional achievement?

Working at Ooredoo Myanmar. With a small team we created the winning technology and business bid for one of two new operator licenses in Myanmar. I regard that as possibly my biggest professional achievement to date. That experience not only provided ample professional lessons learned but will also put Myanmar and its people deep in my heart. Really a lifetime experience in all aspects.

What do you like to do when you are not working?

I am a serial learner. I read a lot to keep up with trends in and outside our industry and I spend much time designing efficient machine learning models for data science problems.

Another pastime is writing blogs about technology and economic issues facing the telco industry as well as actively contributing to the ongoing and important discussion of AI policies and strategies in the public domain as well as for businesses.

What's the biggest challenge facing the telecoms industry?

The relatively big financial requirements for our technology and business transformations – including 5G, fiber deployments, new digitalisation, etc – required to continuously fulfill customers' expectations and shareholder expectations of healthy growth. Companies that get their math right will win. The ones who don't? Hmmm…

What one recommendation would you make to your fellow CTOs?

Keep the passion.

CTO of the Year 2018

The annual awards celebrating technology excellence at mobile network operators

Sponsored by

mycomOSI

Since launching five years ago, Mobile Europe's CTO of the Year award have quickly established themselves as an essential part of the European telecoms industry. They celebrate the achievements of operators across Europe, from the largest Groups with strategies that straddle several time zones, to regional players making the most of their agile size. Coupled with these awards is a must-attend roundtable, where CTOs from across the continent discuss the burning issues affecting them and their organisations.

There are plenty of issues to explore. The industry is ever closer to the tipping point when 5G becomes less a market abstract and more of a reality. Trials and demonstrations are starting to be replaced by deployment timetables. Both part of and separate to the 5G debate is the Internet of Things. Last year saw cellular connectivity move into the IoT in earnest, with everything from smart parking networks to connected cows benefitting from wireless connectivity. CTOs have been tasked with choosing the right technology and deployment strategy with the pressure that if they get it right, it could unlock much needed new revenue streams.

The more ambitious operators have been underpinning their network transformation with virtualisation, which offers a more agile and more efficient means of working, so long as they can overcome the substantive challenges to get to that point first.

That's not to forget the ongoing requirements of consumers today; delivering high quality LTE networks that stretch far and wide across the countryside, punch deep into buildings and deliver coverage even amid the most densely populated area.

These are among the technological challenges. On top of that CTOs have had to tussle with wider financial concerns in the company and argue why investment is needed and needed now. Last year saw a number of executives from outside the traditional telecoms technology area start to express scepticism about whether it is worth investing in the technology now. It seems a key skill of a CTO is to navigate the boardroom as well as to innovate in the labs.

How the awards work

In 2018, there are two awards up for grabs once again.

The first is for Group CTO of the Year, which is open to any CTO responsible for technology strategy across a number of markets. Who will follow inaugural winner Yogesh Malik from VEON?

The regional CTO of the Year award is open to an executive who is either working in an opco of a larger mobile network operator, or in charge of technology strategy within a standalone operator, like last year's winner – Proximus's Geert Stanadert.

Previous winners ofthe award include Deutsche Groups Telekom's Bruno Jacobfeuerborn, Telefónica's Enrique Blanco and EE's Fotis Karonis.

2018 looks set to be another pivotal year for the mobile industry with operators looking to take advantage of new technology, adjust to the ever changing consumer and enterprise landscape and build a network for the decade ahead. We look forward to applauding the best that the European telecoms industry has to offer.

1 Criteria

Candidates for the 2018 CTO of the Year award must demonstrate how they have achieved in the following categories:

Delivery – The execution of network changing projects during the past 12 months, such as extension of LTE coverage, or launch of voice over LTE.

Transformation – The implementation and leadership of new technology, such as software defined networking or network function virtualisation, NB-IoT or other cutting edge services.

Satisfaction – How customers have responded to the CTO's work, whether it's low levels of churn, high acquisition of customers, or adoption of new technology

Influence – How they have affected change within the industry, influenced peers and set the agenda with telecoms

2 Nominate

If you, or a CTO at your organisation, meets the criteria and deserves to be crowned CTO of the Year 2018, please nominate using the short form on our website.

www.mobileeurope.co.uk/ctoy

The closing date for entries is 31 March 2018.

3 The award

The winners will be presented with their awards at an exclusive CTO roundtable and awards dinner due to take place in London on 24 May. The shortlist of candidates will be announced on www.mobileeurope.co.uk ahead of the judging process in April.

Last year's winners

Group CTO of the Year 2017
Yogesh Malik, VEON

Yogesh Malik was a worthy winner of last year's award, impressing judges with his dedication to network transformation, overseeing substantive virtualisation projects across five of the operator's markets.

A strong advocate of change, Malik is an exemplar of how a CTO needs to push their company into uncharted waters and realises that the old way of doing things is not necessarily the best way of doing things anymore.

"The CTO of the Year 2017 award means a lot to our team at VEON, and to me personally. I see this as a recognition of our efforts to transform VEON from a traditional telco to a leading technology company in the markets where we operate. In that journey, persistence and continuous innovation are crucial. We are very happy that our thinking and our efforts are noticed across the industry community. Let me also wish the best of luck to all contestants of the upcoming CTO of the Year 2018. I am looking forward to hearing new innovative ideas and solutions from our industry colleagues."

Regional CTO of the Year 2017
Geert Standaert, Proximus

Geert Standaert showed how size sometimes doesn't matter when it comes to innovating at the level of its larger counterparts. He stood out for his work within the Internet of Things, jumping early and ambitiously in backing the LoRa standard and placing Proximus at the centre of the technology's deployment.

He also impressed judges with a wide-ranging approach to telecoms, spanning LTE invention, small cell deployment and experimentation with virtualisation.

"Receiving the award is a great recognition for the whole technology team, for the strategy they built, the deliveries they achieved. I made sure to grasp every opportunity to dedicate this award to them as recognition, but mostly as motivation to keep raising the bar, learn and become better. More than ever, with the speed of change and many transformations ahead, we need the engagement of everyone to succeed. And recognition is a great energy booster."

EXFO: Transforming network performance for a 5G world

As the pace of network transformation accelerates towards 5G, sensitive real-time IoT applications and service virtualisation, operators will become increasingly reliant on smart, granular network insights for automated network management and proactive mitigation of performance issues. At February's Mobile World Congress, EXFO will set out its commitment to providing everything operators need for the journey.

In the run-up to the event, Germain Lamonde, the company's founder and Executive Chairman, gave Mobile Europe a preview of its vision and plans, highlighting how strategic acquisitions have cemented its global market advantage and will ensure that operators can capitalise on each new opportunity efficiently, reliably – and profitably.

Mobile Europe: There has been a lot of activity at EXFO over the last 18 months with a series of acquisitions. What are the market drivers for this – what gaps in capability are you addressing, and why is this necessary?"

Germain Lamonde: The economic model for operators has undergone immense transformation over the last few years. The accelerating pace of technology advances, increased regulatory pressures, and soaring customer expectations have changed the game. Operators find themselves needing to recover the huge investments they've made in their networks and deliver more, when revenues and profitability are being squeezed by intense market competition and a high degree of consumer pressure. The result is that they need to be more efficient, do more with less.

What does that look like in practice?

They need to work towards more centralised operations, true, real-time end-to-end network visibility, and automated performance management. We're going to see a really radical shift from very manual, labour-intensive processes to real-time responses, self-healing networks, and predictive, proactive interventions. And this isn't a way off in the future – we're talking about some of this being a reality by 2019/2020.

What has been holding operators back from making progress?

Much of it is to do with the siloed way data exists and is used by operators. They have access to increasing volumes of rich, detailed information about customer usage and operational performance - but a lot of this is passive information, stored in disparate places, and not easily accessible to support real-time decision-making or trigger next actions. As operators seek to take advantage of the opportunities new technology opens up to them, they must address this.

How is EXFO helping operators to prepare for this new and more dynamic world?

We're a recognised leader in active service assurance – for instance, in sending small test packets into networks to test a range of specific aspects of performance. Our background was in optical fibre, then, following a series of acquisitions about 10 years ago, our focus shifted with the market towards mobile performance management. We are technology agnostic and can provide a single, end-to-end view and active service assurance capability across any combination of fixed/mobile networks including hybrid services.

More than 100 operators around the world use our solutions. In one of our biggest customer deployments, we're used to performance-test every antenna in the United States – that's 75,000 wireless points of presence, each being tested 10 times per second, across four different types of service. Added to information that's being collected from some 350,000 network elements, we're talking about 100 terabytes of data per second which the operator is able to analyse and respond to in real time, to enable the right decision – that is, to enable real-time network performance management. So that's something we're already delivering today.

But we haven't stopped there, and this is where our acquisition and investment strategy comes in. The service chains involved in delivering communications services are becoming increasingly complex. This can make it very difficult to maintain consistent performance, or spot where problems are arising – certainly in real time. The move to 5G and the expected proliferation of Internet of Things applications that rely on a continuous data feed make this situation unsustainable. Where you have very time-sensitive applications such as connected cars depending on real-time data exchanges – related to traffic density and risk mitigation for instance – even the smallest degree of service latency could cause an accident, making the difference between life and death. A sub-millisecond's delay in data transmission could mean calculations and decisions are several metres out if a car is travelling at 100 km/h.

These are the kinds of scenarios operator service levels need to be geared towards, and that's what we'll be helping to ensure. Our active tests, centralised radio access network measurements, and detailed asset

visibility, combined with our two latest strategic investments, put us at the forefront of this opportunity.

Tell us more about the companies you've invested in over the last year, as you move towards this goal.

The two most noteworthy ones over the last year have been Ontology Systems, a technology leader in real-time network topology discovery and service-chain mapping, which we acquired last March, and then our controlling interest in Astellia, a leading provider of network and subscriber intelligence, which was recently announced.

In Ontology Systems we gained access to a team of amazing technologists in London and solutions that automate the discovery of inventory. Their real-time network and service topology platform and toolset are commonly used for service and customer assurance applications – but also as a source of data for active inventory systems to support visualisation, troubleshooting, workflow and data alignment for NOC, SOC and care systems.

The attraction of this capability for operators as they continue on their innovation journeys is the ability to see across the whole service chain – everything that is going on between end points – which is a critical step towards network performance management, and automation.

Astellia, meanwhile, specialises in RAN optimisation, using orches-

> " **With our portfolio of capabilities we can monitor everything from the fibre to the top of the tower**

trated virtual probes. This paves the way for operators to maximise NFV/SDN opportunities, enabled by robust service assurance.

Astellia brings scale, a complementary portfolio, customer base and markets as well as professional services from a team with deep mobile expertise. EXFO and Astellia are jointly much stronger for 5G, RAN/C-RAN infrastructures, network intelligence, customers experience insights and overall capacity.

Between EXFO, Ontology and Astellia, we have something extremely powerful – a portfolio of capabilities that is much greater than the sum of the parts. Together, they position operators to assure service levels across fixed and mobile networks, and between centralised or cloud-based and site-based assets. They offer an efficient and reliable way to capitalise on creative 4G and emerging 5G opportunities, and to take full advantage of new options to virtualise network infrastructure and services – all while retaining a clear line of sight across network performance and maintaining high service levels, but in a way that could be readily automated and made more intelligent and predictive.

It isn't just new operator customers that will benefit from our combined portfolio. Existing customers of EXFO, Ontology Systems and Astellia will be able to take advantage of more opportunities because of the additional capabilities they can now tap into. Geographically, we have greater reach collectively now too. Astellia's business, based largely

in EMEA, will benefit from EXFO's global footprint (EXFO covers all of the Americas, and Asia-Pac, as well as EMEA), as will Ontology, whose focus to date has been largely in Europe and Asia.

With all of these developments, what will be the main focus of your presence at Mobile World Congress this year?

We'll be highlighting the additional capabilities we can now offer across the combined portfolio of EXFO, Ontology Systems and Astellia, as well as previous strategic acquisitions. We'll be talking about EXFO's positioning in relation to critical areas for operators, including the RAN revolution where a lot of future investment will be directed – to support IoT, more bandwidth at the edge, and so on.

The C-RAN model – using a centralised, cloud computing-based architecture for radio access networks, which supports current and future

> " Between EXFO, Ontology and Astellia, we have something extremely powerful

wireless communication standards, with optical connections to antennas – involves a huge number of assets, all with a bearing on performance. With our portfolio of capabilities we can monitor everything from the fibre to the top of the tower – and we have the largest market share and an unrivalled reputation here.

Critical to this has been another strategic acquisition – Absolute Analysis, based in California, which we bought in November 2016. Combining its technological leadership in real-time optical RF over Common Public Radio Interface protocol analysis with our own strengths in fibre testing has given rise to the only complete solution for optical, Ethernet and RF analysis for next-generation wireless fronthaul networks.

This activity laid the groundwork for this January's launch of EXFO SkyRAN – a scalable remote access and monitoring solution for fibre-based fronthaul networks. It's something we've developed in collaboration with the largest wireless carriers in North America, and provides real-time, on-demand testing and 24/7 monitoring of fibre-optic networks and RF spectrum, from cloud-based data centres.

By diagnosing problems in real time, we give operations a chance to maximise costly spectrum – which is often only at 60-80 percent of its capacity. By pinpointing and addressing issues promptly, operators can unlock more of the value in that spectrum. It's a solution that draws on all of our smartest capabilities – from automated topology discovery to the ability to combine the mindboggling amount of data (100 terabytes per second) that exists in RANs with traditional passive data, for unprecedented end-to-end network visibility.

What will be your message around 5G?

Clearly this is an area where operators are making massive investment. In Europe, Vodafone and Three UK are among the leaders, at this stage primarily for broadband access to feed homes, at rates of 100-200 MBps.

EXFO dominates in this area, with some 300 service providers already using our solutions here. 5G will add to their need for our solutions, so we're well positioned.

And what about network virtualisation, which is clearly another strategically important focus for operators. What is your message here?

We provide an end-to-end performance management suite that transcends the type of network and how it is provisioned, and virtualised networks are a sweet spot within that picture. All of our active tests can be done whether the network is physical or virtualised. And they can be done at massive scale, which fits well with a virtualised scenario where server capacity is pretty much unlimited. We can scale with the new requirements of 5G and crucially we can help operators ensure that the extremely low tolerance for latency expected with emerging applications is respected and managed proactively.

If operators are rolling out a new, virtualised network capability, then we can probe-test it before it goes into production. Our EX1 portable testing probe allows untethered testing on location, combined with regular cloud-based testing, to mitigate any problems.

Our investment in Astellia has expanded our virtualisation offering. They recently won a deal with Three UK to support its virtualisation ambitions with passive service assurance across all of its server probes, which are entirely virtualised now. It is thought to be the biggest deployment in Europe.

Probably our most important message, though, is that we support any combination of networks environments and configurations. Whatever exciting technology roadmaps are in front of us, operators are going to be juggling a hybrid world for many decades to come, and we are uniquely positioned to help them maintain performance across their entire network estate.

Tell us one last thing you want operators to know about EXFO's plans for the future.

I founded this company 32 years ago as a humble start-up, but always with the plan to innovate like no other, and to go global – which our many achievements support. Today we employ around 2,000 people and operate in more than 35 countries. I have recently moved into a more strategic, acquisition-focused role so I can continue to build out our capabilities and international reach.

The plan now is to accelerate the way that we transform and have an impact on the industry, by adding further technologies that will ensure we remain leaders in our field. Our goal is to continue to be a trusted advisor for the management of networks, and to help operators prepare and align themselves for the future, by giving them a deep view of their networks in real time. From complete visibility and real-time root-cause analysis and resolution, we can help them ensure and drive up performance, increasing consumer satisfaction and keeping the right side of regulators, while controlling costs. Bolstered by our recent acquisitions and investments, we offer the most advanced combination of solutions, equipping operators to prepare for the transformation ahead – RAN and 5G preparation, IoT and everything that lies beyond.

Last but not least, our acquisition activity has given us massive scale. We're now one of the top three providers in our industry, with global coverage, which all of our customers stand to benefit from.
www.exfo.com

2018 Reader Survey: cautious optimism about 5G, if the business model question can be solved

Operators are broadly confident they are laying the correct groundwork for 5G, but unsurprisingly there are some concerns. This is the headline finding of Mobile Europe's 2018 reader survey, which aimed to explore the current health and performance of the telecoms ecosystem. **Graeme Neill** reports

This year is a pivotal time as 5G increasingly becomes a substantive part of an operator's in-tray rather than an abstract concept for years down the line. Discussions as to whether the industry is preparing in the right way are set to dominate discussions over the next 12 months. Is the technology fit for purpose, are the right business models being developed and are telcos staffed with the most relevant skills?

Operator respondents polled by Mobile Europe are broadly optimistic their organisations are putting the right plans in place for the decade ahead. They give the industry a score of 6.7 out of 10 for their work thus far. While there is scope for improvement, it is far from the doom you hear in some quarters about the industry's future.

That's not to say some warnings were not sounded by our readership. One said that governments need to speed up the auctioning process and allow operators to get their hands on the bands deemed central to 5G as soon as possible. Another remarked that while vendors will start offering non-standalone 5G New Radio products this year, challenging work with regard to full technical implementation of the technology is still to be thrashed out.

And as you will see in the coming pages, readers were quick to raise a litany of obstacles that telcos need to overcome in order to make 5G a success. The industry may hear more on this matter in Barcelona at Mobile World Congress. Over the coming pages you will see just which companies the telecoms industry feels are innovating the most, which technologies are leading the way within the Internet of Things, and which technology is the most overrated.

What technology have you found the most over-hyped in 2017?

37%	30%	30%	22%	29%	16%	14%	10%
5G New Radio	Artificial intelligence/ machine learning	Blockchain	Augmented/virtual reality	Connected cars	NB-IoT	Wearable technology	Airborne masts
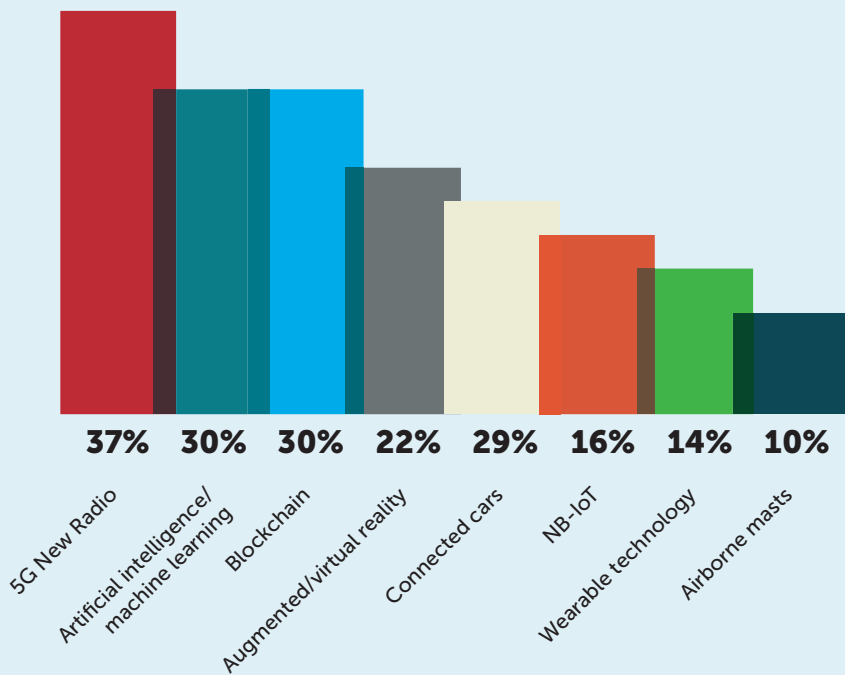
The specifications ratified by the 3GPP pre-Christmas were hailed as a major breakthrough for the telecoms industry, but 5G New Radio was singled out as the most overhyped technology of last year.

Perhaps it was the fatigue of breakthrough after breakthrough or first after first that wore thin on the industry. As one reader pithily put it "5G in general" was what exhausted them the most.

Speaking of ubiquitous terms, blockchain was the joint second most overrated technology, accounting for almost 30 percent of responses, along with artificial intelligence. Enthusiasts see blockchain as unlocking anything in telecoms from fraud management and authentication to the Internet of Things. Cynics wonder whether it will have any tangible use at all, aside from an unerring ability to grab headlines.

Who is currently driving innovation in the mobile industry?

38% Network vendors

26% Start-ups

18% Silicon Valley

Other 1%

Public policy 3%
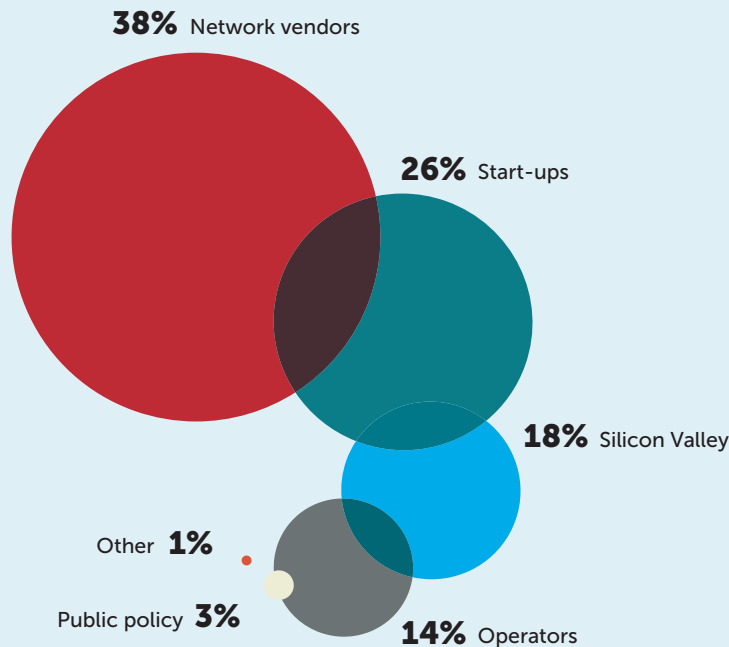
14% Operators

Depending on what way you look at it, operators either are grimly realistic about where they stand in the pecking order, or fatalistic about their capacity for invention. While only 14 percent of all respondents said operators were driving innovation, only 11 percent of operators said they were at the cutting edge of change.

This is perhaps why start-up incubators have become increasingly fashionable among operators – from Deutsche Telekom's hub:raum to Telefónica's Wayra. Start-ups were deemed by more than a quarter of respondents to be pushing the industry forward.

Which technologies will be the biggest priorities for operators in 2018?

Building IoT networks
42%

Improving network security
35%

Preparing for 5G
54%

Widening LTE coverage
32%

Virtualisation projects
30%

Increasing LTE speeds
24%
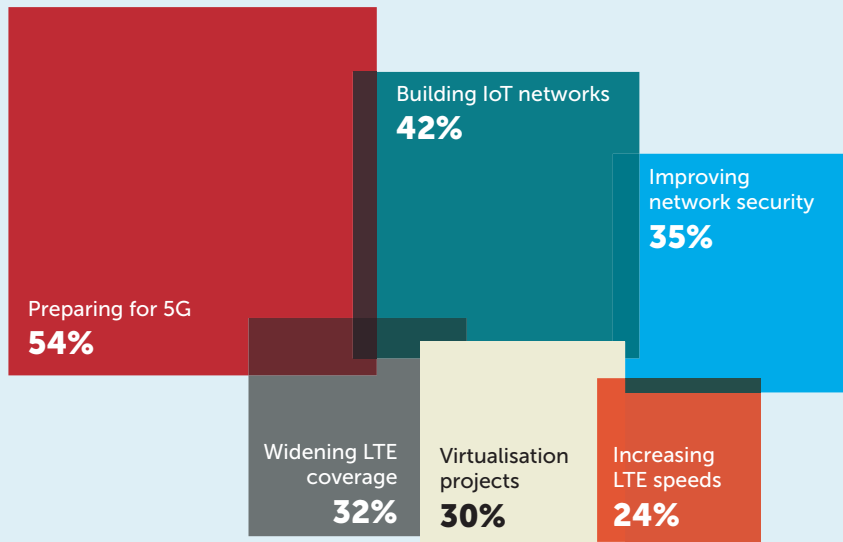
5G New Radio may have been deemed as the most hyped technology of last year but preparing for new networks is top of the industry's in-tray for the year ahead. Fifty four percent of respondents highlighted it as key, considerably ahead of building IoT networks, at 41.6 percent.

Curiously network security was deemed less of a priority among operators than the wider industry. Our results found 35.2 percent of all respondents felt it important, compared to only 26 percent of operators. Complacency or faith in the strength of their network protection? Network breaches only spell headaches for operators so it's a risky strategy.

Despite all of the excitement surrounding new kinds of technology and potential new use cases, two of our respondents identified some of the basics have yet to be solved completely, raising an omni-channel customer experience and indoor coverage as still important. Operators should clearly not be swept away by hype.

What is the biggest potential hindrance to 5G's success in Europe?

28% Poor business models

22% Costs involved

20% Fragmentation and standardisation

9% Lack of adequate spectrum

7% Lack of strategy within company

5% Uncoordinated spectrum policy

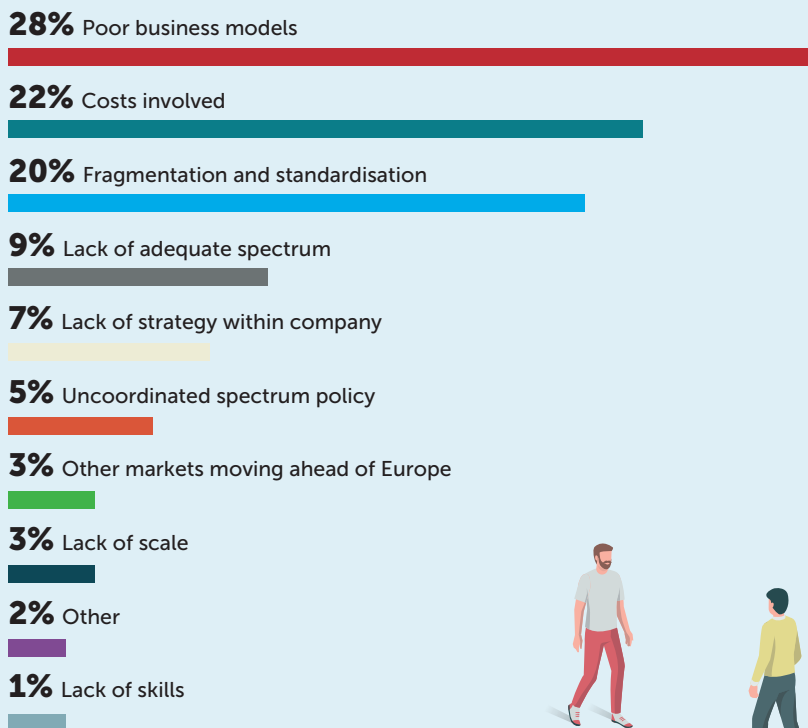**3%** Other markets moving ahead of Europe

3% Lack of scale

2% Other

1% Lack of skills

BT Group CEO Gavin Patterson caused consternation last year when he bluntly said there were no business cases at present for 5G. For an executive usually so keen on a positive headline for the industry, this made for a surprising reality check.

But Patterson's fears are shared by the industry, with 28.4 percent of respondents saying the poor business models are the biggest challenge to 5G's success. Coupled with that are operators' continued concerns about return on investment, with the costs involved in rolling out 5G a concern for 22 percent of respondents.

Despite the breakthrough on the non-standalone 5G New Radio standard last year, fragmentation also remains a concern. Interestingly, this fear has skyrocketed from a year ago, when only 5.45 percent of readers raised the issue in our 2017 survey. As the technology's launch gets closer, there is clearly work to be done.
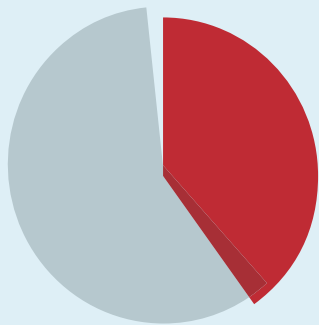
Which operator has innovated the most in 2017?

Vodafone – 40.2 percent

Vodafone also made it two in a row in being voted the most inventive among operators. Whether it's NB-IoT, artificial intelligence in network operations, 5G testbeds, virtualisation or working with Facebook (among others) on new kinds of infrastructure, the UK-based operator is focused on ensuring it best prepares itself for the years ahead.

What will be the crucial differentiator between LTE and 5G?

22% Greater network capacity

21% New business cases

17% Higher speeds

16% Lower latencies

7% More intelligent networks

6% Automation

5% Lower costs

5% Marketing and hype
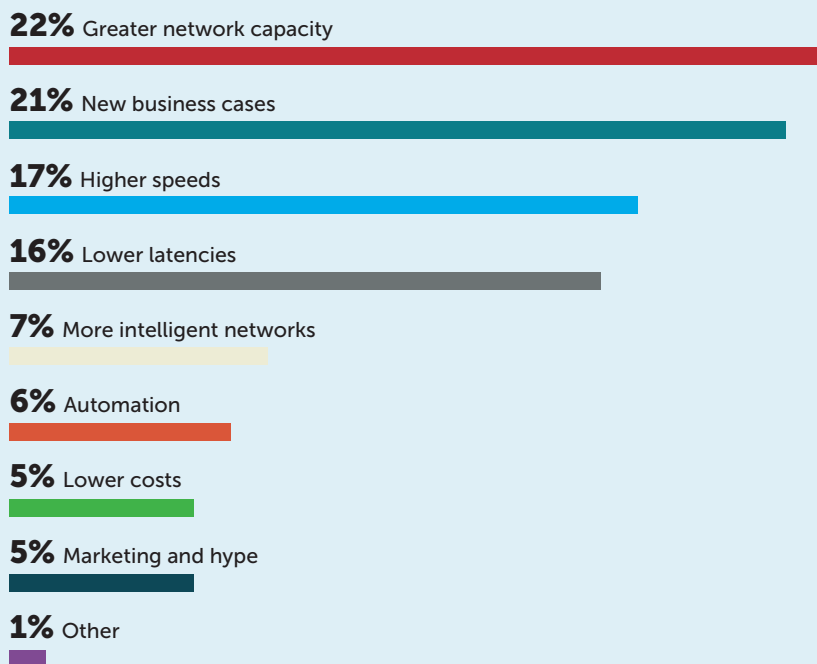
1% Other

Practically all operators will complain they have to do too much with too little, whether it's spectrum or capex or one of a myriad of other factors. Optimism abounds that 5G will deliver greater network capacity, ensuring operators are able to power the services they dream of.

It will have to pan out as the case, if data intensive demonstrations of driverless cars, drones and virtual reality are to be borne out by mass market adoption. But respondents were optimistic that high speeds and low latencies would be a given of next generation networks.

A mere cigarette paper behind greater network capacity was new business cases, but as noted elsewhere, the challenge is on to determine what these exactly will be.
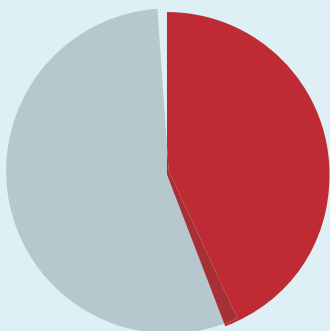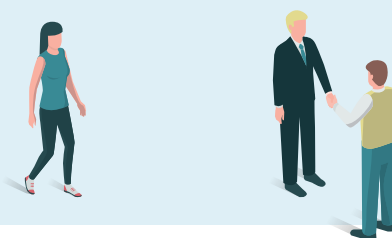
Which large vendor has innovated the most in 2017?

Huawei – 44.25 percent

The Chinese vendor is ubiquitous in the telecoms industry in thirst to hold tests, trials, demonstrations and implementations of new technology. This marks the second year in a row Huawei was voted most innovative vendor and the cacophony of announcements it will undoubtedly make at Mobile World Congress marks the start of its journey to make it three in a row.

What is the biggest threat to operators making a success of the IoT?
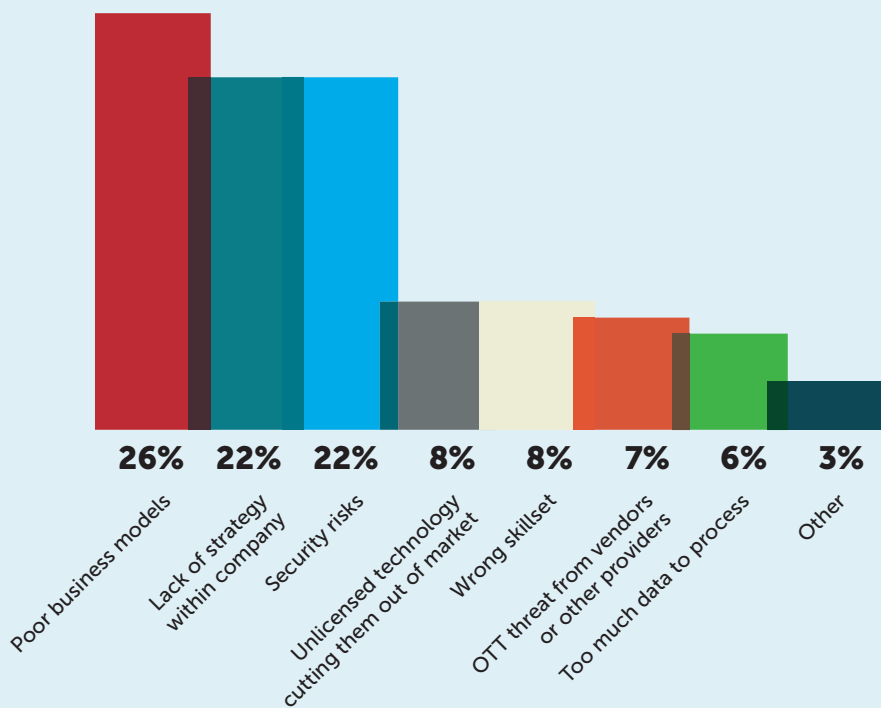
What goes for 5G goes for the Internet of Things. Business cases again were in the spotlight as the biggest issue to be solved before the technology can be a true success. So far, there is cynicism that enough is being done to tap into the technology's potential. Over 21 percent of respondents felt there a lack of strategy within their business, a figure that rose slightly to 22 percent among operator only respondents. This is a cause for concern, especially given how operators are placing the IoT at the forefront of their future plans.

26%	22%	22%	8%	8%	7%	6%	3%
Poor business models	Lack of strategy within company	Security risks	Unlicensed technology cutting them out of market	Wrong skillset	OTT threat from vendors or other providers	Too much data to process	Other

Who is ultimately responsible for securing an IoT network?
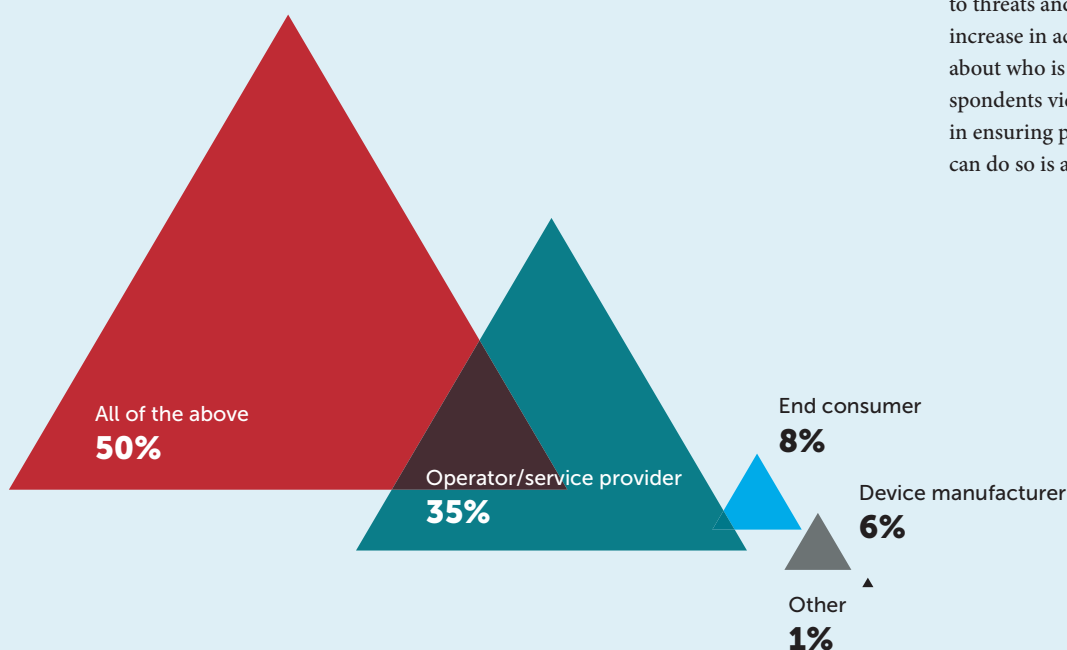
Cooperation is key when it comes to ensuring consumers are protected. The Internet of Things has been seen as potentially open to threats and hacking given the exponential increase in access points and lack of clarity about who is responsible for what. In our respondents view, everyone needs to collaborate in ensuring people are kept safe. Whether they can do so is another question.

All of the above
50%

Operator/service provider
35%

End consumer
8%

Device manufacturer
6%

Other
1%
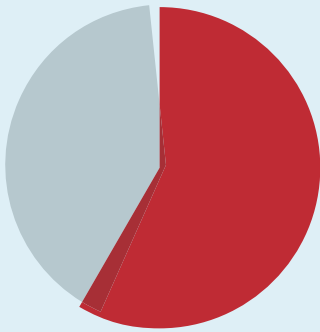
Which IoT technology will be most prominent in Europe by the end of 2018?

NB-IoT – 58.6 percent

2017 saw some rumblings about its future but NB-IoT remains the technology of choice among European operators. Deutsche Telekom, one of the tech's enthusiasts, hit 600 locations in Germany alone recently, with Vodafone and TIM also pushing ahead with widespread deployments of their own. LTE-M was in second place with 25 percent of the vote, followed by LoRa with 10 percent.

Do you have the right technology skills in place at your organisation for the decade ahead?

I don't know
29%

Yes
39%

No
32%
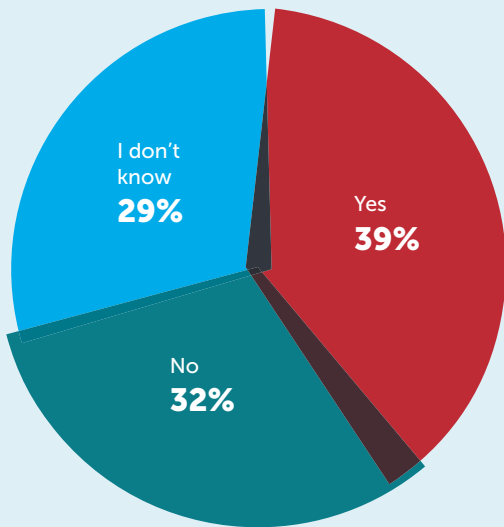
A near three-way tie among the industry in terms of how prepared it is for the future. However, it proved to provoke the most debate among our readership. One respondent said: "The right technology skills are not as widespread throughout the company as they should be. Additionally there are several areas where skills are many years behind what is required."

Another shared a similar sentiment, neatly drawing a line under our look at the state of the industry. They said: "We have to continuously renew our know how and skills. No one has enough skills for a decade ahead." Potential means nothing if a company does not have the right people in place with the ability to realise it.

About this survey

Mobile Europe held its reader survey during December 2017 and January 2018. Of its 125 respondents, 42.4 percent were operators, and 28 percent from vendors. The remainder work for other interested parties such as analysts, consultants and regulators. Ninety two percent of respondents were from Europe, four percent from Asia-Pacific and the remainder split evenly between the Middle East & Africa, North America and South America.

Empirix:
The future won't wait

N ew operator business models require a complete rethink of performance monitoring and management, *writes Franco Messori, CSO and CTO at Empirix,* provider of IntelliSight, the smart end-to-end customer experience and performance assurance platform for telecoms service providers.

Without question there will be some clear topics that will dominate this year's Mobile World Congress. Most notably these will include all forms of network virtualisation/software-defined networking and 5G - and the accompanying need for a new concept in network architecture: one which allows for the growing diversity of traffic and service scenarios that are emerging. Interoperability, open source and automation will be high on the agenda too, as operators strive to follow and stay on the right side of the emerging opportunities and profitable revenue streams.

To do this, they must not only have the technology building blocks in place, but also the ability to provide the calibre, responsiveness, flexibility yet consistency of service that is essential in an all-IP world – a world where service consumers are as likely to be 'things' as people.

Yet operators could be forgiven for struggling to deliver this more dynamic approach to provisioning and managing their infrastructure and services. As much as they may recognise the need for greater integration and fluidity between their diverse network and service operations, the technology hasn't been readily there to support them in delivering this.

Vendors may have some great products for network performance monitoring, service quality assurance, diagnostics, and various manifestations of analytics, but in most cases these solutions have been designed and positioned for a specific application and therefore function in silos. The trouble is that operators now need an analytics approach that extends across the entire communications process, and the current scenario does not generally support this.

Placing customers at the centre
Although the industry has recognised the need to move beyond network-centred operations monitoring (NOC) to a more service-centric approach (SOC), the real core to all of this monitoring and assurance activity must be the customer or user, whether a person or, in the context of the Internet of Things, a machine or device. Unless all efforts result in the expected overall experience, and continue to meet users' evolving requirements, investments will simply be another cost and complexity for the business to manage.

Getting to a holistic customer-centric perspective for network and service management demands a single platform where all respective monitoring, management and service assurance capabilities come together and

are consolidated to form a single, integrated, inter-related/cross-correlating view. As well as giving operators the holistic overview they so badly need now, this also offers them a chance to rein in some costs, simplify their control panels, and scale their activities exponentially.

It's a need we identified at least three years ago, giving Empirix a considerable market advantage. We saw tier 1 operators struggling to make sense of and take decisive, useful action from the huge data lakes they had created as a facilitator for deeper analysis. Although they had everything at their disposal, there was a catch: they couldn't readily see what linked the data they were looking at – how one event intersected with another.

Exposing the joins
Without a clear, at-a-glance understanding of how network flow was affecting the business or the customer, operators weren't able to turn their insights into customer experience improvements, or stem revenue and profit leakage. To turn their operational insight into something beneficial and competitive, operators need the ability to make smart correlations between the data and at speed. At a practical level, they require a way to create logical links between the network/service and customer behaviour and compare this to the expected quality of experience (QoE).

Empirix IntelliSight filled that gap, providing the unprecedented ability for operators to extract new value from existing company data via a single, fit-for-purpose platform and single, consolidated service view. One which spans wireline broadband and wireless networks, and physical as well as public and private cloud provisioned services.

This is a winning formula that our competitors are only just catching up to. In the meantime, we are moving forward again with the next advances made possible by this holistic operational insight: namely the ability to act swiftly in response to emerging service/customer experience issues based on the insight presented; and to increasingly automate more of the processes involved in spotting, diagnosing and resolving problems. To this end, Empirix has recently introduced a further level of intelligence to the IntelliSight platform, in the form of Analysis, Decision and Automation (ADA).

It's not what you know, but what you do about it...
Empirix IntelliSight ADA builds on the existing ability to evaluate network, service, applications and customer QoE by combining all of the relevant data insights, to enable intelligent, real-time (or near-real time) actions.

The decision function determines what to do when analytics reveal why a particular key performance indicator or QoE-Index is not aligned

to expectations. This might generate a single action or a list of actions.

These can be implemented manually or fed straight through to IntelliSight's Automation capability, which is integrated as part of software-defined or self-organising network systems and activated using script integration engines such as Ansible, Jira, Ruby or JavaScript. This in turn will trigger automatic changes in configuration, resources allocation or mapping, traffic routes, quality of service class, or changes in the access authentication process.

Our aim with all of this is to redesign the way service providers harness operational, assurance, marketing monitoring and management platforms to provide a more responsive, user-centric experience that is in line with what is expected and needed, and with what has been promised. It is about closing the loop, so that good insight gives rise to a consistently good experience, in the process reducing costs, churn and revenue/margin erosion. Without this, operators are missing an important trick.

Predictive problem-solving

It is no coincidence that Empirix is also a leader in diagnostics and troubleshooting, capabilities which must also adapt in line with the increased complexity involved in today's communications service chains, leading to highly involved scenarios which can no longer be managed manually if operators are to have any hope of honouring their QoE promises.

IntelliSight is ideally placed to help here too, providing timely, consolidated intelligence which helps reduce the number of repair tickets and the time to root-cause discovery. Again, this is not just about using data efficiently, but combining complete data with supplementary intelligence. In this case, it's a unique knowledge library supported by machine learning. Within the next few months, it will involve the application of artificial intelligence engines to predict and prevent problems and maintain greater service continuity.

Customer-centric service assurance, end-to-end performance management, and smart, real-time problem-solving will be a huge priority for operators in 2018, and Empirix continues to be ahead of the curve.

Framing 5G expectations

By the end of this year, we expect to roll out a 5G customer experience index which combines network and service metrics with those measuring the wider customer experience, in context. We're already piloting this with a couple of major international tier 1 operators, and it will be the only index of its kind, combining measures suited to the diverse services 5G is designed to support through its promise of high density, high speed and low latency – a potentially significant spectrum of services

which in turn demands a range of different quality measurements. This will be crucial in building confidence in 5G services as operators begin to announce products, as well as for charging for services of course.

Operators have much to think about in 2018, not least how they will reorganise themselves to become more customer-centric, responsive and cost-efficient. As ever, technology progress is just one aspect of the challenge.

Certainly service providers can't afford to miss out on the new opportunities that new technology advances are opening up to them, as will become abundantly clear at this month's MWC.
www.empirix.com

Franco Messori, Chief Strategic Officer and SVP for Product Management at Empirix in Modena, Italy, is an authority on network architectures, protocols and communications. As Empirix's CTO, he is responsible for driving the development of the company's multiservice fabric-based system architecture, ESA and for the NFV-based vESA, as the monitoring and analytic framework for all-IP physical and virtualised networks and services.

Franco Messori, CSO and CTO at Empirix

EMPIRIX

Real Time Actionable Results, Driven by Mobile Data

Now more than ever, mobile network operators need solutions that optimize network and service performance while delivering optimum customer experience.

Learn how to gain real-time actionable results, driven by mobile data, with Empirix Monitoring and Analytics solutions addressing both NFV migration and IoT transformation while ensuring the end-end customer experience.

Visit Hall 6, Stand 6C20 to learn firsthand how **Empirix can benefit your organization.**

EMPIRIX

Red Hat: Culture, code and collaboration

Jim Whitehurst, President and CEO, Red Hat, shares his thoughts ahead of Mobile World Congress

So, you're taking to the MWC stage this year – can you give us a sneak preview?

I'll be giving a keynote presentation on Tuesday morning, as part of the session on "The Foundations of The Digital Economy". Based on the premise that the digital economy will continue to transform how we do business, the session will look at how to put the right foundation in place for it to flourish.

I'll be addressing how telco organisations – which have the opportunity to be the beating heart of the digital economy – can create a more dynamic, open culture and rethink their innovation model to thrive. How, in a volatile, uncertain world, they can reshape traditional structures and processes, and instead optimise to be more agile, resilient and innovative.

I'll share a vision of how to deal with change in the face of disruption.

What is Red Hat's role in the mobile and telecoms space?

One hundred percent of telcos in the Fortune Global 500 rely on Red Hat*. Traditionally this relationship has revolved around the datacentre, in the IT domain, where we have deep expertise working with organisations across industries, around the world. Now with telcos making the move to cloudify networks and virtualise network functions, Red Hat is stepping in as a trusted partner supporting their network modernisation strategies.

We're building close collaborations across the ecosystem to deliver solutions from the network core to the edge, and have some exciting stories about how our customers are working to address the rising demand for data and grow their share of the digital economy.

What's open source doing for the telco industry?

Open source is a key driving force for today's innovation across industries and societies. We believe open source is a core building block of the modern telco network and ecosystem, helping organisations transform their infrastructure to be more agile and ready to face change.

However, it's a new area for many in this industry, and it's a learning curve. We are having many conversations with operators and vendors globally to help them navigate and benefit from open source. They know they can tap into open innovation and are seeking to understand better when and how to consume open source code, and where and how to participate in open communities.

We see more operators taking an active role in driving open innovation, for example through initiatives like ONAP or OSM, to develop enabling technologies for virtualised networks.

What else is Red Hat showcasing at MWC this year and where can we find you?

At MWC this year, exhibiting in Hall 2 at stand 2G40, we'll be showcasing a number of our technologies supporting telco transformation and we'll bring the business benefits to life via demos with some of our partners and customers. These will focus on how we are helping to enable innovative services such as IoT, data analytics, machine learning and self-optimising networks, as well as diving into the latest advances in foundational infrastructure, looking at NFV, multi-access edge computing (MEC) and virtualised IP headend, radio access networks (vRAN) and content delivery networks (vCDNs).

You can expect to hear about some fresh collaborations and customer use cases, plus learn more about ongoing projects, such as how Red Hat is behind T-System's AppAgile cloud service; how we are helping the likes of Orange, Verizon, Three UK and Altice get NFV into production; how Red Hat OpenStack Platform is supporting the NFV solutions of network equipment providers; how we are helping Swisscom virtualise its live TV network; and delivering OpenStack clouds for Turkcell, Fastweb and more. We look forward to seeing you there!
www.redhat.com

Red Hat client data and Fortune Global 500 list, June 2017

Top marks: Operators are increasingly using independent network tests in their marketing material

Testing situation — network trials and tribulations

Independent network trials are bigger than ever. But with some operators getting angry about the findings, are the tests all they cracked up to be? **Kate O'Flaherty** reports

Consumers satisfied with the quality of their mobile network are 1.7 times less likely to leave, according to an Ericsson ConsumerLab and Tefficient report. They are also bigger spenders, paying an average of 17 percent more each month for services.

It is for this reason that independent network trials, such as those performed by the likes of RootMetrics, P3 and OpenSignal, are of growing importance to operators. Everyone wants to lead in this area, but it also raises the

stakes when a mobile operator "loses" a test.

Indeed, the typical response to coming last in an independent trial is to complain that the methodology is flawed. One high profile incident in November last year saw the CEO of Swiss operator Salt, Andreas Schönenberger, publically hit out at testing agency P3 following its latest network quality assessment.

P3's test found Sunrise and Swisscom to be Switzerland's best performing operators, with a score of "outstanding" compared to Salt's "good". In retaliation, Salt accused P3 of attacking its staff, suppliers and customers.

Challenges such as these are not helped by the fact that there is no agreed methodology

among the various companies performing network tests. Some independent firms hail the benefits of so-called "drive tests" in cars in addition to "walk tests" in areas not accessible by vehicles, such as buildings. The companies that perform drive tests see this methodology as scientific, hence producing the most accurate and useful results.

Meanwhile, crowd-sourced testing is done through an app downloaded on a user's device. Those performing such tests say this provides a much more life-like view of how consumers use their phones. But critics of the methodology argue that the sample size can be small, saying the tests do not always cover a wide

variety of metrics beyond speeds.

When undertaking a drive test, the company will alert operators of its plans ahead of time, according to Fredrik Jungermann, Founder of the consultancy company Tefficient. He thinks there are merits in both approaches. He says: "Drive testing is 100 percent accurate for that position at that given point in time. But the sample is low: usually one call per network at the same time. Also, you spend a lot of time in a car, which is not always representative of today's use cases. With crowd-sourced tests, there are thousands of individuals moving as they do in real life."

Testing methodology

Brendan Gill is CEO of crowd-sourced testing firm OpenSignal and says his company's differentiator is the breadth of its testing. He says: "The biggest difference is [that] we test everywhere people go and the situations they are in – both indoors and outdoors. Drive testing is limited to roads. Another difference is the devices themselves: we test using multiple models but drive tests usually use just one."

And OpenSignal is far more than just a speed test, says Gill. "Our last report sampled over 50,000 users across the UK and the data points were in the hundreds of millions."

> " **The majority of customers just want a reliable network that makes good quality calls**

In contrast, P3 opts for both drive tests and crowd-sourced data. MD Hakan Ekmen says: "We define the rules before we start the exercise, so no one can influence us."

Meanwhile, RootMetrics performs drive testing as well as walk tests indoors while also covering train stations, airports and stadiums. Scott Stonham, General Manager for Europe, says the firm conducts its testing independently of operators. When results are published, operators choose whether to subscribe to the data.

He adds: "The main business model is you subscribe to our data and as it becomes available, you can have access to it. If you want additional, more detailed information you can pay for it – and operators need to pay licensing fees if they want to use our logo in their marketing."

Dr Paul Carter, CEO of Global Wireless Solutions, which performs data analysis, reporting and benchmarking, says the technology the firm has been monitoring has changed in recent times. "It used to be voice, now it's voice and data. The one thing everyone wants is robust, reliable, consistently performing networks: using the network when and where they want. Voice is still important, as well as texting and also streaming videos."

His company performs its drive tests using commercial equipment inside a vehicle. According to Dr Carter: "We drive around making voice calls as well as using the data network. Depending on the technology we are measuring, we can have anything up to 30 devices in the van at any given time."

The equipment can cost up to $300,000 per van – which Dr Carter admits is "expensive" but worth it because of the insights it delivers. "We get information on availability, reliability and throughput; we can also measure network level Layer 3 information including signalling between device and network. We can identify if a call is dropped and drill down into engineering information to see if it was a coverage or capacity issue."

Testing uses

The tests are useful to mobile operators for whom coverage and network quality are important, says Kester Mann, Analyst at CCS Insight. "This remains a real battle ground. We talk about all these new technologies, but the majority of customers just want a reliable network that makes good quality calls."

In addition, according to Wally Swain, Analyst at 451 Research, the statistical tests are useful when building networks. It is with this in mind that network tests

are often used by an operator's engineering division to make improvements. He explains: "[Operators think] 'We can't build networks based on customer surveys; we use engineering rules' – which are based on these assessments."

And what do operators themselves think of independent tests: Are they more useful than their own internal methods? Salt, which did not do well in P3's recent test, is critical. But as Jungermann points out: "This sort of thing is only raised when they lose."

At the same time, the results are not always clear cut: it is possible to win one type of test and lose another. For example, in the US, says Jungermann, T-Mobile is winning the crowd-sourced trials, but losing the Rootmetrics drive tests. "So, T-Mobile talks about why RootMetrics sucks and crowd-

> " We get a picture of our network and our competitors and we can take actions to improve

sourced is the best methodology."

Unsurprisingly, EE, which regularly comes top of UK network trials, is "very supportive of independent network testing". Gareth Hewlett, Head of Service Management at the operator, says: "It's useful in terms of helping us understand the experience our customers are getting – and you want to be winning; you want to be the best."

However, he concedes there is a problem with the many different ways of measuring and multiple business models underpinning this, because it can see more than one operator claiming they are the best network.

He says that in general, EE prefers "a scientific approach", where professionals "with proper equipment" are testing the network, as opposed to crowd-sourced information.

Testing internally

But even if they don't agree with the findings, external testing is useful for operators to get

an idea of areas requiring work – including coverage issues and outages – as well as giving them an insight into what their competitors are doing.

On the other hand, operators' own internal testing allows them to use their very large customer bases for crowd-sourced tests. They can also choose the perimeters: for example, EE has recently introduced its own metric, 'Time on 4G', to show the percentage of time a customer is connected to LTE when using its mobile network. Currently, the operator is using this measurement, at an anonymised customer level, to identify areas where additional coverage is needed.

T-Mobile Austria says its own internal tests help to improve their network and offer a better service to customers. Athanasios Avgeridis, Senior Vice President Operations at T-Mobile Austria, says its own tests in the region now cover the main cities, roads, railways and suburban areas. "We get a picture of our network and that of our competitors and we can then take actions to improve."

Michael Martin is Director of Infrastructure Services at Sunrise, which recently came top of P3's independent network tests in its region. He says the operator uses tests such as those conducted by OpenSignal alongside its own, conducted with a similar methodology including drive tests and direct customer feedback about the network experience. Martin says: "This helps to support the optimisation of the network."

Meanwhile, Orange performs a variety of different tests, according to Yves Bellego, Director, Europe Networks at the operator. As well as taking into account its net promoter score, the firm performs end to end technical testing which is done using vehicles, both internally and by external companies.

Competition among European operators remains fierce, and network tests are a useful way of ensuring quality is constantly improving. But there are many different methodologies used by operators internally and these even vary across the markets they operate in. This is in addition to the numerous methodologies used by the independent testing companies themselves.

Ultimately, both these factors will continue to make it hard to get a clear picture of which really is the 'best' network. Bragging rights look set to be fought over ferociously for some time to come.

VR and AR: Time for a reality check?

After years on the sidelines, virtual and augmented reality is starting to interest operators. Will the technology move beyond demonstrations into something more lucrative and innovative? **Alex Sword** reports

V irtual reality has been underwhelming until now," a lab technician says as Mobile Europe tours Telecom Italia's TIMLab facility in Turin. A blunt assessment but one largely based in fact. The technology and its sister, augmented reality, known collectively as extended reality or XR, have been around for decades and often been talked up as heralding a breakthrough in the way we live our lives without ever really delivering.

Although often grouped together, VR refers to a fully immersive headset while AR refers to graphics interposed on the user's vision.

Until now, the technologies have largely remained confined to niche consumer applications such as video games. When compared to the most popular devices of today such as smartphones, the devices are bulky and lack application support. They are also expensive while delivering comparatively little functionality. Popular models such as Facebook's Oculus Rift and the Microsoft HoloLens are

usually sold at around the €400 mark.

But recent months have seen some telecoms operators and vendors beginning to explore the technology. Ericsson, Huawei and Sunrise are among those recently holding trials of virtual and augmented reality. Deutsche Telekom launched its own app called Magenta Virtual Reality in September which allows users to view any VR content on an Android phone.

In TIMLab, researchers are running a live demo, where a user equipped with Facebook's Oculus Rift headset and a sensor connected to

In plain sight: Microsoft's Hololens (left) and HTC's Vive are just two of the VR headsets on the market

each hand can experience a tour of the tunnels under the Pietro Micca Museum. Within the simulation, a user can interact with objects such as a torch or even an iPad, and move around the tunnels. The demo allows the user to not only stand inside the historic locations but to examine them.

But demonstrations are one thing, even if they can unlock the secrets of Italian architectural treasures. In spite of these recent showcases, there is hesitation about whether it will ever play a central role in an operator's business.

According to Gartner's latest 'Hype Cycle' in July 2017, which traces the path of emerging technologies from first being discussed to actually becoming productive, it could take up to five years for VR to be widely adopted and as many as 10 years for AR.

Operators are split on its potential. On the one hand, Arnaud Vamparys, SVP of Mobile Networks at Orange, told a press conference in Paris in February that XR will "change the daily lives" of consumers through applications such as virtual tourism.

Gabriele Elia, who heads Technological Scouting, Trend Analysis & Future Centre at TIM, is also bullish, citing "a number of applications in home and in industries" and forecasts in the range of tens of millions of customers in an interview with Mobile Europe.

Less confident is Magnus Leonhardt, Head of Strategy & Business Development at Telia, who says the evidence for large-scale consumer demand is lacking and so are the business models that could monetise it. "We want to do things that have the potential to scale very large. I don't see why 10 percent of the Swedish population would have VR glasses on...They don't have it yet and it's been in the market for many years."

While a survey by Accenture last year found that 67 percent of consumers want to use VR and AR to learn more about a place they are

> ## " Connected experiences will become immersive experiences

visiting while the same proportion want to use it to learn new skills or techniques, there is little data available on if or what they would be willing to pay for it.

Even if the technology is bound for mass popularity, whether operators themselves will be the ones to make any actual money from XR is also unclear. Bengt Nordström, CEO of consultancy firm Northstream, lists several reasons why he doesn't believe the technologies are a volume play for telcos, the first being that they are not based on network capacity, as they primarily uses local computing rather than exchanging information with a data centre.

He adds that it will also take "quite some time" for XR to mature as the correct price points are found and apps are developed. Asked why operators are talking so much about the technology, he speculates that as the industry has had falling revenues over a 10-year period, when new technology appears "it brings a lot of aspiration and hopes that this will be an industry turning point".

Latent potential

One thing that could unlock virtual and augmented reality's potential is 5G. The recent demonstrations have been wrapped in the technology, or at least, the closest thing operators can get to it. VR and AR have been regularly cited as one of the key applications of next generation connectivity, appearing as regularly as the now familiar use cases of connected cars or smart cities.

Luca Bruera, Project Manager for the Virtual & Mixed Reality Team at TIM, explains that while fast connectivity is important, the most crucial step change required for VR is a "network so fast and responsive it becomes invisible". As avatars become more realistic, a low latency

network could share body movements or facial expressions as well as voice, he explains.

Peter Marshall, Marketing Manager Core and Cloud at Ericsson UK, who headed the vendor's recent technology trial in Krakow, expects XR to take advantage of the network slicing approach that is likely to be central to 5G architecture.

In addition, Shamik Mishra, Director of Technology and Innovation at Aricent, an engineering design company which counts tier one operators among its clients, says multi-access edge computing (MEC), another major part of the 5G network architecture, will be vital. "AR and VR are time-sensitive. All the algorithms, data augmentation and display need to happen at very low latency." Hosting the application on a powerful server nearby, rather than on the device or far away in the data centre, would allow the glasses to become slimmer and reduce the cost of the headsets.

Greater technology functionality, coupled with more affordable costs, could open the door to XR becoming a fixture in enterprise use cases. According to Gartner, by 2019 XR will be adopted in 20 percent of large enterprise businesses, while ABI Research has predicted smart glasses shipments to enterprises will increase at a compound annual growth rate of 227 percent from 2018 to reach 28 million by 2021.

Mail service DHL is one example of an enterprise already using the technology for logistics management, boasting of an average productivity boost of 15 percent in trials. Ericsson is using it to support engineers in its own production sites.

In this model operators could be selling the connectivity to facilitate XR, or, if Telia has its way, the associated IT services as well. "We are reshaping Telia to become a new type of player mixing IT and communications in a more integrated bundle in the future," Leonhardt says. "As part of that, AR and VR become extremely interesting."

This has included Telia working with a range of partners to build applications for teacher-led training and virtual classrooms. The approach, he says, is to develop a particular enterprise solution and seek the partnerships, with both start-ups and big internet companies, that make that work.

Mishra of Aricent cites other operator opportunities as providing navigation through real time images from crowd-sourced video streams from cars, as well as multi-player gaming and maintenance for industrial sectors.

These potential types of deployment dovetail with those suggested by Marshall at Ericsson, who says operators could deliver dedicated connectivity solutions, enable new kinds of services or, ideally, build new kinds of businesses offering digital platforms and infrastructure.

Hugh Swart, Head of VR and AR at Qualcomm is similarly bullish, but perhaps inadvertently betrays a potential downside of the technology if it was to become a mass market success. He compares the relationship of 5G with XR to that of LTE and music and video streaming. He says: "The operators gained a lot through enablement of 4G and these experiences. Similarly, the experience is going to move from the hand to in front of the eyes, and connected experiences will become immersive experiences.

"In order for true immersive experiences to be deployed, we will need good 5G infrastructure and deployment. Network operators have a lot to gain from enabling this end-to-end experience and ecosystem for their companies, employees, brand and customers."

They may have a lot to gain, but potentially a lot to miss out on. Many operator CEOs have spent the LTE era bemoaning GAFA – the ubiquitous Google, Apple, Facebook and Amazon – for riding roughshod over their networks and creaming off considerable profits. If VR and AR are not to go the same way, operators will have to ensure they have proper skin in the game. Given a lack of consensus about whether the technology will actually be a success for operators, there's a lack of clarity about the future of virtual reality.

News Spotlight

Nokia looks to Great White 5G hope with new ReefShark chipset, network products

Nokia has launched a new end-to-end 5G network architecture that uses AI-based automation and claims to offer up to three times more data capacity per cell site, as well as 30 percent lower total cost of operation.

Future X will be showcased at Mobile World Congress in Barcelona and is powered by the Finnish vendor's new ReefShark chipset.

Shipping in the third quarter of this year, Nokia said the new range of chipsets gives a significant boost to infrastructure performance.

It said that by deploying its ReefShark chips for radio frequency in Massive MIMO, the size of the antennas can be halved. Power consumption in baseband units can be cut by 64 percent, Nokia added.

The ReefShark for compute capacity chipsets can be plugged into its existing AirScale baseband modules, tripling throughput from up to 28GBps to up to 84GBps.

The chips, which are currently being trialled by 30 operators, can also implement machine learning techniques into their networks, such as beamforming, Nokia said.

Neil McRae, BT Chief Architect, said: "By incorporating ReefShark into our network we will leverage the huge network performance improvements that will allow us to unleash the full potential of 5G."

Nokia said it wanted its Future X products to cope with the increase in traffic and complexity of services that 5G will demand through network slices.

The portfolio will comprise radio software, based on 3GPP's recently published Release 15, more than 20 new radio access products, active antennae including new Massive MIMO products for 5G and LTE, small cells, and additions to its Anyhaul range of products that aim to shift radio access and packet core functions to the cloud.

Other products in the portfolio include new cloud-native packet core solutions that offer new virtualised and physical deployment capabilities, as well as support fixed wireless technology. Nokia will also offer consultancy services on rolling out 5G networks.

Telefónica taps Nokia, Ericsson for 5G pilots in Spain

Telefónica is launching 5G pilots in two Spanish cities as it looks to gain real-world feedback on the next generation technology.

The 5G Technological Cities project will see the operator working with Nokia and Ericsson to establish testbeds in the cities of Sergovia (pictured) and Talavera de la Reina.

Taking place between now and 2020, the project will upgrade the network to support peak speeds to up to 10GBps and latency of between 1 and 5ms. It will also aim to provide the capacity needed to support 100 times more connected devices.

The new networks will initially be based on non-standalone 5G technology, which requires a 4G network for support. The operator will transition to standalone 5G in the future, but did not specify when.

Telefónica will deploy some of the improvements as upgrades to the existing 4G network, meaning that citizens will be able to benefit from them using existing devices.

The project will also explore a range of practical 5G use cases made possible by the technology, with possible areas including virtual or augmented reality and connected industry. One project sees Ericsson and Telefónica working with the City Council of Talavera de la Reina to use the network to launch unspecified new tourist services.

Augmented reality to see 2018 boom as smartphone capabilities grow

The number of augmented reality (AR) users will exceed one billion in 2018, according to Deloitte, as technological advances make it more widely accessible.

The firm's TMT Predictions 2018 report predicted that billions of smartphone users will download apps or operating system updates allowing them to create their own AR content.

In addition, tens of thousands of apps using AR will launch during the year, possibly alongside a dedicated app store, Deloitte predicted.

The adoption of the technology will be driven by a combination of hardware and software upgrades, including the incorporation of AR functionality into operating systems.

Last June, Apple brought augmented reality into iOS by launching ARKit for developers to build new kinds of services.

Despite the take-up, Deloitte claimed revenues from AR content will be less than $100 million globally for the year.

"The quantity of premium AR devices will swell and lower barriers to entry should increase the supply of apps that feature AR throughout 2018," the report said, adding: "2018 is far from the endpoint for AR; many further years of evolution are likely to enchant users and enhance their creations."
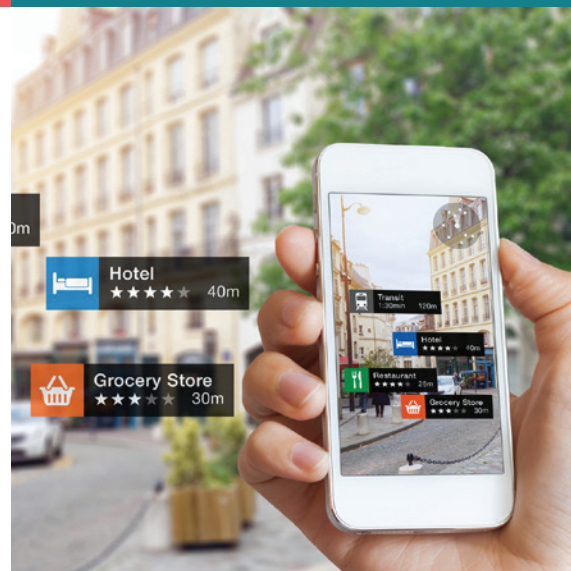
Proximus to boost Belgian LoRa network in 2018

Proximus is dramatically extending the coverage of its LoRa network, with new hardware set to be deployed by IoT player Kerlink.

The vendor helped the Belgian operator launch its LoRa network in 2015 by deploying 130 of its Wirnet Stations.

By the end of this year, Proximus's footprint is set to increase by more than fivefold with over 1,000 Kerlink stations rolled out.

The stations provide carrier grade, long-range, two way and geolocation ready connectivity, Kerlink said.

Joke Tisaun, Proximus IoT Product Manager, said: "This new IoT network has already stimulated innovations and opened the door to new business models. This is the case for some interesting applications we support today, like measuring the fullness of glass containers in order to optimise pick-up routes and enhance customer experience."

Rival Orange Belgium has differed from its rival by choosing NB-IoT to power its Internet of Things network.

Vodafone UK CTO steps down

Vodafone UK CTO Jorge Fernandes is stepping down and will be replaced by an insider from the operator's business division.

Fernandes left his position on 1 February after handing over the reins to Scott Petty, Vodafone Group Enterprise Technology Director.

He parted company with Vodafone after a three-year tenure as CTO to take up an unspecified new role overseas.

The exec, who worked in various positions at Vodafone since joining in 2002, oversaw a multi-billion investment programme – largely focused on improving the company's network – during his time running the opco's technology assets. This project has seen Vodafone expanding network coverage, deploying new technologies such as Massive MIMO and introducing support for HD Voice.

Petty has been in his current role, which sees him lead the enterprise division's technology strategy and develop its products and solutions, since 2013. Prior to joining Vodafone in 2009, Petty worked at Dimension Data as CIO.

The changes at the operator will also see Kye Prigg, Head of Mobile Networks, adding responsibility for fixed networks to his brief.

Petty said: "I'm delighted to be joining Vodafone UK at this exciting time, as we drive forward the likes of artificial intelligence, 5G and full fibre broadband, all of which will power the new digital economy.

"We aim to be the key enabler of this digital revolution, drawing on our leading position in areas such as IoT and unified communications to transform how businesses operate and how we live our lives."

The Wireless World

The latest news and innovation from around the globe

JORDAN

Orange

Orange is launching 4G+ technology in Jordan, aided by its acquisition of two chunks of 10MHz spectrum in the 2.6GHz frequency band.

The operator plans to offer subscribers speeds of up to 250MBps through MIMO, carrier aggregation and high-order modulation technologies.

The operator will cover most of the country with the technology, where its 4G coverage currently extends to 92 percent.
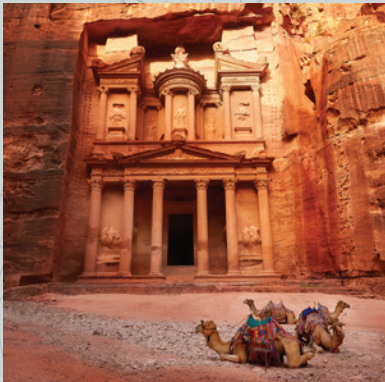

PALESTINE

Wataniya and Jawwal

Palestinians in the West Bank will be able to access 3G services after the Israeli government removed longstanding restrictions.

Local operators Wataniya and Jawwal launched data services in late January after the Israeli government provided frequencies and removed a ban on the import of equipment.

Israel had cited security concerns as the reason for the ban.
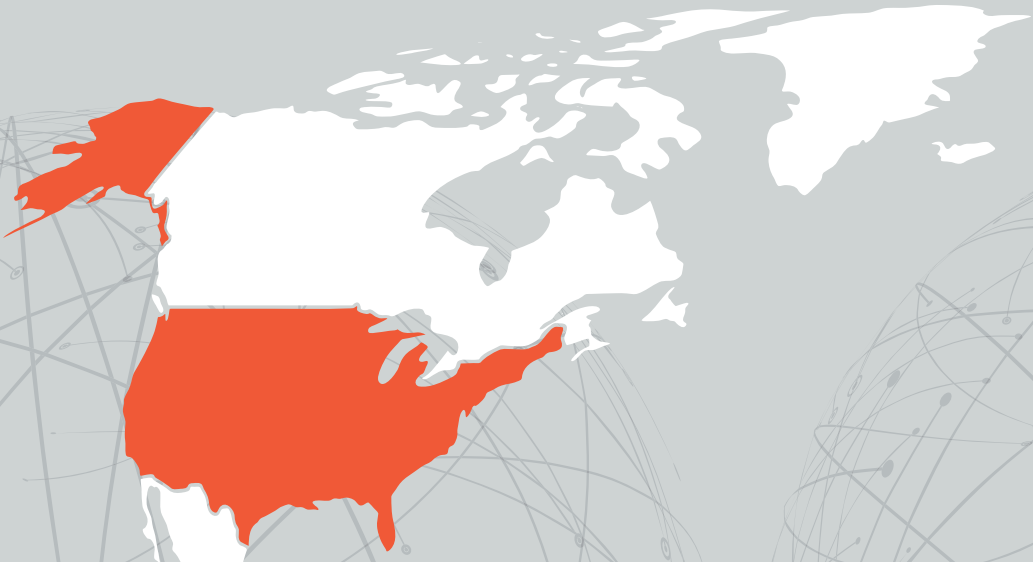
UNITED STATES

AT&T

US operator AT&T plans to be the first US operator and one of the first worldwide to launch commercial 5G services in a dozen cities by the end of this year.

The services will be based on the latest version of the 5G New Radio standard, ratified by 3GPP in December 2017.

SOUTH AFRICA

MTN

MTN announced it was working with Ericsson to launch 5G services in the country after conducting what it said was the first trial of 5G in Africa.

The trial hit throughput of over 20GBps with less than 5ms, using prototype radios and commercially available baseband equipment.

The companies will work together to identify use cases and applications for industries such as mining, transportation, agriculture, manufacturing and utilities.

PAKISTAN

Zong

China Mobile-owned Pakistani operator Zong launched a smart car solution based on 4G connectivity.

The on-board diagnostics device allows users to monitor their driving through data such as RPM, speed, fuel level and mileage, as well as providing tracking capabilities.

It also turns the car into a Wi-Fi hotspot using cellular connectivity for backhaul.

JAPAN

NTT DOCOMO and SoftBank

Japan's NTT DOCOMO and SoftBank are both working with vendor Sequans to launch IoT devices and applications.

NTT DOCOMO will use the French vendor's Monarch LTE Platform, an LTE-M chip solution, to launch and develop LTE-M devices and applications on its network.

SoftBank, meanwhile, will use the platform to launch both NB-IoT and LTE-M services.

INDIA

The Indian government is launching a 5G testbed at a Madras university.

Hosted at Indian Institute of Technology Madras, the centre will work on the development of IoT and M2M applications.

The testbed will explore applications specifically suited to India, including in the manufacturing, energy, utilities, public safety and health sectors.

AUSTRALIA

Optus

SingTel-owned Australian operator Optus plans to launch fixed wireless services via 5G.

Slated for early 2019, the launch follows a successful outdoor trial of 5G New Radio technology, which demonstrated 2GBps download speeds.

Optus plans to showcase 5G technology during the 2018 Commonwealth Games, which are set to take place in April in Gold Coast.

The Final Say

David del Val Latorre, the head of Telefónica's innovation arm and board member of the Telecom Infra Project, shares learnings from the Facebook-led initiative

David del Val Latorre, CEO of Telefónica R+D and Director at the Telecom Infra Project

What is the Telecom Infra Project and why is Telefónica involved?

The Telecom Infra Project (TIP) is an industry association that is exploring new ways of developing and deploying network infrastructure. For Telefónica it is an opportunity to explore novel ways of tackling very difficult technical and operational problems.

Despite major operators taking part, TIP only contains Nokia out of the three main vendors. Is TIP making traditional vendor relationships obsolete?

Not at all. Telcos have a symbiotic relationship with our traditional vendors that spans many years. We expect that most of the innovation that we will see in the coming years in our industry will come from them.

In TIP we are exploring other avenues, that for sure will become a source of inspiration for the technical teams of the traditional vendors.

TIP derived from Facebook's similar data centre initiative, the Open Compute Project. What are the most important lessons traditional telcos can learn from an internet company?

The world of IT and cloud moved to general-purpose hardware running open software and virtualised functions almost a decade ago. Telco networks have been in that journey for a few years now, and can definitely benefit from the learnings coming from other industries.

In addition, internet companies are very adept at gathering data and using machine learning technology. Although we won't necessarily use similar techniques, as we care deeply about the privacy of our customers, we can still learn from OTTs novel ways of using data to improve our service.

What major areas is the TIP working on this year?

There are many areas of work, ranging from edge computing to machine learning to open cellular networks and virtualised RAN. Many project groups are reaching maturity and will start running technical and commercial trials in 2018.

Are telcos taking on a risk by sharing their core business with Facebook, a potential competitor?

We are very used to collaborating with competitors that share common interests with us. All the collaboration among telcos in the last 25+ years to agree on common standards or to share access networks is a clear example of that.

Facebook shares with us the vision of a world that is more connected and better connected. It makes sense that we work together to reach that vision, even though we can disagree or compete in other areas. me

Find faults wherever they're hiding.

Smarter network in sight.™

Because "good enough" mobile network testing just isn't good enough anymore.

As significant transformations take place in the radio access network (RAN), you'll need smarter, scalable test and monitoring solutions to help you find and fix faults faster—before subscribers are impacted. Let us help you seize the opportunities of the RAN evolution.

We're the network test, monitoring and analytics experts and we've got your success in sight.

The smarter way to test.
EXFO.com/SkyRAN

EXFO