NETCRACKER SPECIAL PROMOTION:

Telefónica

Telefónica Global CTIO Enrique Blanco
and Netcracker CCO Frank DeTraglia
on how their strategic partnership is
driving digitalisation transformation

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The price of change

Former US president Bill Clinton once said "the price of doing the same old thing is far higher than the price of change". He could well have had telecoms in mind. The tensions between wanting to change and the fear of getting it wrong have dominated this decade, as the Four Horsemen - Google, Apple, Facebook and Amazon - have torn a swathe through the world, profiting from connectivity and building products and services telcos can only dream of.

While operators maintain they have to change, the problem is the weight of the past, of hardware and systems that are nigh on impossible to unpick, and whether the telecoms industry has the same appeal as heading to Silicon Valley or striking out on your own.

5G could change that, which is why it is the subject of this issue's Insight Report. We explore whether Europe has the same appetite for fixed-wireless access as other markets, whether the vendor hope that 5G will lead to a cash bonanza is well-founded, and look at Deutsche Telekom, Telia Company and Telefónica's early 5G trials.

We speak to Fotis Karonis, Managing Director, Mobile & Voice Converged Services at BT. Formerly EE's CTO and a CTO of the Year winner at this parish, Karonis has hands-on knowledge of how to effect change at a telco. He talks of operators' role within new ecosystems, as well as how EE is fitting into BT following the companies' merger.

There's a special report from Mobile Europe and European Communications' IoT in Telecoms conference, where telco executives explored the myriad of issues affecting the space, from enterprises to the operator role. Finally, we take a look at the small cells market, one that has promised to change the European market but delivered very little. Will next year be their year (again)? Or is the advent of 5G the boost the technology truly needs?

Change also affects this title, which is why you are holding the first issue of Mobile Europe and European Communications. We wanted to reinvent ourselves to deliver the inside track on telecoms operators' technology strategies, bringing together the heritage of both titles and their championing of change, whether it's 5G or fibre, the Internet of Things or digital transformation.

You'll still get the best insight into the telecoms industry, in print and online. Email me graeme.neill@mobileeurope.co.uk and tell me how we are doing or tweet @mobileeurope.

Here's to the future.

Graeme Neill
Executive Editor

NetNumber: building scalable and flexible private LTE networks

L TE is no longer a technology solely for mobile operators, writes Mark Noe, Senior Director, Business Development, NetNumber. LTE has evolved to become simple and affordable for a much larger market, particularly within the enterprise. LTE advantages include:

- Coverage: LTE technology delivers superior indoor and outdoor range compared to Wi-Fi with improved interference characteristics that enable new wireless use cases not possible before.
- Capacity: LTE can now easily accommodate a large number of wireless devices and high data rate applications such as video conferencing, HD voice, surveillance, and social media.
- Seamless mobility: LTE provides greater service continuity in highly mobile environments, such as public safety and defense.
- Ubiquitous user devices: LTE enabled smartphones and tablets are widely available and already used/owned by the user base supporting a BYOD model.
- Interoperability and security: 3GPP standards are closely adhered to across vendors and include some of the strongest security standards (encryption, key management).

Enterprises worldwide such as government, public safety, defence and mining are discovering how LTE technology opens the door to new wireless use cases that provide business transformation. They are also learning the advantages of replacing or augmenting their existing wireless solutions (Wi-Fi) with cost-effective private LTE network technology. A private LTE network can provide a compelling alternative to expensive commercial cellular services and unreliable or costly Wi-Fi-based solutions.

Deployment model examples

SIP digest over LTE/Wi-Fi deployment model: Many enterprise and defence organisations prefer to use an over the top SIP client app for their video, voice, messaging or other collaboration requirements.

There are many standards-based SIP client applications available that work with the TITAN Edge Private LTE solution. The more advanced SIP clients provide inherent features for small group environments such as those at an edge location that permit HD voice/video, messaging, call waiting, multiple lines, transfers, and presence without any additional server applications.

SIM modules on the end user devices would need to be managed by the enterprise for an LTE-based deployment (not necessary if just Wi-Fi). End user devices may support dual SIM slots to enable hybrid network usage or eSIM options may also be used.

All components used for the SIP digest deployment model are 3GPP compliant and are investment protected if/when moving to VoLTE at a later date. The diagram below illustrates the components used for the SIP Digest use case:
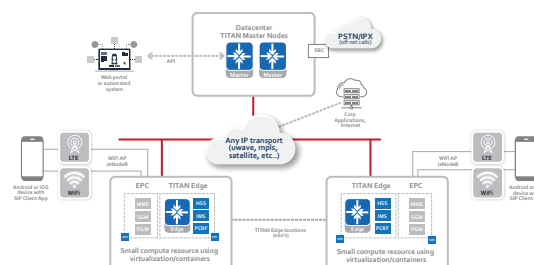
VoLTE deployment model

The VoLTE 3GPP standard has evolved over recent years to enable the all IP mobile network. Carriers are still migrating to VoLTE as they continue to support and evolve existing 2/3/4G-based architectures. For the enterprise considering a private LTE solution, VoLTE provides a solution that is basically the same as a large carrier implementation, but on a much smaller scale. VoLTE enables the iOS or Android native client interface to be used just like how your mobile device works today with your provider.

SIM modules on the end user devices would need to be managed by the enterprise for the VoLTE deployment model. End user devices may support dual SIM slots to enable hybrid network usage or eSIM options may also be used.

The diagram below illustrates the components used for the VoLTE deployment model.
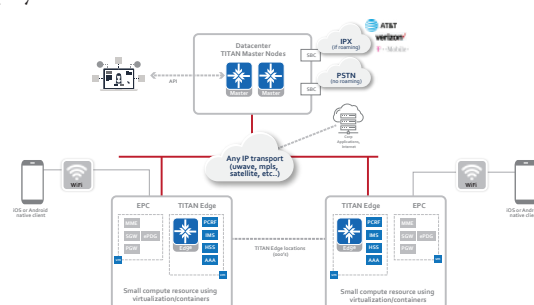
Selecting a spectrum solution

One of the more complicated steps of implementing a private LTE solution is determining the best RF spectrum solution for the needed coverage area. RF spectrum has many dependent components that include frequency band, geographical area, licensed, unlicensed, radio equipment options, etc. The main idea is that you don't use the same frequency, at the same time, as someone else in the same area, which would result in interference. For some use cases, such as offshore and very remote areas, the spectrum usage may be more flexible. There are multiple options available in terms of licensed and unlicensed spectrum for private LTE solutions. Each country has their own government body that regulates which frequency spectrums are utilised and who can use them.

BT/EE CTO:
Building a head of steam for 5G

After building one of Europe's fastest growing LTE networks, **Fotis Karonis** is now juggling EE's merger with BT alongside its emerging 5G strategy. He talks to **Graeme Neill** about pressure, partners and pragmatism

Time is tight when I sit down with Fotis Karonis about 100 yards from King's Cross train station in London. The ebullient Greek is running straight from our interview to a technical team meeting some 100 kilometres away in Cambridge. The challenge is that we've plenty to cover; since Karonis was the winner of Mobile Europe's CTO of the Year award in 2015, EE has merged with BT. His job has also changed from the succinct CTO moniker to the more unwieldy Managing Director, Mobile & Voice Converged Services.

What this means in practice is that Karonis has added the platforms, people and services that handle technology at BT into his more traditional mobile duties. It also includes fixed voice, a critical part of BT's business given its role as the UK's incumbent operator. A straightforward change, then? "No pressure," he laughs. "I didn't have enough pressure! But I'm really happy because I like the teams; it's a nice culture… they are very frontline, very technical but also serving customers daily."

We meet some weeks before EE announces plans to further integrate its products with those of BT, with the aim of creating a fully converged network by 2022. This continued customer focus is no surprise, given how it was central to EE's success under former CEO Olaf Swantee. The ubiquitous presence of Footloose actor Kevin Bacon that underpinned its advertising helped the mobile operator put almost 20 million of its subscriber base onto 4G, in spite of the UK being one of the last European markets to launch LTE.

Karonis says the attitude is still the same, describing the operator as "pace setters and trend setters", but he says what has changed dramatically since the BT takeover in 2016 is the need to upgrade capacity. He says: "The more people will use connectivity, the more they demand to do it anywhere, whether it's video usage or whatever, at any point. We still have a lot of work to do."

He says the basic means of tweaking spectrum management is a solution – EE has been shifting its 2G customers off 1800MHz and trying to use more of its 2.6GHz holding – but he says the operator, like any other, is under pressure to constantly evolve and strengthen its weak spots. When I ask what these weak spots are, Karonis waves towards the concourse outside King's Cross station.

He says: "Because the patterns of people have evolved. It's not like three or four years ago. People are on the move and use video. They want to do the same on the beach as at King's Cross. [The question is] where do we invest? Where do we best invest? How do we have early warnings of patterns during the day, when people have dropped calls?

"To become what we call the 100 percent operator, there is still work to do and that is to reinforce the sites that have a massive amount of consumption all of a sudden. Between the hours of 4pm and 6pm, we have a step change in King's Cross or [fellow London station] Victoria, to give examples. To understand this need and how quickly we can forecast this change so we can do things before it comes an issue."

The problem with percentage points

This wish to meet changing customer demands also extends to the breadth of its network. The operator sits at 90 percent geographical coverage currently, no mean feat, but the hard work is still to come if it is to hit its 95 percent target by 2020. Karonis blows out his cheeks as he describes the process involved, using helicopters to lift and put down towers or using "tank-like" cars to reach the remotest of sites. "There are no roads so how do you get that landmass coverage if there is no way to access it? You have to build this access to put up the site," he says. The operator describes the cost as "inordinately" expensive, noting that each percentage point of coverage makes their subsequent job even harder. On the plus side, Karonis notes: "Very good sheep and goats. Fantastic."

Satellites are another option, as are the drones and balloons that caught the eye as connectivity solutions when they were first launched several years ago. But the latter, which have been used to connect punters at the annual Glastonbury music festival in rural England, are not seen as a long-term scale game. "It can be used if the mud hits the fan," as Karonis puts it before describing them more seriously as "tools of extreme usage".

It does beg the question of why do it at all if it is that difficult? Karonis puts an altruistic spin on it opening up what is likely to be a captive market to EE, arguing the economy of 2020 should not be held back by a lack of broadband. Returning to the challenges regarding the costs involved, he adds: "We can see the economics are not on our side. On the other hand, mobility is about 100 percent, we need to cover where people go. That is our vision of how we see the world and it does push our ecosystem to beyond boundaries. At the end of the day, things change. Postcodes that existed three years ago are much different today."

Another reason is the operator's involvement in the UK's Emergency Services Network, which is set to replace the country's legacy network by the end of next year. Concern is growing about the target date for launch, after delays in starting the migration of shifting services and, farcically, a government report into the problems of its implementation missing its own deadline. Karonis enthuses about the potential of the network, which also involves integration, support and devices provided by partners, but when asked about the delays and teething problems, he pointedly replies: "From our perspective we have delivered all of our milestones. Every single milestone."

Assuming these problems are ironed out effectively, Karonis says the excitement of such a network is it delivers an early peek at one of 5G's core features – network slicing. The emergency services network will effectively sit as a slice above the conventional LTE network with understandable priority over conventional traffic. He says the experience of the ESN will give the company a firmer grasp of what can and should be done ahead of 5G.

New tricks for old dogs

While 4G is far from dead – Karonis says there is a "massive amount of improvement capability" in LTE and that will be the foundation of what is to come – 3G is a different matter. He says that a challenge facing operators, including EE, is shifting its base off 3G in an "elegant" way. This is a problem that particularly affects its enterprise customers with legacy handsets and Karonis casts an envious glance at other sectors at how they handle these kinds of upgrades.

He says: "Our industry seems to be quite generous at times when compared to the IT industry. They just say 'I am not supporting that anymore' when it comes to new versions of [Windows] or Oracle... Whereas we seem to be supporting anybody, any car on any highway."

He says this elegant way is to incentivise customers to make the leap, similar to what has happened in the United States. "We have a role to play here as operators and need to educate. Things are moving fast and we need to give the options to people about understanding the benefits of [switching to 4G] rather than say 'it's like that'." The ultimate goal is to hold around 5MHz of 3Gspectrum from 2020 for M2M devices or UK visitors. The rest will be poured into the spectrum bank.

It will be put to good use and quickly. EE is seeing the immediate benefit of 5G as building capacity at sites that are close to be maxed out.

Only connect: Fotis Karonis' role has grown since the merger with BT

Scale is key – operators are in the process of learning and establishing new business models as best they can with LTE and then applying them more broadly to next generation technology. Karonis says: "Scale is massive. Do we need that this year or next year? I think not but we have to build those capabilities."

Nevertheless, the deadline according to Marc Allera, the CEO of BT's Consumer division, which includes EE, is late next year. The initial focus will be on fixed/wireless access, delivering targeted capacity to those who need it. "It can provide a lot of coverage, quite impressively, in very [wide] city areas," Karonis says. But he has the

> ## " EE is seeing the immediate benefit of 5G as building capacity

same pragmatic approach to other CTOs in noting that 5G is at least a decade-long play. He says: "There are cycles...When you build networks, it doesn't come over two months. It takes time to build those capabilities, evolve core systems etc etc. These cycles are what we saw with 4G when we launched in 2012."

His thinking dovetails with BT Group CEO Gavin Patterson, just one of an increasing number of C-suite executives starting to get antsy about the chatter surrounding 5G. He raised concerns last

One more time: EE has used Footloose star Kevin Bacon (pictured here with Britney Spears) to sell the strengths of its network

year about a lack of business cases in the short term and risks that a multitude of connected devices could open the door to.

Some have blamed the vendors for the market hype, with the big beasts in the industry keen to bring forward some much needed business. Karonis says both operators and vendors need to work together in a realistic manner. He adds: "We have to be pragmatic on what are the economics. On the other hand, what is the value; on the other, what is the investment required? It's a balance and by working on that balance,

> ## "EE's role within 5G is connecting a variety of ecosystems as much as it can

your needs are becoming well understood by that vendor partner."

He says through discussions vendors are starting to come around to the operators' point of view, nothing that there is a learning curve for both parties. He says by operators putting more into engineering, they can be clearer on what they need from vendors, which in turn simplifies the process.

Transform and roll out

Where Karonis is more effusive is 5G's potential to transform industries and the telecoms industry's role within it. He says: "Connectivity is not a commodity, it is part of your lifestyle, critical for companies. So we need to ensure coverage, quality of our networks, strong focus on customer experience and resilience."

He says EE's role within 5G is connecting a variety of ecosystems as much as it can. APIs can help the likes of Amazon, Apple or Google plug into its network, he says, and leave the operator to concentrate on what it is good at, whether that's LTE or 5G. He says: "You just say 'alright, do we need to have everything in-house? Where do we differentiate?'

"Your core business becomes stronger and stronger because by having a great customer experience on your core product, which means you don't have dropped calls, you are micromanaging your availability, you have proactive capacity management, you are very granular about where you put your money in, you are very relevant with these companies."

No sign of an EE social network or smart speaker then. Is this a sign the operator knows it can't do everything? "Yes, absolutely. And vice versa. The experiment of doing stuff and building an ecosystem is not the reality for us. The evolution of communication happens with the infrastructure and services and that opens a variety of applications for companies and industries.

"The important thing for a really good communications operator is to

be blended in every industry and that's where I see my role. I see mobile and communications at the heart of all industries; car manufacturers, manufacturing industries, the energy industry, aviation etc."

He says the car industry is a case in point. The telecoms industry will play a key role but it is one part of a vehicle requiring artificial intelligence, software, energy efficient batteries and the like. He says: "I want to contribute to V2X, through 5G, lower latencies, higher capacity, predictive modelling. We can help using these technologies."

He adds: "We want to make other industries much more effective, much more human centric, much more real-time, reliable and provide that added value. That's why I'm very much an advocate of [mobile] not being a commodity. It is not just a price war, it is helping other people and other activities."

In some cases then, operators can serve as the junior partner albeit a critical one that is lending its services and expertise rather than blithely assuming they can do everything. Karonis says: "We need to evolve our business model and provide that help, enabling other companies to perform better. That is a win-win situation, a complete partnership. We believe, as we always did, that our DNA was about creating an ecosystem partnership where we are great at what we do here, but at this point this is where you guys hook on. This collabora-

tion is even greater for our customers."

The long term is starry eyed but it is the present where EE has been uncharacteristically quiet about 5G. Anyone who has seen the image of Kevin Bacon dressed in a red PVC catsuit a la Britney Spears on an EE advert knows it is an operator that is happy not to do things on the quiet. However, 5G has been different with EE very much focused on LTE, publicly at least.

Karonis bristles slightly when I ask him if EE is being less noisy on 5G compared to what it was with LTE, and particularly in comparison to the likes of Deutsche Telekom or Vodafone's litany of tests, trials, demos and firsts. He says: "No, no, no, I wouldn't say that. We are absolutely working on design elements and are very close and motivated to be in the first tier.

"I am not sure about competitors; I see a lot of proofs of concept. But we are talking about the real stuff and there's an element of how do we use 5G in a way that it provides values. It's not to do a fireworks display. It's how does this actually provide value. It's a short term thing rather than a transformational element."

He concludes: "We certainly want to be one of the first waves [but] we also don't want to be the first to make any mistakes." And with that, he's gone. Trains and technical teams wait for no man.

High speed: EE has been using balloons among its temporary solutions to connect areas with poor coverage

Telefónica Global CTIO Enrique Blanco (left) and Frank DeTraglia, Chief Commercial Officer at Netcracker Technology (right)

Telefónica and Netcracker: Driving digital transformation on a global scale

As the world continues on its path towards the digitalisation of almost everything, the role of the communications service provider has shifted dramatically. But a 2017 ICT Intuition survey showed that while most service providers have embraced the prospect of digitalisation, the majority are unsure how to create, execute and enable a successful digital transformation.

Two senior executives at the forefront of digital transformation gave Mobile Europe and European Communications insight into their approaches and outlined why they have succeeded in an area that some rivals can find more difficult.

Enrique Blanco, the Global CTIO at Telefónica, oversees perhaps the largest digital transformation initiative in the communications industry, covering fixed, mobile and converged networks, as well as a diverse residential and enterprise customer base across Europe and Latin America.

Joining him is Frank DeTraglia, Chief Commercial Officer at Netcracker Technology, a strategic partner of Telefónica that is tasked with supplying the right solutions and services to enable its large-scale digital transformation.

Mobile Europe and European Communications: Enrique, can you give us a quick overview of Telefónica, your global presence and some sense of the scale of your business?

Enrique Blanco: Telefónica is one of the largest telecommunications companies in the world by market capitalisation and number of customers. We provide comprehensive, high-quality offerings over world-class fixed and mobile networks.

Telefónica operates in 17 countries, split into two geographic regions: Europe and Latin America. We have more than 343 million customers, of which 272 million are mobile, nearly 11 million are fibre and cable customers, and more than eight million are pay-TV customers. We employ more than 120,000 employees.

From January to December 2017, Telefónica had consolidated revenues of more than €52 billion.

Frank, as a strategic supplier and longstanding partner of Telefónica, tell us a little about Netcracker.

Frank DeTraglia: Founded 25 years ago, Netcracker serves more than 250 fixed, mobile, cable and satellite providers today in close to 100 countries around the world. We deliver innovative BSS, OSS, virtualisation and cloud solutions that help our customers across industries become successful digital businesses.

Our parent company, NEC Corporation of Japan, is a global conglomerate with more than $25 billion in revenues, over 110,000 employees and a presence in practically every country in the world. Like our partner Telefónica, we have a long history and experience in the communications industry, a strong customer focus and the desire to help our customers maximise their potential.

Enrique, you were the CTIO and recently you took over as the Global CTIO, in charge of both the network and IT. Can you give us some insight into how bringing together both network and IT under a single organisation will help in the digital transformation at Telefónica?

Blanco: In the long journey towards the digital transformation of the company there is no doubt that technology is the key. Technology is the critical tool that we are using to transform this company. But to maximise the value proposition of the technology, network and IT have to work as a single team, adding, unifying and homogenising their approaches.

This merging of network and IT is a natural process because the boundaries between the IT world and the network are blurred. And virtualisation further accelerates this new way of working which strengthens the integration of network and systems functionalities.

But it is important to recognise that any benefit of digital transformation at Telefónica has to be felt directly by the customer. And this is not possible without end-to-end digitalisation that covers all systems, network processes and applications to guarantee that the customer has a real digital experience in any interaction with Telefónica.

That is the reason we are focusing on full stack deployments, assuring that all of Telefónica's capabilities and assets support these deployments. There is still a long way to go, but it is clear that we are on the right path, as we already see clear results of execution. Ecuador is an example of this, with the consolidated full stack BSS and OSS. Other examples in our footprint are Telefónica Business Solutions, Uruguay and El Salvador with many others yet to come.

Since all these projects require seamless integration between network and IT, they need excellent solutions' design and an impeccable execution model, coupled with strong project governance and execution. This is why we have redefined our strategy to work with more partners best suited to our model. Netcracker is one of them. We are using all the ex-

perience that we had in the network and are taking it to the systems. The case of OSS is an example. We are leveraging our successful approach in OSS and bringing it to the field of BSS.

We also want to follow the success of full stack implementations through metrics that really measure progress beyond the number of clients. We want to know how these implementations impact the improvements of quality indicators (CSI, NPS, etc.). The goal is to have a new operating model based on new processes that allow us to introduce new products and services more quickly while making us more digital. And having a full alignment of network and IT is fundamental to this.

Can you explain the scope, scale and nature of this complete digital transformation?

Blanco: From what we've seen, our transformation is probably the largest one to date in the communications industry, as it reaches across dozens of countries and most of our 340 million plus customers.

There are four key areas of emphasis driving our digital transformation. First, maintaining network leadership through the use of new virtualised network elements and IP communications and migrating away from legacy systems by keeping a focus on new technologies such as SDN, eSON and 5G. Second, we need to automate core processes in order to enable more

> " **I can say with confidence that Netcracker has been a strong partner for us**

efficient sales, service provisioning and issue resolution through the use of full-stack solutions with minimal back-office support.

Third, we must deliver a world-class digital experience which enables enriched interactions with customers. Finally, our program must create a distinctive digital value proposition that aligns our offers to customer needs in real time.

Frank, can you tell us about Netcracker's role in supporting and enabling Telefónica's digital transformation?

DeTraglia: We are working closely with Telefónica across the four domains that Enrique mentioned; we are providing a full-stack solution comprised of BSS, OSS and virtualisation capabilities.

For example, Telefónica Business Solutions is using an end-to-end BSS/OSS stack from Netcracker to help it become a more automated and efficient service provider by enabling the faster delivery of business services. In Ecuador, we are enabling efficient service provisioning and automation through our real-time BSS and OSS.

Meanwhile, our Digital Customer Enablement platform covering billing, CRM and point of sale is helping Telefónica in Uruguay to optimise critical customer-facing processes. Finally, our cloud-based, multi-country hosted BSS solution is enabling five Telefónica operating companies in Central America to create a distinctive digital value proposition while benefiting from the economics of a cloud platform.

Enrique, given the critical roles that partners play in your transformation journey, what are you looking for from vendors?

Blanco: We look for a number of characteristics when identifying prospective partners. First, the technology must be best in class and based on industry standards. The solutions should be fully functional out of the box and meet our extremely aggressive data security standards. This is particularly important because we have made a promise to our customers to keep their digital information safe.

We also look for experience; our partners should be able to showcase a proven track record of delivering digital transformation projects and the ability to operate on a global scale. It is vital that our partners can execute. All of the above means little if our partners cannot deliver projects on schedule. I can say with confidence that Netcracker has been a strong partner for us.

DeTraglia: I could not agree more. As much as we are known for innovative technology, we always ensure that the execution of projects meets Telefónica's expectations. We use proven methodologies while investing in new and faster approaches, such as DevOps. We leverage joint innovation centres for quick conceptualisation, rapid prototyping and speedy deployment. We also offer strong project management, visibility and governance to ensure on-budget and on-time delivery. At the end of the day, we're measured on whether we were able to successfully deliver complex and mission-critical projects in alignment with our customers' expectations.

Enrique, can you tell us if you have seen measureable success in your multiple ongoing projects?

Blanco: While we still have many projects to complete, we have seen tangible results both at macro and micro levels. For example, our mobile data revenues grew by almost 17 percent. In the enterprise segment, offerings like security grew by almost 25 percent.

On the digitalisation side, we saw sales more than double through self-assisted channels and the number of payments made through self-assisted channels increased by more than 12 percent. We have also been able to enable greater remote troubleshooting and problem resolution, with calls into contact centres decreasing by 30 percent. We expect to see even more impact across the board as our ongoing programs continue to evolve and progress.

The implementation at Telefónica Business Solutions has been recognised in the industry for both innovation and speed. Can you provide some insight into this award-winning program?

Blanco: Speed was one of the key elements we needed to implement in our wholesale business practice. Our enterprise customers are digitalising at a rapid pace and are asking for more flexible connectivity, digital interaction portals and interfaces and the ability to order and manage services on demand.

Given the urgency of our customer requirements, we decided to go with a full-stack approach using next-gen BSS, OSS and orchestration for B2B services from Netcracker. Thanks to Netcracker solutions we are able to work with legacy systems and infrastructure without being dependent on them. The full-stack solution enabled us to deploy new digital offerings in weeks—a remarkable achievement that has been recognised in the industry. These capabilities validated our decision to

Blanco: "Technology is the critical tool that we are using to transform this company."

use Netcracker's full-stack approach, as we have been able to exceed the expectations of some of our most important enterprise customers.

Frank, as a supplier, what challenges did you face in delivering this full-stack solution?

DeTraglia: With our innovative and proven technology combined with our experienced delivery professionals, we were able meet very aggressive timelines. We had to rethink conventional approaches and use DevOps extensively. We also brought forward our award-winning Network-as-a-Service solution and rich ecosystem of partners. Most importantly, we had to ensure strong governance for timely delivery. We worked very closely with Telefónica throughout the project, acting as a single team to ensure the program's success.

What else should telcos consider?

DeTraglia: The communications industry is standing at the cusp of a major transformation and evolution to a world of digital customers, services and infrastructure. It is an incredibly exciting time to be in this industry and be part of something as innovative and pioneering as what Telefónica is doing. As we look at delivering value across both B2C and B2B markets, we are committed to making our customers successful through transformation.

Enrique, what advice would you give other operators that are planning or struggling with their digital transformation efforts?

Blanco: Be bold. Be decisive. Be consistent. Realise that digital transformation is a journey; take meaningful steps that guarantee success over the short term while laying the foundation for the future. Choose strategic partners carefully and ensure strong governance to keep projects on track. Keep in mind that not all operators and markets are the same. We have chosen different starting points and focus areas for different operating businesses. Keep the unique aspects of each market in mind and then customise an approach for that market with the best chance of success.
www.netcracker.com

SmartCitiesWorld

SmartCitiesWorld.net is a site focussed on creating a central pool of smart infrastructure intelligence

This online community enables you to keep abreast of the latest developments and trends in smart cities

The aim is to help foster the partnerships and dialogue between the key vertical sectors of **Connectivity, Transport, Energy, Data, Buildings** and **Governance**

www.smartcitiesworld.net

CTO of the Year 2018

Mobile Europe and European Communications hosted its annual CTO of the Year awards in May, which saw execs from across the continent head to London for a roundtable discussion, dinner and prizegiving ceremony

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Turkcell's Gediz Sezgin (far left) won the Regional CTO of the Year award, while the Group CTO of the Year gong, awarded to Vodafone's Johan Wibergh, was picked up by colleague Andy MacLeod (second from right).

Assuring service quality on your digital transformation journey

Digital transformation remains a key priority for Communications Service Providers (CSPs) around the world, with deployment of a telco cloud – a virtualised network where NFV and SDN architectures use state-of-the-art IT cloud technology – a critical objective and key component.

One of the barriers undermining transformation projects is legacy service assurance solutions that consist of dozens of limited, overlapping systems operated in organisational and technological silos that depend on manual processes. Increased network and service complexity means that existing legacy service assurance solutions cannot meet the agility, automation and virtualisation required by transforming CSPs.

Next generation service assurance is key to delivering the goals of digital transformation that include customer and service focus, fast time to market, high levels of automation and agility, reduced costs and rapid expansion of new services and markets. Solutions must provide a single, integrated, real time assurance suite (service, performance and fault management) spanning all hybrid (virtual and physical) network domains. They should be ecosystem-agnostic, open and cloud native, with agility that significantly reduces operational effort versus legacy systems and be available on private or public clouds under a subscription business model to maximise flexibility.

Based on extensive engagements, MYCOM OSI sees the migration of next generation service assurance during transformation resolve into Simplification, Service and Customer Experience focus and Automation that leverages AI/ML phases. These phases are common at whatever stage the CSP might be on their transformation.

Key capabilities that next generation service assurance solutions must provide during each phase are:

Simplification:
- Provide a single end-to-end service focused view across all network domains and technologies used to deliver those services including physical, hybrid and telco cloud
- Provide subscription models enabling budget and cost flexibility that support service innovation and rapid deployment
- Be cloud native, self-orchestrating, ecosystem agnostic, deployed and operated using DevOps CI/CD processes and provide flexible scaling and high availability on bare metal, private or public clouds
- Incorporate a silo-collapsing unified inventory database automating discovery and onboarding of network inventory, topology and service models in real time, enabling a unified end-to-end view of services across all networks, technologies and vendors

Service and customer experience focused:
- Provide a 360 degree view of network, service and customer experience with integrated root cause analysis to increase customer experience and reduce problem resolution time and complexity
- Deliver real time service impact analysis linking network issues to services and customers with integrated root cause analysis
- Provide a standardised CEI (Customer Experience Index) with data from CRM and BSS solutions, to prioritise high value customers with drill down into underlying data and KPIs
- Support end-to-end service quality analysis integrating data from many sources to provide value-based investment prioritisation

Automation:
- Support open and closed loop automation of NetOps tasks and processes to reduce repair times, improve organisational efficiency, improve customer experience, reduce Opex and support progress to zero-touch operations
- Provide closed loop service quality driven management and monitoring of end-to-end service quality providing intent-based direction to resource-focused orchestrators and element management systems to ensure QoS
- Integrate AI/ML capabilities with deep telco knowledge to provide pre-emptive maintenance scaling, and predict outages based on extreme weather and spikes in demand using analytics to suggest next best actions
- Automate organisational knowledge and wisdom to minimise resource, skill and knowledge gaps, improve organisational efficiency and accelerate network and services deployment

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MYCOM OSI was also selected by Stratecast | Frost & Sullivan as a 'Top 10 company to watch' in its 'Digital Transformation Means New Tools for New Business' report. Additionally, it was a finalist in the Light Reading 'Leading Lights' awards in the 'Outstanding Digital Enablement Vendor' category for displaying continued leadership and innovation in guiding CSPs on their transformation journey.

MYCOM OSI is playing a key role in enabling the transformation of many of its customers globally, including Tier 1 CSPs such as AT&T, Deutsche Telekom, Globe, Reliance Jio, Sprint, STC, Telefónica, Telenor, T-Mobile, Verizon and Vodafone.
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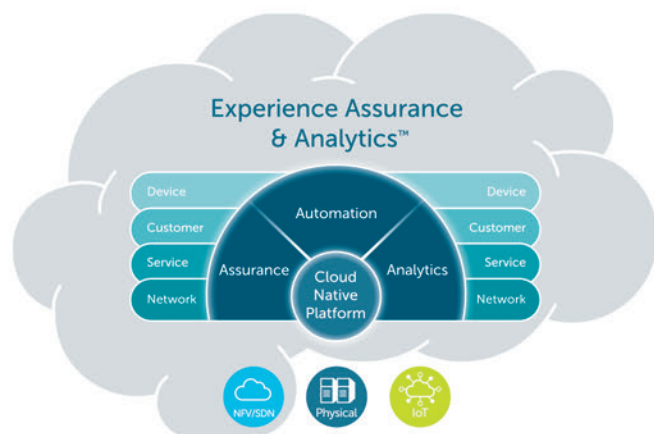
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Latest dispatches on the road from 4G to 5G

As operators juggle priorities between today's and tomorrow's technologies, Mobile Europe and European Communications quizzed industry analysts about ongoing 4G deployments and emerging 5G plans

How is Europe getting on when it comes to 4G coverage in 2018 – who are the leaders and laggards in your view?

John Delaney, Associate VP, Mobility, IDC: Almost all European countries are now reporting 4G population coverage in excess of 90 percent, so it's not very meaningful to talk in terms of "leaders and laggards" anymore. The four Nordics each claim 100 percent population coverage, so perhaps we should call them the leaders – though bearing in mind that some northern parts of Norway, Sweden and Finland are almost unpopulated.

Kester Mann, Principal Analyst, CCS Insight: 4G coverage continues to improve across the region as operators maintain strong network investment. In the leading markets, 4G services are now widely available in most urban areas, although rural communities and transport links remain concerning not-spots. Despite good progress, Europe still lags pacesetters in 4G such as the US and South Korea, which were much earlier with commercial services.

In April, French regulator Arcep announced a consultation on reallocating 2G and 3G spectrum for 4G. Are there any drawbacks to such proposals?

Delaney: There could be drawbacks in cases where allowing the use of legacy spectrum for 4G leads to an imbalance in spectrum holdings between operators. If "refarming" leads to one operator having significantly more 4G spectrum than the others, it could be argued that this would diminish the vigour of 4G competition in that country in the long term. The French case is a special one, in that the 2G and 3G licences held by Orange, SFR and Bouygues are due to expire in the early 2020s, so those frequencies will come up for re-licensing.

Mann: The 2G and 3G frequencies were originally awarded before Free Mobile launched as the nation's fourth network operator in 2012. As such, Arcep needs to ensure that the holdings continue to support effective competition between all mobile providers. In implementing coverage obligations, it should also ensure that operators have sufficient incentive to invest that will not pressure them to raise prices at a future date.

Bengt Nordström, CEO, Northstream: I think it makes sense as long as it does not require operators to force customers to buy 4G capable devices.

> **Strong competition, fragmented markets and burdensome regulation will drag 5G progress across Europe**

What other strategies are proving popular when it comes to filling in coverage gaps currently?

Delaney: At the macro level, the licensing of 700MHz spectrum could be used to improve 4G coverage since the signals spread out further from the transmitter than the frequency bands that are currently being used for 4G in Europe.

Some operators are deploying small cells to improve indoor coverage and capacity in locations such as shopping centres. There are solutions for improving coverage for individual end-users, such as signal boosters and femtocells. Operators are also trialling some innovative pop-up coverage solutions when coverage is needed in an area for a specific event.

Discussion of MIMO mainly focuses on capacity, but there's also interest in the potential of MIMO to improve the usable range between transmitters and receivers. This could have the effect of improving the coverage that a grid of cell sites can produce. One European operator, for example, has been trialling these range effects, and believes it may be possible with massive MIMO to provide the same signal coverage at 3.5GHz that its current grid achieves at 1800MHz.

Mann: A small number of operators are seeking to improve coverage by deploying balloons and drones into hard to reach places. Such solutions can quickly improve communication in the wake of disasters like flooding or aid search and rescue operations. EE is one of the pioneers in this area and is also using a fleet of Rapid Response Vehicles to provide coverage on demand; they are able to erect a mast 11.5 metres tall in less than 30 minutes.

Nordström: It has become more common to include coverage requirements in the licensing process, which is good. Yet more can be done and we are of the opinion that spectrum licensing should move away from costly spectrum auctions and focus more on service and coverage requirements for being allowed to use spectrum.

How would you assess customer appetite for 4G services, such as VoLTE? How does that compare to the likes of VoWiFi?

Delaney: VoWifi can solve the problem of not being able to make and receive calls at home on your mobile phone owing to poor signal, and it has proved popular among the relatively small, but still significant, number of custom-

ers who are experiencing that problem.

VoLTE does have some benefits for customers too, such as faster call set-up, but it's hard to market as a customer proposition because it mainly benefits operators by reducing the capacity need on their legacy 2G and 3G networks. If you're using a VoLTE-compatible phone, it's now relatively straightforward for your operator to provision you with VoLTE by default. However, there are still significant numbers of people using non-compatible phones – up to and including the 5S, for example, iPhones were not compatible with VoLTE.

Mann: Customers typically don't care about the underlying technology, just that they receive the best possible service as regularly as possible. As such, acronyms like VoLTE will mean nothing to the vast majority, although this is a technology vital to enhancing current 4G networks. Many providers are branding VoWiFi as "Wi-Fi calling" and this service is gaining good traction as a means of improving voice coverage in remote or hard-to-reach locations. Its momentum has been helped by strong support from device manufacturers.

Nordström: Customers are unaware and indifferent to what kind of voice service they are using. As networks are upgraded to support VoLTE and devices become mainstream, customers will use VoLTE without thinking about it.

This year we're seeing LTE take to the sky with the new European Aviation Network and to the moon thanks to Vodafone and Nokia. Should the industry be looking more at such "innovative" use cases such as those and the likes of LTE-Broadcast (LTE-B)?

Delaney: LTE-B has some quite interesting possibilities. It's currently being deployed for venue-based applications, such as content streaming at sports events and concerts. But as connected home and connected car applications become more widespread, LTE-B could also be applied to make the distribution of over-the-air software updates more efficient and economical.

The connected car is also giving rise to another specialised form of 4G, called C-V2X (cellular vehicle-to-vehicle/infrastructure), which is currently being trialled as a way of using the public network to support semi-autonomous and fully autonomous vehicles.

Mann: Operators need to strike the right balance between supporting existing technologies and developing new ones that will satisfy future demand. Vodafone's plans for lunar connectivity may have achieved marketing kudos at Mobile World Congress, but consumers are bound to question whether the investment would have been better allocated toward improving coverage back on planet Earth.

Nordström: The vendor and operator community is working very hard to find new use cases for cellular services, but they are not that easy to find in a saturated market.

Would you agree with the view that 5G services will be delivered on the 3.5GHz band initially given LTE's strengths on lower bands?

Delaney: Yes – 3.5GHz is likely to be the most important band for 5G in the first phases of deployment. 4G networks now provide widespread mobile data network coverage, and both uptake and usage of 4G are growing fast. This means operators' priority, in network development, is starting to shift from increasing coverage towards increasing capacity.

There is a comparatively large amount of spectrum available for mobile in 3.5GHz, which means that by deploying 5G in that band, operators can start delivering significantly higher capacity with 5G from the outset.

Mann: 3.5GHz is indeed a priority band for 5G in Europe and is likely to see widespread deployment in initial launches. However, to make the long-term vision of 5G a success, and to achieve both wide-area coverage and exponential throughput, carriers will need to deploy a range of bands, from 700MHz to mmWave.

What is biggest challenge European operators face to ensure 5G is a success?

Delaney: To get people excited, operators really need to be able to market 5G as something more than "what 4G does, but a bit faster". Identifying, delivering and communicating the things that make 5G distinctive will be among the biggest challenges that operators need to overcome, to make a commercial success of 5G.

Mann: Establishing solid business models to justify the huge network investment required to make 5G a reality will form the biggest headache for operators. Europe lacks a provider with the scale and ambition to match the likes of Verizon and NTT DoCoMo in other regions, meaning it will be at least a year behind the industry pacesetters. Strong competition, fragmented markets and burdensome regulation will also continue to drag progress for the region.

Nordström: There are three things. First, a lack of coordination at EU level of 5G launches. Second, the unwillingness from the EU to allow market consolidation from four to three operators per market, which would create a more stable market with a better investment climate. Third, spectrum auctions focus more on filling deficits in government budgets rather than focusing what drives operators to invest in networks.

5G NR trials: putting the new 'super cells' through their paces

Hype around 5G NR is at fever pitch as operators across the planet start to put the technology through its paces for the first time. James Blackman looks at three of Europe's most eyecatching trials

TELIA + NOKIA | SMART FACTORIES (FINLAND)

In April, Swedish operator Telia ran a series of 5G New Radio smart factory tests in the 28 GHz frequency band at Nokia's plant in Oulu, Finland. The idea was to run 5G-enabled video analytics on an assembly line to send real-time alerts of any inconsistencies in the manufacturing process.

Telia reckons digital transformation will rise from the industrial sector, and move outwards. "Industrial transformation will be a major part of 5G in the early days, at least here in Finland, followed step-by-step by smart cities," says Janne Koistinen, Director of 5G at Telia Finland.

Telia and Nokia ran twin scenarios from the plant to compare the impact of latency requirements for production. The first involved data processing and analytics at the edge of the network and close to the assembly line through multi-access edge computing. Data processing in the second was handled in a centralised data centre in a Telia site in Helsinki, 600 kilometres away.

How did the two set-ups compare? "It varies depending on the backbone network, but we're talking 10s of milliseconds in practice," says Koistinen. In the end, they found distance is meaningless in human terms whether the processing was carried out at the network edge or the data centre.

"The distance of 600 kilometres does not af-fect the process in our network, at least where there's a human element in the equation. Yes, the latency increases, but not to the extent it impacts the ability of a person to do their work. Humans are slow – the slowest parts in the equation."

Multi-access edge computing steps in when low latencies are essential because of the requirements of a production process. As ever, it comes down to the use case, Koistinen says, and the minutiae of network planning. "The 5G radio network has to be complemented by a very well designed backbone network to ensure latencies are not impacted, and the benefits are not lost."

For video analytics to discern errors on

a production line, imaging quality needs to be sufficiently high, notes Koistinen, and bandwidth needs to be able to cope with the necessary video streams. The 28GHz spectrum selected for the Oulu trial suits these highly-packed, data-hungry industrial settings.

Since the trial, Nokia has reverted to LTE for as much of its production line analytics as possible, but it requires a permanent 5G fixture to make it work properly. "To cover an entire factory with video analytics, 5G would be the only solution providing adequate capacity, reliability and latency," Susanna Patja, Head of the Telia Customer Team at Nokia.

Koistinen agrees: "It will require 5G, ultimately, to extend at full scale and support all the capacity that's needed." Not just 5G, the pair note: the evolution of data centres and the rise of artificial intelligence are also transforming industries. The hope is all three will combine to be more than the sum of their parts.

DEUTSCHE TELEKOM + HUAWEI | URBAN CONNECTIVITY (GERMANY)

Deutsche Telekom has only just put 5G New Radio antennas into operation with three antennas in Leipziger Straße and three in Winterfeldtstraße covering an area of about five kilometres in downtown Berlin. It is already transmitting over 5G NR equipment, software and terminals from Huawei.

The set-up, launched in May, integrates 5G NR into the operator's live LTE network and uses 3.7GHz spectrum thanks to a test license from the Bundesnetzagentur, the state telecoms agency. The German-Chinese pairing are using a dedicated anchor layer in the live LTE network, so 5G test users are sharing spectrum with 4G customers. "This infrastructure cluster we are deploying today will form the nucleus of the coming commercial deployment, ready to be upgraded before a full commercial launch," says Walter Goldenits, Chief Technology Officer at Deutsche Telekom.

The real-world deployment has been informative, say its authors, in order to verify user equipment, antenna, radio, core and transport network in tandem. Features of the radio set-up include an evolved packet core and transport solution to support the high data rate and low latency. The duo are working to understand coverage permutations, space on the mast, aspects of 32x32 and 64x64 MIMO set-ups, usage of multi-user beam-forming,

and gnarly regulatory implications to max-out data transmissions and spectral efficiencies.

In the early stages, tests will be carried out in single and multiple user-equipment scenarios, including interactions between up to 10 devices; the pair will evaluate mobility across a sector to check proper beam tracking and mobility across the cluster to check handover.

The Berlin trials are a staging post on the way to a broader 5G test-bed in the heart of the capital, with 70 cells across 20 sites earmarked for the summer, and a nationwide network by 2019, in time for a 2020 launch. "We're preparing the ground so our network will be ready when the first 5G smartphones hit the market from 2019," says Goldenits.

The starter-cluster follows lab trials in February, where 5G NR interoperability tests were completed in the 3.5GHz band with a commercial base station from Huawei and device prototypes from Intel. Deutsche Telekom says the February trials marked Europe's first pre-commercial 5G NR connection using commercial gear; the live deployment of 5G NR antennas in May was also Europe's first.

"Deploying 5G across an urban area will be a chance to test different methods of deployment and validate the capabilities and benefits predicted for the technology," says Alexander Lautz, SVP of 5G at Deutsche Telekom. "Ultimately, we aim to improve connectivity for everybody in the cluster."

TELEFÓNICA + ERICSSON | CONNECTED MOBILITY (SPAIN)

Telefónica teamed up with Ericsson in April to investigate 5G New Radio (NR) data streaming in an autonomous mini-bus in Talavera de la Reina, in Spain. The trial was the first to test 5G NR on the move using the 3.5 GHz spectrum, the 5G pioneer band in Europe.

The Spanish operator established urban 5G trials under the '5G Technological Cities' banner in two cities: Talavera de la Reina and Segovia, both in the middle of the country and within easy reach of Madrid.

"Ericsson is our radio provider in Talavera de La Reina; the location was selected for this reason," says Mercedes Fernández, Head of Innovation at Telefónica Spain, alluding vaguely to its "nice environment" as well as "roundabouts and crossings" providing a somewhat more testing work-out for the technology.

The set-up comprised a 5G Ericsson antenna, featuring 64x64 MIMO transmitters,

and an electric mini-bus from French firm EasyMile, also equipped with LIDAR, GPS, and plentiful video cameras, which combined to position the vehicle in three-dimensional maps of the immediate surroundings.

A "permanent" 5G connection with the vehicle and various on-board user equipment provided live access to the vehicle's telemetry data, and established its autonomy. "The tests showed telemetry information can be transmitted instantaneously to a remote device able to process it and give instructions if necessary. Extremely low latencies are critical in this kind of scenario," explains Fernández.

Beyond the driving exercise, the Talavera tests also demonstrated in-car multimedia content, digital services and virtual office functions. "Cars won't have drivers; occupants are going to consume huge amounts of data," says Fernández.

As the vehicle moved along in Talavera, even crossing the border to France in the north, passengers were able to stream high-definition Movistar+ content and received contextual promos about eating-places and tourist spots; data-hungry enterprise applications, such as video-conferencing and streaming, were also tested.

But the most challenging aspect was not technical, but rather organisational. "The hardest part was coordinating between four companies to achieve a common goal in a short period of time," says Fernández. The technical challenge, to prove a technology still in its preliminary form, made this close collaboration more crucial, she says.

"It required the coordination between the different companies participating in order to achieve the final results: carrying the EZ10 minibus from France to Spain, perform the autonomous driving test, integrate the 5G user equipment in the bus, install the screens in the bus and connect them to the 5G user equipment and so on."

For Ericsson, Talavera is just one of 40 5G NR trials it is running with operator customers. "Early trials are importance for the development of 5G use cases and to understand local market and industry-specific needs. Early adopters will be in a better position to capture the 5G market and its different use cases," comments Somaya El Marrakchi, Head of Networks for Ericsson in Iberia and Morocco.

Telefónica plans to have pre-commercial launches of 5G NR later this year in Spain in the 3.5 GHz band.

Mavenir: Transforming network economics

John Baker, Senior Vice President of Business Development, discusses why networks need to change in the 5G era and how Mavenir is leading the transformation

What is driving operator 5G strategies today — cost savings or revenue generation?

John Baker: It's actually both and you really can't divorce the two. 5G is all about delivering higher bandwidth to the end user at a lower cost-per-bit. Growth has slowed considerably for mobile operators. How can they deliver 150MBps consistently to an end user, compared to the 5MBps or 10MBps they see today, without increasing costs? They will have to produce 10 times the bandwidth at same or less cost as they do today, so they've got to take costs out somewhere. They'll need to reconsider all the elements in the network. At the same time, they also need to think how they will create the services that will generate new revenue.

Would you say that current operator business models are not sustainable?

That's a good way to describe it. You can't carry on passing everything through a single pipe. There's an apt analogy here with the history of computing. Back in the 1960s, everyone believed the mainframe was the way to go. Suddenly, when the personal computer arrived, the ability for everyone to have a PC on their desk changed the whole economics of computing. The same thing is going on in the mobile world. The centralised core has just about had its day because you can't afford to keep increasing tenfold the amount of data that has to go down that centralised pipe.

What needs to change?

We believe there is going to be a fundamental change in network architecture to deploy 5G. Operators are already starting to think about how to rearchitect the network for key parameters such as latency, service quality and cost reduction. Today, everything goes through the core, comes out the other side, and you end up with pretty high latency in the network; whereas 5G is all about high-bandwidth, low-latency services.

How operators will achieve that is driving the discussions around mobile edge computing and moving compute functionality out to the edge of the network, for example. Important decisions, such as those about disaggregation in the core, will affect 4G networks today and 5G tomorrow. There are some architectural changes that operators can implement today and don't have to wait for 5G.

Is it long overdue for operators to be thinking about radical changes to their networks and businesses?

Absolutely. But they're starting to get it. I've seen operators starting to recruit back some of the skills that they've lost to put the technical knowledge back into the organisation. The business model over the last several years has been to outsource to one of the big OEMs and let them guide their strategies. But that model has made it more difficult for carriers to compete on features and functionality because everyone has nearly the same capabilities from day one.

Existing network architectures also don't allow operators to move fast enough to compete with web-scale service providers. Meanwhile, their traditional vendors aren't really helping because they want to maintain what I call the "big box theory." They're producing boxes with custom hardware and the more they can scale that legacy business, the more profitable they are. While the large vendors are making moves in software-based networking and virtualisation, they ultimately don't want to cannibalise their own offerings. As for any company facing disruption, it's tough for them to pivot.

How does Mavenir help operators to transform network economics?

First of all, we view everything from the radio to the core as virtualised software running on generally available, commodity off the shelf (COTS) hardware. We're taking the same approach to the radio architecture, which is really the last piece to be put on a commodity platform, with our Cloud RAN offering.

We've also been working with the xRAN Forum to develop a specification for software-based radio architecture, which will allow the radio access to be treated like a white box function. The RAN has very much been controlled by three big suppliers – Ericsson, Huawei and Nokia. We're challenging these old business models, introducing competition and price erosion in the market.

New architectures like Cloud RAN enable major cost reductions. A recent RoI study found that Mavenir's Cloud RAN can save mobile operators 49 percent in capital costs and 31 percent in annual operating costs, compared to traditional RAN implementations.

Those are big changes for the RAN, but what about the core network?

Through virtualisation, you not only can easily scale up large networks, but also scale down. Our microservices-based vEPC scales up, down, in or out independently across parameters including throughput, transaction rate and session capacity. The ability to scale down to small form factors of commodity hardware cost-effectively creates new business models. For example, we can put a complete standalone network in the enterprise running on few compute cores at very low cost.

You mentioned Mobile Edge Computing (MEC) as one of the architectural changes for 5G. But are mobile operators ready to embrace edge computing?

I think the industry has been struggling with MEC because nobody could come up with the applications that could produce the revenue numbers that the carriers would need. But if you come at it from a cost saving perspective, you can justify the platform.

Video services account for 80 percent of mobile network traffic today and that doesn't look set to change. If you can break that out as quickly as possible and offload it from operator's licensed network elements, that reduces costs. So as part of the vEPC functionality, we developed a virtual Media Breakout Controller that does just that. It's essentially a mobile edge computing application that allows early offload. We've shown that if you can offload just 40 percent of video traffic, the edge computing deployment pays for itself in one year and operators can defer capacity investments in the mobile core by more than two years. That also shows the amount of unprofitable traffic operators are carrying over an archaic architecture. Another application we're working on puts video optimisation algorithms at the edge of the network, which results in more than a 20 percent improvement in cell site capacity.

The point is that these two applications alone justify the placement of compute functionality at the mobile edge. And once cost savings are realised, operators then have an edge compute foundation upon which to build new revenue generating services. Once operators are virtualised, they can quickly deploy new services. The big question for operators over the next couple of years is, are they ready to challenge their legacy systems and reinvent themselves?

It's not easy for large, legacy businesses to change quickly. What opportunities do operators have for reinventing themselves?

Remember that 5G is an evolution not a revolution. Operators can evolve their networks one site at a time. The challenge is that on one hand, they need to reduce costs and deliver new services, but on the other hand, they need to protect features and functionality from current suppliers. At some point, they'll decide to stop paying to maintain proprietary hardware-based solutions and invest in 5G-ready virtualised software solutions. They're thinking: when is the right time to take the risk on new technology? Part of the answer is when they have the right software skillsets in their organizations to support the new opportunities. And again, that is starting to happen.

In the US, the availability of CBRS spectrum is going to reinvigorate the mobile services market. The spectrum will be freely available to any entrepreneur. Along with the ability to deploy low-cost, standalone private networks at enterprises, this spectrum is likely to unleash disruptive service models.

We've talked a lot about cost savings, but is that enough to transform network economics?

No. Operators can't survive simply by taking costs out of the network. Revenue generation and protection are equally important. Mavenir has developed some of the most innovative new services, such as Multi-ID virtual lines and a mobile-first unified communications and Messaging as a Platform capabilities. Each service leverages mobile operators' existing network assets to create differentiated new services.

Beyond that, we also ensure those revenues are protected from security threats. We have a messaging firewall that uses artificial intelligence and machine learning to detect and block spam messages. We also have a signalling security firewall that detects and blocks denial-of-service (DOS) attacks, protects privacy and identifies fraud.

Altogether, we're everything from the app on the handset right the way through to the ability to deliver all the results of that app in a secure and cost-efficient way. Operators don't have to wait for 5G to get the benefits of virtualisation. They can start today. As a nimble, software company ourselves, our solutions are helping mobile operators transform network economics through cost savings, revenue-generating services and revenue protection capabilities.

www.mavenir.com

MAVENIR

John Baker,
Senior Vice President, Business Development

Where next for infrastructure investment?

5G should be a fresh and welcome source of income for vendors but operators are choosing to sit on their hands. Sue Tabbitt explores when, or even if, the gold rush is happening

Too tight to mention: vendors have bemoaned spending by European operators

The advent of 5G should be leaving technology vendors rubbing their hands together as operators clamour to bring their infrastructures up to scratch. Yet IHS Markit recently reported that last year saw mobile infrastructure spending fall 14 percent. Worries this might not turn around any time soon are palpable among equipment supplier. Even Huawei, the most bullish vendor, hasn't sounded as gung-ho as usual lately, as political pressures in the US on top of declining operator spending in European markets threaten to put the dampers on international revenues.

What's behind this reticence? Have mobile operators been paralysed by the multitude of choices? Do they lack conviction around the latest technology, or is reduced spending linked to delicate business models and uninspiring ROI projections? John Delaney, who heads research house IDC's European mobility team, believes it's a combination of the three and notes that operators' capex has been declining for the past four years. He predicts this is likely to continue for the next 12 months. When operators finally do start spending in earnest around 2020, it will be because they will not have a choice any longer.

A central cause of muted spending is doubt about where new revenue growth will come from. When communications was moving from fixed to mobile and there was a new market to play for, spending was justified. But as mobility matured and margins on core services fell away, maintaining the same level of spending has become more risky. "Operators have tried to get into adjacent areas, but ultimately connectivity still accounts for the main source of their income, and the trajectory of the curve into the 2020s is clear – it will be difficult to sustain revenue growth," Delaney says.

And 5G isn't the answer. "Our expectation was that this would create a bit of an uptick –as operators reach the limits of their capacity," he explains. "They need 5G to keep up with demand over the next decade, but whether that investment will be enthusiastic or otherwise is another matter."

Operators won't readily admit that their spending plans are cautious, for fear of unnerving consumers. "We continue to invest in infrastructure, and are convinced that this

is the only feasible way - especially as the volume of data is doubling annually," says Elmar Grasser, CTO of Swiss operator Sunrise. Priding itself on a 4G network with over 95 percent area coverage and 99.9 percent population coverage, Sunrise has no plans to stop investing in it, he says.

If there are barriers to this ambition, they are regulatory ones, Grasser notes, referring to the restrictive non-ionising radiation regulation, which is much stricter locally than abroad. "There is still a good investment climate in Switzerland, but regulation must ensure that this does not deteriorate," he says. He also points to the strategy, common across Europe, of "wanting to sell new frequencies at the highest possible price" running counter to operators' willingness to invest. "This leaves less money for further expansion," he notes.

At Orange, plans for investment in 5G are largely an extension of what the operator is already doing with 4G, according to Yves Bellego, its Director of Networks in Europe. Just as Orange's fibre backhaul strategy sees current deployments taking 5G into consideration, the same approach will be applied to radio. "For 5G radio, we expect this to ramp up over the coming years - starting in 2019," Bellego says.

Otherwise, the operator's spending plans are split between driving new efficiencies and bolstering targeted service areas. Bellego claims that, overall, Orange's spending is going up rather than down. Where Group spending has increased, much of that growth can be accounted for by the deployment of Fibre-to-the-Home. Bellego adds that there is a plan to spread rollouts out over time, "to avoid overwhelming pressure on industrial capabilities – not only for Orange, but also for our suppliers and installation teams".

The priority is upholding the customer experience: Orange's 4G network now reaches 96 percent of population in France and Spain, while customers have experienced a threefold increase in performance on both its mobile and fixed networks over the last four years, Bellego says. By continuing to exploit the latest technologies, Orange will continue to improve technical performance through speed, latency and capacity, and support for new services such as IoT and specialised services in a way that is sustainable economically, he hopes.

Bad news for bottom lines

While operators maintain they will continue to spend, the larger vendors are more sceptical. At Mobile World Congress this year Nokia CEO Rajeev Suri said Europe was behind other continents when it came to 5G plans, telling Mobile Europe it was due to a combination of operators' existing and untapped capacity and scope for further carriers being aggregated into LTE-Advanced. He added: "It's unfortunate that even if I'm optimistic by nature, I do not see catalysts for 5G in the near future." The vendor needs it, with tumbling operating profits in its network infrastructure business in the opening quarter of this year.

As does rival Ericsson, which is keen to put a calamitous 2017, when it posted a net loss of SEK35.1 billion, behind it. Fadi Paharaon, Head of Networks and Managed Services for Europe and Latin America, says he is counting on an inevitable increase in infrastructure investment as operators vie to maintain and improve their position in publicly published network performance reports.

As you might expect, he argues that operators need to prepare infrastructures now that will be fit for the types of services 5G will bring. "It is clear that fully contiguous 5G coverage will be not be the norm in the initial phases, so the underlying 4G baseline capability needs to be as high as possible - to minimise any potential swings in user experience when moving from 5G to 4G coverage in the future," Pharaon says. He claims many operators are accelerating the deployment of LTE-Advanced in anticipation, something he deems as a positive compared to Suri's more negative assessment.

So how else are vendors trying to squeeze out spending from operators? IDC's Delaney identifies virtualisation as one opportunity. Ericsson is just one of the vendors offering a solution running operators' networks as a service, a solution that could increase in strategic importance. He also notes that, as 5G services come online and consumers' service demands increase, performance levels will need to be maintained as close to users as possible – increasing the need for operators to invest in 'edge' capabilities.

In the UK, Three is working with Astellia and MYCOM OSI on a telco cloud project, which will see it deploy a fully integrated cloud native core network. MYCOM OSI CTO Mounir Ladki says these projects will help operators achieved massive scalability, elasticity and reliability. Future customer demands for high quality voice, video and other digital experiences will need to be underpinned by high performance, low latency networks powered by virtualisation.

But this technology is not necessarily all plain sailing for profits. IDC's Delaney notes this shift in moving away from expensive, proprietary systems has had a knock on effect on vendors who used to rely on these products. "Another factor is the decoupling of the service logic from the fabric of the switch. This is less costly than buying dedicated hardware for telecommunications, and marks a fundamental change. Yes, it needs some consultancy and services to get it right, so some spending will be needed at first, but once infrastructure is 'cloudified' this will reduce."

Elsewhere, William Webb, Director at wireless consultancy Webb Search, envisages a growing role for infrastructure players to act as neutral hosts. Taking over more of the value chain is one way to reduce their exposure to reduced hardware spending, he says. The opportunity could be building on additional services where vendors already maintain radio access networks for operators.

Another area where investment may increase is in performance metrics, especially given the increasingly competitive fight for business across Europe. Operators can also use the findings to drive network improvements, target investment and market their operations as more reliable than rivals.

OpenSignal is just one company in this space and it collects anonymised data from millions of mobile users' smartphones in 200 countries daily. CEO Brendan Gill says: "An operator's track record for delivering high-quality mobile services today will go a long way toward assuring subscribers that it will not disappoint when the time comes to choose their next-generation wireless technology provider."

These areas could be routes into new sources of revenue for vendors but the wider challenge remains stark. In February, Vodafone Group CTO Johan Wibergh told Mobile Europe vendors were overhyping 5G because of their own financial pressures. When the CTO of one of Europe's busiest testers of 5G expresses scepticism, the challenge is stark. With 2020 looming ever closer, vendors will become ever anxious that the potential bonanza from 5G spending comes to pass.

Fixed wireless access:
The first mile of 5G

Experts say fixed wireless access will be one of the first ways 5G is deployed. But there are technical and business challenges that must be overcome. Kate O'Flaherty reports

Fixed wireless access (FWA) is being widely seen as one of the first technologies to be deployed in 5G networks. But cellular networks being used as an alternative to fixed broadband is something that has been used for years. What's changed?

Interest is being fuelled by significantly faster speeds and lower latency offered by forthcoming next generation cellular. Experts think these characteristics will allow 5G to provide reliable and fast last mile connectivity to homes and businesses as capacity demands increase. Further into the future, 5G FWA could even compete with fibre, seeing mobile operators go toe-to-toe with traditional broadband providers such as Virgin Media and BT.

It's a simple premise, and predictions are that 5G FWA will be a fast-growing market, with the first standardised deployments expected to arrive as early as 2019. By the end of that year, 5G-based FWA subscriptions are expected to account for $1bn in service revenue, according to a Market Insights report. The market is expected to grow at a CAGR of approximately 84 percent between 2019 and 2025, eventually accounting for more than $4bn.

It is with this potential in mind that trials are starting to take place, particularly in the United States, where the millimetre wave spectrum thought to be ideal for 5G FWA is readily available. This has so far seen AT&T assessing the business advantage of using FWA in the last mile. Verizon has tested the technology in 11 cities and is planning to roll it out to 30 million US households in the near future.

In Europe, Samsung and Arqiva became the first to conduct a 5G FWA trial last year in London via the 28GHz band. Another European trial kicked off this year in Romania, seeing Orange taking advantage of Samsung equipment and Cisco infrastructure to use 5G FWA to complement existing fibre deployments.

FWA is preferable to fixed connectivity in certain situations because the technology does not require expensive groundwork laying cable or fibre. Furthermore, it offers clear opportunities to provide gigabit broadband access for households, says Hans Hammar, Head of Radio, Europe and Latin America at Ericsson. The vendor is taking part in a number of 5G trials in North America, using 5G millimetre wave, and in Europe and Latin America with mid-band and millimetre wave.

Ian Hughes, Analyst at 451 Research has high hopes for 5G FWA: "Advances in transmission techniques and the use of the higher frequency spectrum in 5G looks to offer lower latency and greater throughput than existing solutions, wired or wireless."

5G could also extend FWA's current benefits of reaching rural and remote areas where it is too tough to lay fibre. Tiago Rodrigues, General Manager, Wireless Broadband Alliance, identifies enterprise deployments as a fresh opportunity. "For example, a car manufacturer or an industrial compound that does not want to be reliant on Wi-Fi or 4G will increasingly look to fixed wireless access for connectivity instead."

At the same time, there is potential to grow fixed wireless access in very dense urban scenarios. According to Rodrigues: "In areas such as city centres it can be tricky to deploy more fibre or capacity, so FWA provides an easier alternative."

Taking this one step further, future smart cities could also benefit from it. John Naylon, CTO and Founder at wireless backhaul provider CBNL says: "We have been involved in smart city projects and it is actually a good match with FWA. You can get umbrella connectivity to anywhere in the city."

Identifying the unknowns

Powered by 5G, FWA offers a host of potential use cases, but there are also technical issues that must be overcome before it can be deployed. For example, the 5G that will enable FWA is split into two categories, points out Leopold Diouf, Nokia's Head of Fixed Wireless Access Business Group; sub-6GHz and millimetre wave. He sees significant opportunities in the sub 6GHz band, including the ability to drive peak gigabit services and IPTV.

And, according to Steve Collins, CTO of NetComm Wireless, if the operator is using 3.5GHz spectrum, it can "actually be quite easy" to deploy 5G FWA. But when using millimetre wave, he says "there are a lot of unknowns".

Indeed, millimetre wave spectrum is not suitable for long distances and cannot easily penetrate trees or shrubs. Jaime Fink, CTO and co-founder at wireless broadband player Mimosa Networks, points out: "It's good for short range, such as urban environments where it's a couple of hundred metres to the next base station, but it's not a great technology for the last mile."

He explains: "You are trying to optimise the distance and density of homes you are going to service. In residential areas, there are often tall structures. You either have to blow through the trees or reflect off them so the mid band is superior – but less of that spectrum is available, so we have to be careful about how we use it."

Bengt Nordstrom, co-founder and CEO of independent telecoms consultancy Northstream, raises another issue: "The number of households supported by each FWA node must be within a certain range. Too high and the performance and service quality for each user suffers; too low and the cost advantage over digging fibre is limited."

According to Conrad Mallon, Chief Network Architect from SSE Enterprise Telecoms, there are multiple problems for service providers deploying 5G FWA. For example, he says it can be challenging calculating where and how to determine tower locations and which cus-

Trunk calling: FWA is the likely first 5G use case but the humble tree could disrupt coverage at some frequencies

tomers to target. It is also essential to ensure adequate backhaul capacity is available. "If fixed wireless access in 5G is to succeed it will require access to a large, dense fibre footprint to use as backhaul," he points out.

Fixing opinion

How are operators getting to grips in understanding these benefits and limitations? In Europe, 5G FWA tests are very much in the early stages and mobile operators themselves are only just starting to get involved.

Orange claims its trial in Romania is the first major test in the continent. Arnaud Vamparys, SVP Radio Networks and Microwave at Orange, explains the operator's strategy: "Where fibre is not available to homes we want to use high speed broadband access in 5G."

In the Romanian trial, says Vamparys, Orange wants to understand performance to see if it is possible to offer a fibre-like experience. "We want also to assess the perception of customers," he adds.

Orange's trial utilises millimetre wave as an option for connecting the last hundreds of metres to homes. "We want to test it in real conditions because we need to understand the deployment," Vamparys says. "This includes how to manage sites – as new ones will need to be built – and we are also looking at how best to install on customer premises."

Another operator set to hold trials of FWA is EE, which will be testing the technology in the UK this year, again using millimetre wave spectrum. According to Tom Bennett, Director Network Services and Devices, EE: "5G throughput can be better and it's capable of offering more, for less."

But at the same time, the operator is cautious about how much of a difference 5G FWA will make for consumers compared to using 4G. In contrast to Orange, Bennett thinks 5G FWA for industry, including bespoke applications such as factory automation, could be a very serious contributor to operators' revenues in a few years' time. "We have never had a cellular service that is so software-oriented, and with so much control. If you take away cabling, there is flexibility," he says.

However, as these early trials are demonstrating, urgent issues must to be overcome before 5G FWA can be deployed at scale. In addition, aside from the technical challenges in 5G FWA deployment, more detail is needed around the business model.

Rodrigues at the WBA says the cost eco-nomics of fixed wireless access versus other connectivity such as fibre "must be much clearer and understandable for operators". "The issue is one of volume here: while FWA is the best option to deliver connectivity to a single house in a rural area, 50,000 houses is quite another matter," he says. "That's when the volume and business case of fixed wireless access needs to be explored."

But at the same time, 5G FWA could represent a significant opportunity for operators, according to the CBNL's Naylon, who says that in the future "some operators will specialise in millimetre wave spectrum and target metropolitan areas". He adds: "Others will look at low frequency spectrum and become Internet of Things specialist operators. Where operators have been similar for the last 15 years, they will diversify: it will allow differentiation and could be a way of bringing back profitability."

FWA is on the doorstep given the expectation it will be deployed from next year. Once the issues are ironed out, and assuming they are, Hughes thinks it could be deployed "quite rapidly". Despite the challenges, the industry is confident that FWA will be one of the first ways of deploying 5G. Whether that will be game-changing – at least at the start – is debatable.

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Red Hat: Cloudification is coming, but processes and culture must change

Santiago Madruga, VP of Communications Service Providers market, Red Hat EMEA

Communication service providers worldwide are looking to claim their position at the heart of the digital society, writes Santiago Madruga, VP of Communications Service Providers market, Red Hat EMEA, but they first need to become more agile.

There are many innovations that can help: NFV, SDN, the convergence of networks and IT, cloudification, DevOps, and more. In most cases the required technologies are now available and ready for mission-critical environments. However, the surrounding operational processes and mindset are often in need of a thorough review.

CSPs are already modernising. Look at Altice Group, which is building a holistic NFV platform with ambitious timelines for getting the majority of mobile traffic running on it. Or Three UK, which has developed a world-first cloud-native core network, designed to be massively scalable so it can respond to subscribers' service demands.

Once CSPs have initial NFV use cases up and running, they must turn their attention to how to scale, adapting and improving operational processes and the way they think about their organisation to become more agile.

Open source is a key element of this process. It brings the desired innovation, yet is fundamentally different in the way it is engineered to other technologies. CSPs need to understand how can they avoid the risks and reap the benefits: already, many are getting themselves educated and are participating actively in open source communities, either independently or with partners.

Cloudification brings speed, efficiently. Digital and cloud-native businesses are more agile and innovative, including many over-the-top companies that compete with CSPs for the value-add services that drive margins and customer loyalty. These companies experiment with new services without huge amounts of upfront investment or commitment, and they're not afraid to fail fast. When a service does take off it can scale quickly and reliably.

Out of the blocks

Most CSPs were not born directly in the cloud, but are fast adopting it. They are moving away from dedicated hardware and monolithic systems with proprietary software running on specific equipment. This is a change that may take time for CSPs owning significant legacy systems that may not be fully paid off.

But as their old systems come to the end of their lifecycle or as new initiatives are launched, every new system is designed for modern architectures. These are typically based on open source, helping to avoid proprietary lock-in and importantly, to avoid the customisation of open source code that deviates from standard upstream communities.

Agility and efficiency do not come from technology innovation alone, but require changes in process, mindset and culture. Red Hat's recent Open Source Culture Survey revealed that 91 percent of respondents thought that technological developments were changing the way their organisation had to operate in order to succeed and 81 percent agreed that having an open organisational culture is important to their company. However, only 67 percent said their organisation has the resources necessary to build an open culture, with 59 percent identifying legacy systems and outdated technology as a barrier to change.

Having the right skills on board is only half of the challenge; having people work in the most efficient way is the other. CSPs are used to working in a certain way. Typically, they work on projects from beginning to end, ensuring any new service or application is absolutely watertight before it is deployed. And rightly so - in the old inflexible world this is completely necessary as revising things on the fly is not an option.

Cloudified environments are different. They break the relationship between software and hardware, and even between different layers of software architecture, enabling flexibility and hybridity. Faster change is possible without jeopardising reliability and operations, but this also requires a review of organisations, processes and mindset.

Knowing this and doing this are very different matters. It is unrealistic to expect sweeping reform among the CSPs community. It is more likely on a project-by-project basis, step-by-step. Building open cloud platforms to enable virtualisation is a first step, and CSPs are well on the way.
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Burning question: Exactly how far the Internet of Things can go and what it can offer operators is very much up for debate

Telcos temper optimism with pragmatism at IoT in Telecoms Conference

Mobile Europe and European Communications' annual IoT in Telecoms Conference found delegates embracing realism as to what the Internet of Things can offer. **Alex Sword** reports

Perhaps the best way to sum up the mood at the IoT in Telecoms Conference, which was sponsored by TCTS and F5, is one of cautious optimism.

Delegates from major operators across Europe as well as a range of other industry stakeholders join Mobile Europe and European Communications for the London-based event in April. The day's agenda spans IoT standards, strategy for the enterprise and consumer markets, use of data, and security.

Amongst the attendees, especially those from operators, there is a continued recognition that the Internet of Things represents a transformational opportunity combined with an acknowledgment that this opportunity will not simply fall into their laps.

Stefano Gastaut, CEO of Vodafone IoT, kicks off proceedings with a keynote titled "How we plan to succeed in the IoT?".

Although he cautions the audience that there is "no one answer" to this, he also delivers a firm riposte to operator fears that they might become dumb pipes, and bats away as "annoying" and "clichéd" the assessment that connectivity for the IoT could become a commodity.

His argument is that the breadth of the market, spanning different sectors with different connectivity needs, provides a sizeable role for operators in tailoring the quality of service needed for each use case. But here the caution kicks in. This will require a change of business

model, he says, with operators needing to move away from charging by the megabyte towards charging for outcomes – for example, guaranteeing delivery times to an online retailer such as Amazon.

The next session is perhaps less focused on the IoT's bright future than the failures of its past, as analysts from Gartner, Analysys Mason and Northstream take on the topic of the IoT's credibility or lack thereof. The natural place to start is with the terminology itself, and one point the analysts agree on is that the Internet of Things is suffering from an ongoing identity crisis.

Bengt Nordström, CEO of Northstream, introduces the key problem: do customers actually identify with the concept? "Predictions were very high and it was thought that telcos would lead it," says Nordström. "But in verticals, it is not being called IoT but digitalisation." Tom Rebbeck, Research Director at Analysys Mason, also believes that awareness is a challenge. "Talking about IoT doesn't help because it doesn't mean anything."

> **" IoT is not going to take over; it is a nice chunk of additional revenue**

The lack of clarity over the term presents an issue for operators, says Nordström. With

businesses conceptualising transformation as an IT rather than communications project, they are turning to IT providers such as Accenture and IBM in the first instance to transform their business, he says. Connectivity is then introduced as an adjunct to this wider digitalisation, and it's at this stage that telcos get involved. There is a lesson in this: operators need to talk the right language and make their businesses more like Accenture, Nordström says. This means getting better at reselling and systems integration.

Matt Hatton, VP of Research at Gartner, believes that the Internet of Things' lack of specificity has done it no favours. "IoT doesn't have a credibility problem, it has an identity problem." This has meant that how fundamental the technology is to many business models has been obscured. From the operator's perspective, says Hatton, this means focusing in on a more limited set of verticals – "pick one or pick two" – where they can build expertise and replicability.

The fact that the three panellists don't work directly for operators gives the opportunity for a candid assessment of the sector. Nordström thinks the choice to realise the "enormous potential" of IoT lies with each individual operator, but they will have to develop skills outside their core competencies to succeed. Rebbeck gives an upbeat view: Vodafone along with US operators Verizon and AT&T are showing that IoT can be "big business". But he cautions it is "not going to take over – it is a nice chunk of additional revenue".

Making the business case for the Internet of Things

Executives from Three, Cisco, Telecom Italia (TIM) and BT then take the stage to assess the opportunities of enterprise IoT. Firstly, what are the telcos up to, and are the analysts from the previous panel right about the need to focus in on a small number of verticals? Martin Tufft, Director of IoT at BT, which has built a centre of excellence to focus on the area, picks out retailers as a particular opportunity the operator has seen. "It's a great example of where customers aren't necessarily looking for IoT, but solutions to business problems." He says the industry needs to make sure it talks about business and not products and services.

TIM's Head of Innovation Enrico Bagnasco backs up the earlier point from Vodafone's Gastaut that the wide range of applications

will require a wide range of connectivity types, requiring the market to be segmented. For TIM, the approach should be a horizontal one, he says. "As soon as you get deep into a vertical you get deep in the business logic and environment. We can't afford to do that." Going to vertical markets will need partners, Bagnasco says.

For Tom Gardner, Head of IoT and MVNO at Three, a varied approach is also the order of the day to give connectivity to a variety of players. In Italy, smart metering is a big area, while in Ireland, it is home security solutions. Greg Leonard, Technical Executive EMEAR for IoT Business Unit at Cisco, says his employer is taking a horizontal approach through the Jasper platform but with customisation for individual enterprises.

> ## " Telcos need to take this space seriously to win

Jonathan Rowan, Partner at Arthur D. Little, quotes the iconic film Field of Dreams as he brings in the consumer side of the equation. He says the sector has had a bit of a "build it and they will come" mentality, he says, compared to the enterprise where every IoT use case has been "analysed to death". Overall, he says this market is in an "early adopter environment but moving towards a mass market one".

The figures may be a little daunting. One presentation slide shows the extent to which the market is dominated by tech firms such as Amazon, Google and Apple. Arthur D. Little research has found that these firms are the best positioned in the minds of customers to succeed in the space, followed by home appliances makers, with telcos in third. Not coincidentally, the most successful company, Amazon, is also the biggest investor in terms of M&A. "The lesson is telcos need to take this space seriously to win," says Rowan.

A presentation by TCTS on the challenges of running the world's largest LPWA network in India, set to cover 53 cities with LoRa connectivity by the end of 2019, sets the stage nicely for an afternoon

panel with executives from Proximus and Orange, who discuss their own progress in rolling out networks. Vincent Hebbelynck, Head of Technology Incubation & Corporate Venturing at Proximus, begins proceedings by admitting that deployments on its LoRa network since 2015 have not quite hit expectations although they have been gaining momentum.

However, he and Ronan Le Bras, Head of Technical Strategy for Wireless Networks at Orange, which introduced LoRa to France in 2015, concur that they are seeing demand for projects on LoRa increase. Hebbelynck cites a project which has seen an unnamed gas supplier adding it to its meters while Le Bras mentions a number of smart city projects focused on applications such as waste collection.

On cellular, the operators have taken different approaches. Orange has largely rolled out LTE-M, with Le Bras saying that NB-IoT has been disappointing so far in terms of its cost. Hebbelynck, whose employer has backed NB-IoT, says that it has provided a complement to LoRa by allowing it to scale up coverage quickly. But both execs expect LoRa, LTE-M and NB-IoT all to survive into the 5G era with Le Bras adding 2G to the list, which he says will remain important to the Internet of Things despite its legacy nature.

The last two discussions of the day focus on a potential thorn in the IoT's side: security. Andrew Bargery, Solutions Lead for IoT Security, F5, has stark warnings about the threats facing the IoT but gives practical advice on how they can be warded off: in particular, he counsels introducing security at every layer of the network. Mirko Ross, Executive Member of the IoT Council, agrees that simply deploying more powerful firewalls will not be enough – operators should be looking to engage and educate their customers how to shield themselves against threats. This is not a peripheral issue. "If you don't fix these [security] problems, you will get no money," says Ross.

The overall picture that emerges is that the industry has managed to navigate the hype around the IoT and has begun seriously considering both incipient problems, such as security, and past failures, particularly in the likes of branding and marketing. From this position, they are increasingly able to assess with a cool head what the IoT's business benefits are and how they might be realised.

Now they just have to make them happen.

Ever decreasing circles?

Will Europe ever embrace small cells or has the opportunity already peaked and gone? **Sue Tabbitt** reports

Whatever else operators are concentrating on in their strategies for better, deeper, more efficient coverage with their mobile networks, small cells still make up a small and insignificant part of that plan. Compared to American and Asian markets, Europe seems at best ambivalent about the potential.

Orange's Director of Strategy and Planning Yves Bellego says his position hasn't changed from a year ago. "It's not that it's not strategic, but more than our involvement with small cells is not industrialised," he explains. "That is, we use small cells on a case by case basis, to support a particular need – stadia, for instance, or indoor coverage for enterprise coverage as part of a mobile fleet deal. But we're not getting into city-wide or large-scale deployments."

Nor can he see that situation changing any time soon. "We don't discount it, we do use small cells, but it's not widespread," he says. And it's certainly not a priority, he adds.

So what's the sticking point? For Orange, the issue is twofold. First, there are more pressing items on the agenda, such as building out coverage for 5G starting with existing macro cells. Density considerations will come later. Second, the economics associated with small cells do not stack up.

"Compared to the US and Asian markets, our city make-ups tend to be quite different – a mixture of skyscrapers, enterprise buildings, single houses, flats and so on," he notes. "And we don't have the same density you get in Japan. Where La Defense [Paris's outlying modern business district] might resemble more of the structure of Tokyo, Paris itself is very diverse. So small cells don't offer the same appeal."

Especially as the effort to set up a small cell is considerable. "If operators did have a need to deploy more small cells, it would help if it was easier to navigate the permissions, the regulatory aspects," Bellego says. "Yes, there is a lot of admin involved to deploy a macro cell site, but the reach makes it worth it. If you're talking about hundreds or thousands of small

> " **Additional spectrum is another headwind against small cells**

cells, you need them to be as easy to bring online as Wi-Fi, without the need for building permits, etc. Processes need to be easier – and harmonised across Europe, which is not the situation currently. Operationally, if you're planning a lot of small cells, you need a lot of automation to keep the overheads down."

The London look

But there are signs that the logistics could be improving. Jon Freeman, Product and Technology Director at Arqiva, is driving a number of small cell projects in the UK, including a London rollout for O2 designed to improve density so that customers' LTE experience doesn't deteriorate in high-traffic areas of the city and/or at peak times of the day.

The joint project will see Arqiva and O2 install an initial 300 outdoor small cells, one of the operator's largest deployments of this technology to date. As well as delivering improved mobile coverage, the investment is designed to pave the way for 5G.

The project will make use of some of Arqiva's concession contracts with 14 London

boroughs. Initial sites are expected to be live by this summer, with deployment continuing up to 2020. The cells will be installed on street assets such as lampposts to deliver targeted coverage and increased capacity in areas where mobile data demand is particularly high, such as outside transport hubs and major retail zones.

Although 5G as radio access technology won't change the potential role for small cells, Freeman notes that it will drive demand for continuous coverage. "Users won't want to drop off a cliff to 4G in terms of their performance and experience," he notes.

On the economics of small cells, Freeman says progress is being made and that, as an infrastructure provider, Arqiva has a responsibility here. "We're very conscious of the need to get the total cost of ownership as low as possible, and are doing a lot of work to make small cell deployments very efficient," he says. It does this through a combination of using street-level contractors, traditional number crunching and the advantages of its existing public sector contracts.

Through its alternative strategies and better insights into locations before work is planned, Arqiva estimates that it has as much as halved the costs of deployment, while working with its operator customers to maximise returns. A test bed outside of London, comprising lampposts strewn across a car park, helps it conduct time and motion studies on getting power to them, for example.

"Beyond O2, we're doing another commercial rollout with a [unnamed] UK MNO, and a trial with another, so the market is emerging," Freeman says. "Other markets might be further ahead, but in Europe it's just a question of timing really."

Backhaul specialist Cambridge Broadband Networks (CBNL) provides infrastructure spanning macro and small cell networks and takes a horses-for-courses approach to provisioning. In addition to questionable economics, CTO and co-founder John Naylon believes Europeans are more sensitive to aesthetics of the kit, especially in older parts of cities not given over to business zones or high-rise apartment blocks.

He also wonders whether small cells have taken so long to get off the ground in Europe that the proposition has now crashed into 5G, "which answers the same question of 'I want more mobile capacity'," he says. "40MHz of additional spectrum gives more predictable capacity at lower risk. It's another headwind against small cells. They'll find their niche, but I can't see them ever representing a significant proportion of the network. I think, eventually, small cells will be supplied by the major RAN players, as part of a wider solution. Otherwise, the volumes are not there."

Tiago Rodrigues, General Manager at the Wireless Broadband Alliance, believes a further barrier is the current business model. "In Europe, operators abide by a model that asks the consumer to pay for additional coverage," he notes. "Where they will get the revenue to compensate the investment is unknown. Operators will have to determine which services customers are willing to pay more for to increase revenues."

Then there is the relationship that operators have with venue owners, he notes. "Small cells can reinforce mobile coverage at locations such as hotels and shopping malls that have higher

> " **Processes need to be easier and harmonised across Europe**

traffic levels. But these venue owners are yet to understand the benefits of small cells for both their businesses and customers. This leads to another problem: ownership of the infrastructure. While the deployment of Wi-Fi is straightforward, knowing who owns small cells is not."

Saying hi to Wi-Fi

To breathe some life into small cells, Rodrigues proposes they could be integrated with other technologies such as Wi-Fi to provide much-needed benefits. "For example, adding Wi-Fi to small cells in dense locations such as airports offers a simple and low-cost method to increase capacity and coverage," he suggests. It would also address the need for greater density, which is key for 5G. "5G will present a demand for much greater bandwidth, so operators need more small cells, as well as any other access technologies, to address this."

Ezhirpavai Pavai, Assistant VP for Tech-

nology at design and engineering company Aricent, whose clients include operators that have deployed small cells, says because Europe has relatively good outdoor coverage, this too has dampened the desire for investment. "Cost-conscious operators do not see a need to deploy small cells," she says. "Small cells are viewed by carriers as a means to increase coverage rather than the usage of services by subscribers and subsequently revenues.

"Subscribers obviously want robust connectivity and operators use different methods to boost coverage. One strategy has been to deploy small cells in homes. In Europe there is one major difference in that the operators also offer other means of coverage like Wi-Fi/DSL coverage at homes. So, if LTE/cellular signals are weak, the device shifts to Wi-Fi."

One important need small cells could address is where signal penetration is very poor, she suggests. "Millimetre wave bands are a boost as that they increase capacity, but at the same time they are easily attenuated by walls and other barriers," she says. Here small cells could offer a way forward.

The enterprise market could offer hope too, especially in a 5G world, according to Carsten Brinkschulte, CEO of software-oriented network provider Core Network Dynamics. He argues the current EPC solutions are not flexible, simple or cost-effective enough for what businesses want.

He says: "Enterprises need a new breed of EPC. They need a mobile core network that is flexible and can scale up to connect, for example, all the devices of huge utility companies or scale down to function in resource-constrained environments such as mining, where each vehicle operating on premise needs coverage and the network isn't static and has to adapt dynamically."

Brinkschulte argues this market could be invigorated through a tighter integration with the radio and a lightweight EPC inside the cell. "In other words, integrating the core network as a function into the radio," he explains. "Adding a mesh between these cells keeps deployment costs down further because typically about 30 percent of the cost of deploying a network is cabling."

But when so much has been promised, and has not yet materialised, it's hard to know what the future holds for small cells. They could well have a part to play, and may have simply come onto the scene too soon. Only time will tell.
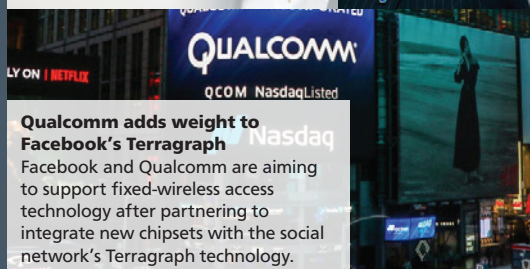
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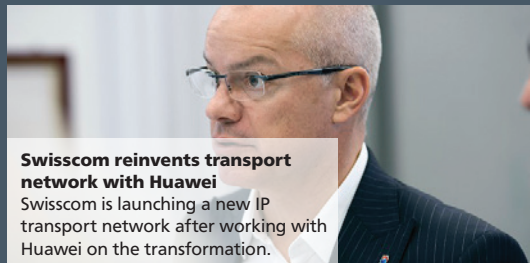
Swisscom reinvents transport network with Huawei
Swisscom is launching a new IP transport network after working with Huawei on the transformation.

Arcep turns attention to 26GHz for 5G services
French regulator Arcep has launched a consultation exploring whether 26GHz could cover the country with 5G.

Qualcomm adds weight to Facebook's Terragraph
Facebook and Qualcomm are aiming to support fixed-wireless access technology after partnering to integrate new chipsets with the social network's Terragraph technology.

BT offers LTE fallback to enterprises with broken broadband
BT has launched a new service for enterprises offering LTE fallback if a workplace's broadband network fails.

Turkcell aiming for small cell rollout after Dot test
Turkcell is looking to boost its indoor coverage within commercial buildings and conference centres with small cells after holding a trial of Ericsson's Radio Dot System.

Telia uses 5G to hold eSports face-off in Finland
Telia has held its first demonstration of 5G technology in a live environment, connecting gamers at an eSports event in Finland.
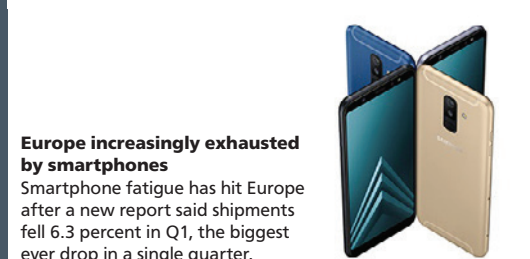
Europe increasingly exhausted by smartphones
Smartphone fatigue has hit Europe after a new report said shipments fell 6.3 percent in Q1, the biggest ever drop in a single quarter.

Telefónica Spain grows virtualised network with new data centre framework
Telefónica Spain is building virtualised data centre network architecture that it said will expand the agility, scale and efficiency of its cloud-based services.

IoT and 5G to fuel carrier Wi-Fi growth
The carrier Wi-Fi market is set to grow by a total of $3.5 billion over the next four years thanks to ongoing demand for network density and the Internet of Things, new research has claimed.

TIM turns to Ericsson to fill CTO role
TIM has poached Ericsson's head of Packet Core and Identity Management to be its new Chief Technology Officer.

Spain kicks off 5G spectrum auction

Spain has begun the process of auctioning nationwide 5G spectrum, setting a reserve price of €100 million.

The Ministry of Tourism, Energy and Digital Agenda (MINETAD) has tendered 200MHz of 3.6-3.8GHz frequencies, divided into 40 blocks of 5MHz, each with a reserve of €2.5 million. Licences will last 20 years.

Operators have until 29th June to apply for the auction, with bidding expected to begin in mid-July.

Earlier this year, Spain introduced a spectrum cap limiting mobile operators to holding no more than 120MHz of spectrum in the 3.4-3.8GHz band. It means that

Orange Spain, which holds 40MHz of 3.5GHz spectrum, will be restricted to bidding on a maximum of 80MHz of the available airwaves.

MINETAD has allocated the 3.4-3.8GHz band as the main band for the introduction of 5G services in Spain. The auction forms part of the government's National Plan 5G 2018-2020, which aims to put the country at the vanguard of next generation mobile technology development.

Spain plans to also auction 1.5GHz frequencies for 5G services at some point this year.

TIM, Fastweb, Huawei unveil 5G VR, AR services

TIM and Fastweb have shown off their first 5G-based virtual/augmented reality (VR/AR) services, as part of Italy's ambitious plan to lead Europe in the rollout of next-generation mobile technology.

Two demonstrations were held at live 5G testbeds in Bari and Matera respectively. The first saw VR being used to offer remote visits to Matera's main tourist attractions. The second used an AR helmet to provide remote assistance to ship engineers, including a 3D overlay of the inner workings of a ship's engine, thereby improving the effectiveness of

maintenance and staff training.

The showcase, presented in concert with Huawei, comes as Italy seeks to drive the rollout of 5G to 75 percent of the populations of Bari and Matera by the end of this year, with a view to reaching 100 percent by 2019.

Saverio Orlando, TIM Technology Manager, said: "The new low latency and high speed mobile technology, supported by the fibre optic network, allows us to create an innovative ecosystem that involves all industrial and service processes."

SFR dials up 5GNR voice call first in France

SFR has made the first voice call in France over a 5G New Radio network running on 3.5GHz spectrum.

The call was held at Nokia's 5G Test Network and Competence Centre in Paris-Saclay. The vendor provided its AirScale radio platform, Cloud RAN running on Nokia's AirFrame data centre solution, and end-user devices compliant with 3GPP's 5G NR standards.

Nokia said its New Radio systems would help the likes of SFR to increase its network capacity on spectrum below the 6GHz band and deliver wide-area coverage.

François Vincent, Head of Mobile Network at SFR, said: "SFR is developing a roadmap for the evolution of its networks that takes into account the benefits and complexity of implementing 5G.

"The joint projects and trials will enable us to meet future data demand in the most effective way, while exploring new ways to deliver our media content that will increase the subscriber experience."

Marc Rouanne, president of Mobile Networks at Nokia, said: "By testing 5G technologies now, we can place SFR ahead of the needs of its data-hungry customers

while preparing the operator for the launch of next-generation services."

In February, Vodafone became the first operator to make a voice call over a 5G New Radio network, just months after the 5GNR standard was locked down by 3GPP. It worked with Huawei on the project, which involved the 3.7GHz band.

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BURKINA FASO

West Africa Regional Communications Infrastructure Project

The World Bank has pledged a further $20 million for the Burkina Faso government to improve broadband services across the country.

It more than doubles the money first put in place in 2011 to fund the construction of capital Ouagadougou with the Ghanaian border.

A public-private partnership has been running the project, which aims to strength the African country's digital infrastructure.

PHILLIPINES

PLDT and Globe Telecom

PLDT and Globe Telecom are considering setting up a joint tower infrastructure company in a bid to reduce capex.

Globe Telecom reportedly made the first move but added that any agreement would need to ensure that infrastructure was built according to its network demands.

UNITED STATES

Verizon Communications

Verizon has joined the 5G scramble across North America by revealing plans to launch fixed-wireless 5G services in Los Angeles this year.

It joins the previously announced Sacramento, also set for a FWA network in 2018, with the operator keeping the two remaining cities a secret for now.

PERU

Bitel

Bitel is seeking to further the spread of 2.6GHz spectrum across the country in a new $110 million project.

The Peruvian telco said it will spend the next three years rolling out the frequency with plans in place to connect 183 provinces by the end of this year.

CEO Phan Hoang Viet said high-speed mobile internet access would drive the economic, educational, personal and collective development of citizens.

CAMEROON

MTN

MTN has followed rival Orange Cameroon in signing up to a coverage and service obligation agreement.

The country's regulator has decreed both operators need to target coverage in major economic locales, rail routes and universities, as well as provide a timetable for the future rollout of 2G, 3G and LTE services.

In return, the operators will be allocated spectrum in the 700MHz and 800MHz bands.

UNITED ARAB EMIRATES

Etisalat

Etisalat is planning to launch its pre-standard 5G network in September, claiming a first for operators in the Middle East and North Africa region.

The deployment will be fixed-wireless access focused and rolled out to different parts of the country according to demand.

The operator said the launch would fuel digital transformation, the Internet of Things, smart cities and next generation industrial deployments.

AUSTRALIA

Telstra

Telstra has been forced to apologise to customers again after its second widespread network outage in a matter of weeks.

The Australia operator saw its LTE network go down in May, with its 3G services also collapsing under the strain of offloaded traffic.

Earlier that month, technical work in Melbourne led to its 4G network going dark.

KENYA

Safaricom

Safaricom has passed the 5,000 kilometre mark in its fibre deployment project, growth of nearly a fifth on 2017.

The Kenyan operator said it has now passed more than 141,000 and 15,000 businesses with ultrafast fixed line services.

It announced 53,000 homes have take advantage of the service, up from 28,000 from late 2017.

Swedes set 'best before' date for 3G

Tele2 and Telia announced in May that they are working to phase out their joint 3G network, operated by Sunab, in Sweden. Tele2 said it aims to start shifting traffic over to its LTE network by the end of this year with the goal of completing the transition by the end of 2025. Telia did not specify its plans.

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Received TM Forum Excellence Award for Operational Transformation and Agility

May 2018
Received TM Forum Catalyst Award for Revenue Generation through 5G Network Slicing

January 2018
Named Leader in Digital Transformation Platforms by GlobalData

March 2018
Named a Leader in Gartner Magic Quadrant for OSS for 8th Consecutive Year

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