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As we head for MWC2020, the ranking of the world's top 50 most valuable operator brands (page 26) doesn't make for the cheeriest reading, but it is intriguing. This year has seen Telefónica and Vodafone pulling back to core, largely European, markets, having been buffeted by many forces over which they have no control, from political and economic instability in parts of Latin America, for instance, to erratic regulation and immense demands for payment elsewhere.

Orange in particular emphasises the implied belief that there is room for plenty of growth in Europe. In January, Ramon Fernandez, Deputy CEO Finance, Performance and Europe at Orange, called convergence, "The jewel in Orange's crown". He said that in some markets, 40% of its revenues were from its converged services and that in all markets converged services are growing fast.

He was speaking at the company's Orange Engage 2025 event in London, which gave more details on a country-by-country basis of the five-year strategy the group announced in Paris last November.

This was a good reminder that converged services is about more than offering TV, mobile, broadband and fixed lines – it's about offering them in a coherent way that bolsters the brand and allows the customer to pick and mix services, and easily. In support of the convergence market, Orange has invested massively and widely in fibre (particularly in Spain and France) and mobile infrastructure elsewhere – the CTO Spotlight with Emmanuel Chautard of Orange Romania is a surprising and enlightening read (page 10).

Arguably, the closest the UK has to a converged service provider, is the pay-TV company, Sky, which offers mobile and broadband through others' infrastructure, and with innovative spin. Whether convergence is no longer an innovative approach so much as the only route forward for operators, as was suggested by Strategy Analytics at the Orange event, remains to be seen. But as Sky illustrates, it's an opportunity open to a wider field than operators.

Rakuten has already said it plans to take its Japanese mobile operations and business model global, as just another strand in its ecosystem of 70 or so services, which are spanned by a single loyalty scheme. The parent company, also Rakuten, is an ecommerce giant that offers loans, credit cards, travel and insurance, and a wide range of consumer goods. Its ecosystem is designed to offer an unmatched lifestyle experience where each line of business feeds the others. It has operations in more than 29 countries and regions, and more than 1 billion customers worldwide.

Still, Rakuten is yet to launch fully in Japan and it's far from game over for Europe's operators.

Annie Turner, Editor
Mobile Europe & European Communications

A person is seen from behind, kayaking through a narrow passage in a cave. The scene is bathed in a deep red light, creating a dramatic and somewhat mysterious atmosphere. The person is wearing a dark jacket and a hood, and is holding a double-bladed kayak paddle. The cave walls are rugged and textured, with some light reflecting off the water's surface.

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Accenture: transforming the smart home into the future home

The home is at the heart of our lives as well as where the heart is, writes George Nazi, Global Lead, Communications & Media Industries at Accenture. It's where we spend most of our time, it's where we relax with those dearest to us, it's where we decompress after work and where we manage our lives. But the home is changing and changing dramatically. We've seen this over the past 10 years with the advent of the smart home – smart TVs, speakers, lights, fully connected entertainment systems to name just a few.

But it's increasingly clear the smart home is too limited a term for the decade ahead. Our new book christens it "The Future Home" - the Hub for Hyper-Connected Living and a means of being At Home, Anywhere. With the advent of 5G and the maturation of AI, edge compute and advanced data analytics, we will be able to take our home wherever we go - our preferences for lighting, entertainment, education, fitness and health devices, even the contents of our fridge.

It will differ from today's smart home world, which is dominated by too many isolated point to point devices. They are fiddly to set up, inconsistent in their performance and lack overarching orchestration. 5G will remove these problems by acting as a powerful consolidator and facilitator of the Future Home.

However, to open the doors to this, operators need to think creatively and build solutions that aren't just a product in search of a market. They need to reorient their businesses away from vertical silos and radically revamp their operations towards a more agile, innovative and responsive one.

This isn't impossible. At Accenture, we believe that operators have the levels of trust and ownership of the 5G ecosystem to make this happen. But it will take change. Operators can be at the heart of the Future Home but only if they are prepared to transform themselves.

Residents of the Future Home

If the Future Home is going to be led by consumers, who are they? We have identified eight distinct mindsets for the years ahead - from Hip-Happening Parents to Conscientious Controllers. For example, Social Grandparents view technology from a security perspective. They want their Future Home to connect them to friends and family, monitor their health and handle housework. This is in sharp contrast to the Wired-Up Urbanite, juggling an active work and home life and desiring high quality products and services that just work. They want health and fitness solutions and a Future Home that is clean and serene.

What unites these eight tribes is a series of "megatrends". These are the increasing hyper connection and hyper-personalization of daily life, the emergence of millennials and Generation Z and their familiarity with technology, an ageing society and their desire to stay within their homes, the rejection of Do It Yourself in favour of Do It For Me, and a desire to manage the tensions between a digital social life and a physical one.

This creates a challenge for service providers. They need to be conscious of the demographics and the megatrends if their solutions are to succeed. Each of the mindsets have different identities, different requirements of their living space, and different opinions about how much a force for good technology is and how much they want it to play a role in



their daily lives. They also need to be sophisticated enough to recognise that a Future Home could house several different demographics with different requirements. Above all, Future Home service providers need to build solutions that meet the needs of these socio-economic demographics; build according to the market, not the other way around.

Operators: your guide to the Future Home

The hyper-connected dynamic Future Home will require someone who can knit together the myriad of products and services through a series of technologies, platforms and protocols. And this is where operators can truly succeed. By 2023, the connected home market will grow from \$20 billion today to \$37.3 billion. Operators can and have provided an unprecedented data-powered experience, placing them in pole position to satisfy the demands of the Future Home.

The reasons they can do so are threefold. The first is trust. More connected and personalised products and services requires more personal data, an area that is only subject to liberal regulation at present. However, operators' trust scores are far ahead of those of digital companies, some of whom have been at the centre of data privacy scandals in recent years. Accenture research has found fixed-line and wireless operators rank second and third after banks when it comes to trust.

Second is customer experience. Despite the variety of the Future Home's demographics, they will all require a consistent and world-class experience, from personalisation to customer support. Operators are in a position to solve problems before they happen through data analytics enabled failure prediction. Their stores can act as a one-stop shop to showcase their own and other Future Home solutions, their distribution hubs can deliver products and their staff can serve as installation experts and support staff if something goes wrong.

While digital companies have experience building sophisticated products, they do not have operators' decades of expertise providing high quality and diverse customer service. This legacy of core competencies and skills means operators can tap into a large chunk of the Future Home ecosystem margin.

Third and most crucially is mission-critical infrastructure. They are the sole providers of the hardware that connects our homes, our smartphones, our people and our societies. Without them, the Future Home is the stuff of imagina-

tion. Therefore it's necessary to have operators as the Future Home ecosystem orchestrator.

Additionally, regulation helps underpin this role by ensuring both competition as well as a guarantee of secure connectivity. Operators are being kept in check not just by market forces but also governments.

5G and the Future Home

This mission-critical infrastructure will power 5G. The smart home ecosystem has taken great strides in recent years - with video-enabled doorbells, connected speakers controlled by a smartphone, or voice activated smart TVs all becoming commonplace. But they mostly sit within silos, controlled by different connectivity protocols and unable to talk to one another in a way that would have brought about the Future Home much earlier than hoped.

To date, operators have been guilty of launching products without working out the market first, failing to partner with the right kinds of hardware manufacturers and being unwilling or unable to spend the money required to break into a new market of this kind. By contrast, Google spent \$3.2 billion acquiring the home technology company Nest. However, companies have so far had limited success with smart home devices that do not have access to the data that resides on rivals' products or in ecosystems they are not members of. They are also protective of their own

“ Operators have the levels of trust and 5G ownership to make the Future Home happen

data and unwilling to collaborate with rivals if at all possible.

Whether they are built by operators or device manufacturers, smart home products of all kinds have suffered from additional weaknesses. These include the high cost of a smart device compared to its unconnected counterpart, the difficulty in setting the

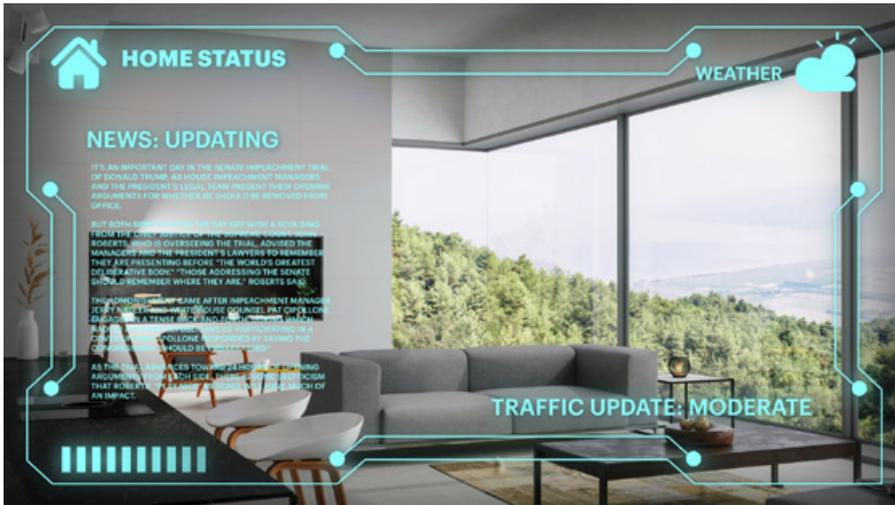


George Nazi, Global Lead,
Communications & Media Industries
at Accenture

devices up (iQor's Customer and Product Experience 360 Survey found consumers spend an average 2.5 hours setting up their smart devices), a highly fragmented ecosystem, where Zigbee sits beside Wi-Fi, Z-Wave and so on, and finally the weaknesses of Wi-Fi. Typically, Wi-Fi can be unreliable, choked in densely populated areas, prone to interference, guilty of "dead zones" or low signal areas because of its short range, and subject to relatively long latencies compared to cellular.

5G solves each of those problems. It offers 10GBps peak data rate, the ability to support one million connections per square kilometre and one millisecond latency for ultra-reliable low latency communications, functionalities far in excess of LTE. NB-IoT will be part of the 5G standard and will play a key role in the Future Home with its ability to deliver low-cost, low-power connectivity.

5G's low latencies, plus the high reliability of cellular connectivity, will be vital to connecting the likes of medical monitoring equipment within the Future Home. It can also connect 10 times as many devices as LTE. To return to the example of the Social Grandparent, 5G could connect safety and security devices, those tracking nutrition



and body weight, connected items for monitoring health and those providing a healthy and engaging daily lifestyle, from connected speakers to intelligent lighting.

While one Wi-Fi router in theory could connect these devices, their proximity would lead to interference and unreliability. LTE networks would be unable to handle the sheer volume of connected devices, if the example above was replicated in other houses in the same areas.

That said, 5G will need to be supported by other technologies. eSIMs are considerably smaller than conventional SIMs. They can be soldered into a device and remotely host multiple user profiles. Edge computing takes the centralised cloud concept but slashes latencies and data processing costs by building smaller and more localised data centres. Finally, advanced data analytics will dynamically identify specific contexts and respond accordingly. In a Future Home context, that would be when you break your routine and stay at home, such as when you are sick.

Rebuilding the network operator

We believe operators will play a critical role in using 5G to underpin the Future Home. They can succeed in doing so but they need to transform themselves for the decade ahead. Following extensive research and conversations with key stakeholders, we have identified the following six areas where operators need to change:

- **Reinvent the front office digitally**

Customers are becoming more demanding as they realise they can easily switch provider if

they are unhappy. Operators need to rebuild their customer interfaces to provide near real-time support through various avenues, powered by automation, and artificial and data intelligence. This will enable them to introduce or remove services across all of the Future Home's furniture.

“ 5G's low latencies and high reliability will be vital to connecting the Future Home

- **Reinvent the back office**

The siloed Operational Support Systems are defunct. The back office of the future must be agile, responsive and fully cooperative with the front office. Given the requirements of a successful Future Home ecosystem, the back office must be able to manage these networks and the associated data. A means of doing so is via Intelligent Network Operations, using AI to anticipate consumer or staff demands and better manage the rollout of new capabilities.

- **Train and hire talent for the telco of the future**

Digital technologies have transformed how people work and operators need to be conscious of how they need to change their workforce. Artificial intelligence is one such technology. It can increase the quality of

staff and customer experiences, make an organisation more agile, collaborative and personalised, and speed up decision making but critically not at the expense of jobs. Reskilling the existing workforce will also be required through bespoke training schemes and internal skills academies. These experienced employees armed with new skills can then mentor the digitally adept graduates entering the company for the first time.

- **Instigate rapid fire product development**

Operators need to slash production times in order to keep up with impatient customers and the ever evolving technology landscape. Again, a data focused approach working with ecosystem partners can facilitate agile working. Operators need to be prepared to fail fast, as their digital counterparts have been doing for many years.

- **Revamp technology platforms**

An open and scalable platform will be essential to seamlessly integrate the ever-increasing world of Future Home devices and companies. To do so, this platform will need to be multi-vendor, open source, fully softwarised and API-driven. This will require a shift from the waterfall structure to a DevOps approach and must also be embraced across the entire organisation, from networks, systems and processes to people.

- **Secure it with a pervasive connectivity layer**

It is vital that operators knit together 5G with the supporting technologies outlined above through a layer that delivers the connectivity required for the Future Home. We believe this can be achieved by reinventing the back office, building a layer of programmable network platforms that lock into the overall platform, unlocking network services and creating elastic, on-demand infrastructures that can absorb new services.

Reorienting for the Future Home will not be easy but is essential. It will happen with or without operators. But with the widespread connectivity capabilities of 5G, the potential for consumers to be connected everywhere, the limitless scope of what could be connected, the desire for a trustworthy and reliable company to manage this ecosystem, operators are best placed to be at the centre of the Future Home.

www.accenture.com/5gfuturehome

CTO INSIGHT

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CTO Spotlight

Emmanuel Chautard, CTO, Orange Romania, explains why his market is such a special and successful one for the operator group

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CTO of the Year Awards 2020

We have updated our categories to Trailblazer and Gamechanger. Which are you? Entries by 27 March, please.

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CTO Interview

Michele Gamberini was appointed as TIM's CTIO at the end of last year – in this first interview in his new post, he describes his ambitions and priorities

CTO Spotlight: Emmanuel Chautard, CTO, Orange Romania



Why is Romania such an important and special market – the first and only country in Europe where Orange has launched consumer 5G services?

It was as a consequence of the work and research our teams have been doing since 2017, including collaborating with start-ups and all equipment suppliers on powering innovative projects such as live stem cells printers, and deploying the first 5G fixed wireless access (FWA) live test with clients in Europe.

The involvement of Orange Romania in European [Union] R&D projects – Horizon 2020 initiative (MATILDA, SliceNet, 5G-EVE and 5G-VICTORI) – is equally important. The company contributes both to the development of 5G and its standardisation.

To what extent is your success due to your mobile network coverage?

Since the beginning, our focus was to make the benefits of top internet speeds accessible to a larger number of people. This has been the key theme of our network strategy for the past two decades and it is paying off. We have invested over €3.5 billion in Romania in the past 22 years.

At the end of 2019, over 98% of the country's population and 100% of the urban population had access to the largest 4G network in Romania. Furthermore, 53% of the population can access the 4G+ network that offers improved speeds up to 500Mbps.

These numbers are backed-up by several network certifications including Ookla Speedtest, which recognised our network as having Romania's Widest Mobile Coverage.

How do you meet the demands of Romanians' high data consumption?

The national average for mobile traffic per user is 3.4GB per month, but for our customers this rises to about 7GB, well above the European average. The 4G/4G+ network is a key pillar for Orange. We will continue to invest in its development for consumers and businesses. The 5G network integrates with the other mobile networks and provides improvements, while enabling continuity with the previous generations.

Faster internet speeds and new technologies will unleash an increase in data consumption. We see it in our customers' behaviour, especially when it comes to video consumption and the demands of 4K content.

The arrival of 5G will open incredible new opportunities and applications that will generate an

exponential increase in data consumption. We look forward to meeting this demand and to the technological advances that it will enable. We contribute actively to the creation of tomorrow's services that can use the full potential of 5G through co-innovation with our business customers, as well as with all suppliers and start-ups through a dedicated programme called Orange Fab.

Could you tell us more about the 5G roll-out plans?

Launched initially in three cities, we recently deployed 5G in Brasov and Poiana Brasov. This year we will focus on other big cities in Romania and consolidate coverage in Bucharest, Cluj and Iasi.

We will expand the 5G network with the spectrum we have, while preparing for the 5G tender that will take place this year for the all-important radio licences in the 700MHz band. We look forward to seeing new 5G use cases for the benefit of customers and the Romanian economy.

Why has your convergence strategy worked so well in Romania?

Romanian customers are price sensitive, but enjoy easy to use services and having an abundance of resources. That is why Orange's convergent packages offer value for money; customers can enjoy TV, fixed internet access and mobile services in one package with one invoice.

Orange is present in 42% of households, and one out of every two Romanians uses at least one service from Orange.

What advice could you offer to your peers among Europe's CTOs?

Stay aware all the time to anticipate the right changes in operation. Never stay in your comfort zone. Listen carefully to the customers' voices (internal and external). Always remain calm and optimistic.

Who has had the biggest influence on your career?

Within Orange Group I have collaborated closely with some outstanding managers on tough projects. They gave me the best illustration of what proper management means and how work can be stimulating and meaningful.

Authors like Dan Millman provided good lessons applicable to business and for professional development. These are accessible through the film *Peaceful Warrior*, which I recommend.

My family and my friends, as well as some colleagues and partners, have the most impact on me. They inspire me to develop a proper career path.

CTO of the Year Awards 2020

Now in its seventh year, our prestigious annual awards celebrate outstanding, strategic use of technology and talent by Europe's converged and mobile operators.

This year we've updated the categories to
Trailblazer and **Gamechanger**:

A Trailblazer has bold ideas for a future telco – a creative CTO or equivalent-title leader who is pioneering a completely different technology or strategy. At this stage, it might be more about the vision than results; perhaps the most talked-about example right now is Rakuten (which is not eligible to enter as it's not European) and its cloud-native approach, but there are many others out there. **We want to hear about the CTO and their role, not the company at large!**

A Gamechanger who gets that imaginative execution is everything. An inspirational CTO or equivalent-title leader who has deployed a strategy or technology to deliver tangible operational and business benefits. Here are some suggested examples of outcomes that might make the cut, but the list is not exhaustive. Have you reduced costs while improving services? Reimagined customer experience? Slashed time to market or launched new services? Boosted your profits? **We are really focusing how the CTO links what goes on in the network with business outcomes with this Award.**

You can apply enter online or email anniet@mobileeurope.co.uk for a Word document version.

Short is beautiful: Please note the total wordage should not be more than 1200 words, excluding contact details. Also, the questions are just suggestions to get you started – you do not have to answer every one, just those that are most relevant, and there is room to include anything you feel we missed. By all means provide hyperlinks to supporting material.

Good luck! We'll be announcing the short list in April
– make sure you're on it!

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TIM CTIO: Giving customers easy access to new network and IT capabilities

In November 2019, **Michele Gamberini** was appointed to lead the Chief Technology & Information Office at Italy's TIM. In this first interview since his appointment, he talked to **Annie Turner** about the tasks ahead

Gamberini has worked at TIM in a variety of roles and locations since 1996, including the group's Greek operating company and most recently as the Head of Network and Service Engineering.

He has no illusions about the scale and scope of his task. Incumbent European mobile operators face fierce competition and their services have been increasingly commoditised. As Gamberini notes, there are only four mobile operators for the whole of the US (whose population is roughly equivalent to that of Europe), whereas the 28 countries in the EU typically have four competitors.

Soaring data volumes

Also, as modern life becomes increasingly digital, consumers and enterprises want and expect digital services from their communications service provider too – access to services any time, from anywhere, from any device. One result of this is that data volumes are increasing each year by 60 to 70%.

He says, “We need to move to a simple way of providing connectivity and build new applications and services”. Gamberini stresses that this is not about emulating the so-called over-the-top players, but about building services in and around the network's capabilities, and making those capabilities available to customers through services that are easy to find, choose, use and change.

Possible pull quote highlighted above

He says, “Only by doing this will we get new markets and new business models”.

He adds, “Automation will be key together with the implementation of a new layer able of exposing those capabilities in a flexible way to consumers and enterprises. The challenges are to redesign the business and operational models, and the business proposition.

“On top of that, we have to change the customer journey from wherever it starts, whether that's a call to a contact centre, or they enter our portal or shops to look at something new or review a subscription – all of this must be digital and must change how they interact with us.

“This requires a complete renewal of the IT and Network and network sub-systems. Data collection and usage, artificial intelligence (AI), full softwareisation and APIs [application program interfaces] are some of the means by which we will get there. It is a tremendous opportunity but to get there, we have to change the way we work.”

Digital blueprint

Gamberini acknowledges that this is a long journey that will have to be completed step by step. The good news is that the operator is already underway, having designed a blueprint for its digital transformation. It began with the move towards virtualisation, and now the migration from virtualised infrastructure to cloud-native is underway for both network functions and IT.

The original virtualisation efforts, which for operators were built around network functions virtualisation (NFV) did not deliver what was expected in terms of automation and progress was much slower than predicted. He said the architectural stack was too complex to be managed, with automation and orchestration proving to be big stumbling blocks.

Gamberini says this was, in part, due to the big, established vendors struggling to renew their portfolios, or perhaps seeing no value in moving away from their traditional, vertical implementations. They were used to engineering and releasing products in vertical, highly integrated, software and hardware stacks.

Suddenly they were – and are – being asked to move to developing and sup-



porting software products running on generic hardware, relying on open source middleware from the likes of VMware and Red Hat.

Proliferating interfaces

According to TIM's new CTIO, since committing to digitalisation, the operator has, "Refused all attempts to take proprietary stacks," although this brings new issues. He points out that by "dealing with a unique vendor you are locked in, but at least there is only one interface to integrate and now there are multiple ones and we have to go through all of them and manage them."

On this thorny matter, Gamberini says open APIs are foundational to the evolution of the entire organisation. The disaggregated approach means his team will have to deal with hundreds, rather than tens, of APIs but this is part of its blueprint to achieve digitalisation through seamless integration from end to end. He also thinks the situation will improve as 5G progresses.

Another consequence of moving away from proprietary stacks is having new actors who have entered the arena, such as Altiostar with its efforts to proceed towards open RAN technology and Affirmed Networks, which offers an interesting virtualised evolved packet core (vEPC) solution and enables operators to deploy a microservice solution on public cloud – for example on AWS – for possible new use cases. Ma-

venir claims to be, "the industry's only end-to-end cloud-native network software provider" and has grown rapidly by acquiring small companies with innovative technologies.

Gamberini notes, "Typically, these companies do not have the same solidity as the traditional vendors, and it can be challenging to go with them, but we have started a fruitful collaboration and we are pushing our traditional vendors to work with them too."

"We want the traditional ones to be open – it is a key evolution issue to avoid proprietary technology and to move easily from one vendor to another, according to our needs. Virtualisation was just the first stage, it is not enough. We need to enable higher levels of automation by accelerating the process towards the implementation of cloud-native network and IT solutions. New software products based on microservices will provide a flexible way of self-healing and scaling up network functions or IT applications."

He says the network functions lifecycle and service assurance need particular attention, as they are fundamental to becoming more operationally agile and being able to support new business models and opportunities.

New business models

Like other operators, traditionally TIM sold connectivity and devices, largely through business-to-business and a business-to-consumer (B2B



and B2C) models. This too will become more complex, involving B2B2C as well as B2B2B. Again Gamberini stressed the critical importance of open APIs in achieving this.

He gives smart homes as an example, and the challenge involved in integrating the high number of objects people need to connect to digitalise – automate – the running of their homes. TIM offers a smart box that runs on the Android platform to provide its on-demand TV proposition TIMVISION and “has the capabilities to integrate with a wide portfolio of existing objects in the home environment, hence this a possible model for consumers,” he explains.

The stakes are higher, though in the business market, Gamberini adds. Here it is critical that TIM increases its margins, and he sees as 5G as the key to this: “Network slicing is important, but there are other [attributes] too, such as very low latency and the unprecedented number of devices you can support in a square kilometre, which is a pre-condition for the connected society where millions of individuals, organisations, sensors and terminals will connect to each other, and for new use cases like smart cities or self-driving cars.”

He sees the combination of network slicing and ultralow latency as the real sweet spot as TIM will be able to create multiple slices, each with different quality and service levels to suit the exact needs of different customers and use cases. He expects such services will become commercial in 2021 to 2022, remarking, “We will push hard in this direction”.

A new, open stack

Gamberini observes that 5G is not only about a new radio access and some additional components in the core, but about a new, open stack in the RAN,

starting in the 3.6 to 3.8GHz spectrum, that runs through the transport network all the way to the core and the service layer. He stresses, “The radio route is different than for previous mobile generations. We won’t go from rolling out in the biggest cities to the small towns. The radio deployment will be use-case driven and will start with 5G providing fixed wireless access (FWA) in rural areas or high-speed connectivity in industrial districts.

The next 20 years

“The way we transport traffic to and from the RAN needs to be flexible and programmable; we need to progress the transport and IP layer all over – from the back-bone to the metro and the access. We have started to renew it this year. It is a revolution that will ensure an E2E SDN [software-defined network] automation from the core to all our long-term central offices and will provide the skeleton of our network for the next 20 years.”

He continued, “Last but not least the core network will have a revolution too”. TIM will start the tender process for a fully cloud-based, new ‘combo-core’ that embraces 5G EPC and 5G new core in 2020.

Like almost all the operators in the world, TIM began with the non-standalone (NSA) architecture for 5G, because that’s how the standardisation, undertaken by 3GPP, has progressed. However, the imminent standalone (SA) deployment model will be particularly important for industry segments, which will need the advanced, specific network and IT capabilities that TIM is working to build and expose to them. This is how TIM expects to add value to customers across many industry verticals, and to monetise 5G.

Outlying issues

In July, TIM signed an agreement with Vodafone for RAN sharing, in a move aimed at speeding the deployment of 4G and 5G, as well as avoiding duplicating infrastructure build-out. The companies are waiting for approval from the European Antitrust Commission before they can implement their proposal although TIM is close to closing its RAN tender.

Gamberini comments, “We have common infrastructure and about the same number of sites, so this is a business agreement, where each part provides more or less the same contribution”.

Iliad has also requested to be included in the RAN-sharing scheme and this has been agreed in principle, but not yet progressed.

Another aspect is the mooted merger of TIM’s fibre infrastructure with that of OpenFiber, which is owned by Cassa Depositi e Prestiti (CDP), which in turn is owned by the Ministry of Economy and Finance, and energy company Enel.

While these issues work their way through the necessary procedures, Gamberini acknowledges the importance of fibre infrastructure, and its commitment to expanding the amount of fibre quickly. According to the FTTH Council Europe’s figures published in March, with 4% fibre penetration, Italy is twenty-seventh out of the 33 European countries ranked by the Council. This might seem low, but is still above both Germany and the UK, and of course takes no account of technologies like fibre to the cabinet (FTTC), 4G deployment or cable coverage and their role in national digital infrastructure.

Gamberini confirms that in TIM’s case, it will be looking to the combination of fibre to the home (FTTH), fibre to the premises (FTTP) for businesses and multi-tenancy buildings, plus 4G/5G FWA to provide ultra-broadband. ■■

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5G network slicing: how to truly make it a foundation for service innovation and monetization



5G promises a world of unprecedented speed and differentiated quality of service with the potential to unleash a wide array of use cases, new services and business models. Network slicing is the cornerstone of the 5G architecture that supports this.

A network slice is a logical network that serves a defined business need with a particular set of characteristics, comprising all the required network resources that are configured and connected to each other. Network slices span across the 5G RAN, transport and core domains, utilizing physical and virtual network resources that can be either dedicated to a particular slice or shared between slices.

For communications service providers (CSPs), network slicing introduces the ability to build elastically-scalable and dedicated logical/virtual networks. In turn, this allows them to support diverse services with specific performance or control requirements on a common network platform to address a large variety of use cases, services, industries and customers. As a result, the technology empowers them to offer specialized services that address the precise needs of customers, by tailoring

them to meet the specific technical, performance, regulatory, security or other requirements to improve service performance, customer experience and enhance customer satisfaction.

The challenge however remains in identifying the means towards reaching this end state. Specifically, how do you manage these network slices from end to end, given their composition of multiple network functions, controlled and managed by different network domains (5G RAN, transport and core networks) across a hybrid network?

CSPs: "we need to adapt"

To better understand whether this is indeed a top-of-mind concern for service providers, and to better understand CSPs' current approaches to 5G network slice management and monetization, Coleman Parkes recently conducted a survey on behalf of Amdocs of 50 mobile operators across the globe. Key research findings revealed:

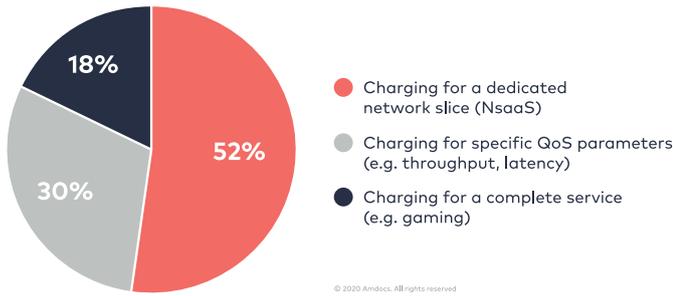
- 76% believed that to cut time to market and reduce fail risk/cost, it is vital to automate the end-to-end network slice lifecycle from design to fulfilment and operations
- 70% believed their current operational systems cannot handle the adaptive, real-time resource allocation needed for 5G network slicing management
- 52% believed Network Slice as a Service (NSaaS) will be the leading approach to network slice monetization, while 30% expect to charge for specific QoS parameters (e.g. throughput, latency)

The optimal answer to the challenge facing service providers lies in adopting a holistic, automated approach to end-to-end network slice lifecycle management, enabling 5G networks to be transformed into agile monetization platforms. Efficient network slice management requires:

- End-to-end lifecycle automation of the network slices across network domains and multiple vendors, enhancing operational efficiency, optimizing network resource utilization and reducing time to market
- Responsive, adaptive and real-time network and processes for tuning network resources to specific business and customer needs in a timely and cost-efficient manner, in order to control and guarantee QoS, SLA delivery and security requirements
- Business and customer-centric slice segmentation fully integrated with the CSP's ordering and charging system to support new business and monetization models (e.g. network slice as a service – or NSaaS) with new levels of performance and functionality.

The solution: network slice lifecycle management

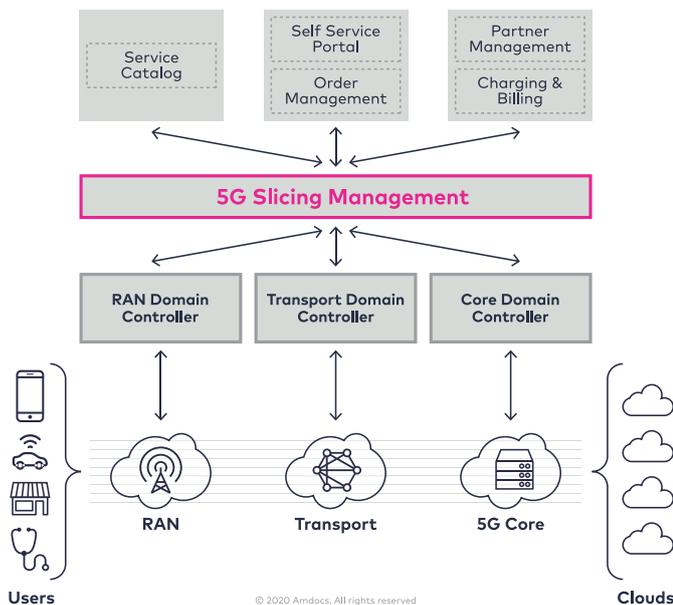
To successfully manage network slices across a multi-domain hybrid 5G network, CSPs must adopt a 5G slicing management entity, hierarchically positioned at the top of the 5G network management architecture. The purpose of such an entity is to coordinate and automate the RAN,



transport and core network slices’ subnets operations and services across the network’s siloed operational domains. Specifically, the entity must be able to coordinate the coexistence of multiple network slices, while also guaranteeing that the required resources within each network domain remain available for each network slice.

5G network slicing management is based on SDN and NFV technologies and principles that enable dynamic programmability and control:

- Allows CSPs to adopt new methodologies that enable them to automate network slice lifecycle management based on modeling of resources and services
- Automation of network slice operations is based on the creation and design of service models and policies for their lifecycle management



- Defined slice service business attributes, such as latency, throughput, maximum number of concurrent sessions and so on are exposed in the services catalog – enabling product designers and product managers to define network slice-based products and sellable commercial offers

The 5G slicing management entity is responsible for fulfilling service business orders into efficient and effective network-oriented service implementation plans, by means of predefined workflows and deployment optimization across the distributed 5G network and cloud envi-

ronments. Its closed-loop operations (based on fault and performance monitoring, advanced analytics and machine learning) to maintain the service intent, ensure all network cloud resources are properly and timely allocated and that services’ and slices’ KPIs are met. The 5G slicing management entity also serves as a charging triggering function, which passes information about a slice’s utilization and performance to the charging function, thereby enabling new monetization and business models possibilities.

Unleashing network slicing monetization possibilities

With virtual infrastructure and programable 5G networks, the granularity and speed with which CSPs can introduce and deliver services will substantially impact their ability to monetize the network. A 5G slicing management entity for holistic, automated end-to-end network slice lifecycle management must therefore be an integral part of the CSP’s 5G monetization platform, enabling them to best position the organization to revolutionize its service offerings. This in turn, based on a wide range of new 5G use cases, will enable them to unleash a whole new world of network services and monetization possibilities that can support complex B2C, B2B and B2B2x business models.

For information on how Amdocs’ portfolio of solutions and services can help you accelerate 5G network slicing monetization, visit www.amdocs.com/5G-Slice



Oren Marmur, VP, Head of NFV | Amdocs

Oren Marmur is the Head of NFV at Amdocs and leads all business and product-related activities in the Network Function Virtualization space, including NFV Orchestration, VNF Management and the NFV Ecosystem and Partnership program.

With over 20 years’ experience in the telecom and optical industries, Oren has held several executive, business and technical-related positions and specializes in leading advanced technologies into successful execution, market penetration and strong business growth.

Previous senior roles prior to Amdocs include CEO of Mishor 3D (developing an innovative Augmented Reality solution for the automotive market), and CEO of Mobix, a leading communication solution provider for the Smart-Grid and Smart-Metering market. Oren was also Head of the Optical Networking & CESR Line of Business at ECI Telecom, a leading supplier of networking infrastructure for carrier and service provider networks worldwide and has successfully managed the transition of ECI’s Optical Networking business to become ECI’s major growth engine and one of the company’s most profitable businesses. Oren was also the Founder of FlexLight Networks, a venture capital-backed startup company that pioneered the GPON optical-access market.



Tuning up open source for telecoms

Open source is essential to the transition operators must make from virtual to cloud-native network infrastructures as they deploy 5G, and strive to make better use of their resources to offer dynamic and innovative services. Toward the end of last year, senior executives from leading vendors gathered in London at a roundtable hosted by *Mobile Europe & European Communications* and sponsored by Red Hat, to discuss developments and obstacles.



L to R (backview) Timo Jokiah, Red Hat, Hans Hammar, Ericsson, Giles Heron, Cisco Systems, Gary Ashworth, Red Hat, Annie Turner, Editor, Mobile Europe & European Communications, Richard Miedzinski, Red Hat, Martin Taylor, Metaswitch, William Crowe, Intel, (backview) Oliver Carter, Metaswitch

The group started by discussing open source models for service providers. As Timo Jokiahho, Red Hat's global lead for Telco Partner Technology Development noted, there are many open source development models, as well as different approaches to consuming and contributing to it.

In-house development vs. the value of a vendor

William Crowe, partner solution architect – Telco Sales EMEA at Intel, commented, “It largely comes down to the kind of capability and expertise the end customer has with open source. If a service provider has several hundred internal software engineering resources and they are comfortable to consume [the work done in the] upstream community, they have that choice, but few have that capability.

“Everybody else is more likely to benefit from taking a supported, integrated product from a vendor. The value a vendor offers is bringing leading-edge innovation to market quickly, and giving customers an easier migration path to new platform versions through automated tooling and so on.”

Giles Heron, principal engineer, Cisco, added, “The carriers need to benefit from what vendors create – so it's more about everyone being motivated to get carriers involved since we need their input.”

He continued, “The wider dilemma for some who are worried about contributing to open source is the possibility that each individual or organisation that contributes won't necessarily see a proportional return on their effort, but if everyone contributes, then everyone will get back more than they individually put in.”

Several people expressed concerns that companies can leverage competitors' investment and expertise when it is shared in the community. However, as Jokiahho pointed out, “Enabling our competitors is exactly what Red Hat does every day. What we contribute and develop in the open source community – OpenStack for example – is available to every one of our competitors.” Further, in the interests of protecting the integrity and ongoing compatibility of its portfolio, and therefore its customers' investments, Red Hat's policy is to never deviate from the work done in various open source communities. This means that its portfolio always has the resources and strength of the entire community behind it. That is not the case when a vendor or operator diverges from the upstream community's work, because that effectively turns open source into a proprietary solution, with all that implies, including vendor lock-in, and potential integration and upgrade issues.

Virtyt Koshi, Ph.D., senior vice president and general manager EMEA at Mavenir, agreed, saying, “It can be a trap because customers lose innovation if they are not looking to open source for new ideas. You become a prisoner of one supplier – you get people who build a comfortable career on tuning existing solutions, but innovation is lacking. In my experience, pick any vendor you can think of and, if it wasn't for open source, the total cost of ownership would be much higher.

“Another problem is that, in procurement, everyone is incentivised to commoditise everything. Then we talk about innovation – such as we're now looking at with applications at the edge – but if you have only a compliant box instead of innovative software, it is very difficult to achieve gains.”

Understanding the difference between open source and commercial open source

The group agreed that many operators are in early stages of understanding the difference between upstream and commercial open source. The roundtable attendees conceded that a good analogy is water. Rain is free, but collecting it, ensuring it is safe to drink, distributing it and recycling waste water costs money.

In the same way, the amount of engineering that goes into open source to enable innovation is not well appreciated by service providers, nor is the collaborative upstream development process, which has to be completed before developments are sent downstream to be leveraged for commercial use.

Crowe said, “They assume stuff just happens and it's there for free and you can download it, but... we invest a huge amount of effort. All of our innovation in silicon is enabled first in open source, because we can get things done upstream and exposed, and then get people using it, feeding back and contributing to it. What we would ideally like to see is more telcos getting involved in the upstream development and engineering operators – that is, as developers – rather than their more traditional role of defining requirements.”

He continued, “Any innovation we create on a silicon platform is typically made available in open source first. It may be 12 to 18 months before it becomes available with a proprietary software stack.” As an example, he highlighted that Intel contributed some critical networking features to Kubernetes that are essential for networking workloads – for example, Multus, the multi-cloud network interface. They were upstreamed for development and have now been downstreamed into commercially-supported distributions such as Red Hat OpenShift Container Platform, the company's enterprise Kubernetes platform.

Crowe concluded, “The process of getting new technology upstreamed into community code and then downstreamed into commercially supported software is critical to understand. We need to make sure that the engineering effort into upstream contribution is enabling the right features that customers care about and that it leads to a material benefit to their operational model.”



L to R Oliver Carter, Metaswitch, Giles Heron, Cisco Systems



L to R Timo Jokiahho, Red Hat, William Crowe, Intel

Security at the forefront

Security is another critical advantage of working with an ecosystem of trusted technology partners. The power of such an ecosystem plays a big role in exceptional cases, such as the massive, so-called ‘side-channel attacks’, known as Spectre and Meltdown, that created worldwide headlines in 2018. They overturned decades of perceived wisdom about how to design secure silicon, affecting chip makers ARM and Intel, among others. Red Hat’s Product Security team, which constantly monitors possible vulnerabilities, worked alongside other industry leaders to make mitigations available to customers as soon as possible after the issues were disclosed.

Crowe believes that the biggest kind of security vulnerability that service providers face today is inevitable in the shift to network functions virtualisation (NFV) and open architecture. He said, “Security is an area that needs huge education. There is technology capability in platforms that service providers simply don’t use. It goes back to the point raised earlier – that procurement folks don’t value this stuff and they strip it out of requirements. Operators need to have the right processes in place so that when a patch becomes available, they can operationalise it. Customers need to understand

how to design security into business processes.”

The industry only wins when it acts together, which brought us to our next topic for discussion: how operators and vendors will succeed or fail together in the quest to deploy cloud-native infrastructure.

Stand or fall together

Gary Ashworth, senior director of Network Ecosystem Partner Sales at Red Hat, noted, “In the community, we’re seeing a lot more push from service providers who want a horizontal platform that can handle different workloads and different virtual network functions (VNFs) or containers to leverage their value. Some of the bigger ones, like AT&T, are driving their own ecosystem. Every day, we see the ecosystem becoming increasingly relevant.”

The most striking and radical instance of an ecosystem in action is Japan’s Rakuten Mobile network. A subsidiary of the Japanese-owned e-commerce giant of the same name, it has built the world’s first end-to-end cloud-native network from scratch. This is scheduled to go live this spring and the revolutionary infrastructure has the same horizontal, open source platform across the network, from the disaggregated base stations to the core. Red Hat, alongside an ecosystem of more than 50 vendor partners brought this to life, and Rakuten has already said it intends to take the technology and business model global.

Extending beyond the edge

A couple of participants believe, as was the case with OpenStack, they may be able to advance beyond their original boundaries and move open source contributions for telecommunication use cases into the wider community. For example, Red Hat and Intel, among others, plan to invest heavily in developing the networking aspects of Kubernetes within the community.

Jokiahho said, “We are following the same path for Kubernetes as we did for OpenStack five years ago. OpenStack was not designed for NFV or even for telecommunications. Still, today, service providers rely on OpenStack for both NFV and edge computing following significant feature developments over the past few years. Kubernetes now has many of the same features as OpenStack, and has become critical for NFV use cases and 5G core specifically, which is where containers and microservices come in. Edge and Kubernetes will be a perfect match, I believe.”

A special case?

Attendees agreed that telecommunications are something of a special case – with needs unlike those of general enterprise networks. For example, they need to offer 99.999% network availability and maintain huge, legacy systems (such as highly integrated, monolithic OSS and BSS) which are expensive to run and stifle innovation.

Martin Taylor, chief technical officer at Metaswitch Networks said, “Telcos need a critical mass of technical capability, but over the last 20 years the technology capabilities within telcos have been totally hollowed out. The investment has mainly been in procurement. They know with NFV, for example, they have to staff up (but the right talent is hard for them to attract) or rely on their normal incumbent vendors.”

The larger Tier 1 carriers have a greater critical mass – sufficient resources to at least work on deploying horizontal platforms. Smaller operators are generally obliged to rely on vertical, integrated systems.

Crowe feels that the vendors are moving to make horizontal platform features more accessible: “I think the traditional Tier 1 network

equipment vendors are now innovating in software development. For example, new use categories such as 5G core appear [in] many of the solutions [from] vendors with containerised offerings, following cloud-native principles. When NFV started, there was always going to be a lag, as software solutions that were already in existence had to be amortised and written down before they could start a new development phase, but there is strong evidence that it is happening across the vendor community.

“This raises some additional challenges, not least of which is that we don’t have an industry standardised agreement on what ‘cloud-native’ software architecture means for the telco cloud. This is where we need industry collaboration and education.”

Do it once, replicate everywhere

This lack of a common definition or understanding has big implications for the debate topic: the desirability and possibility of developing something once, then being able to replicate and deploy it everywhere. The idea is to make changes at scale and fast.

Richard Miedzinski, telco partner account director at Red Hat, outlined the challenge: “Most network services require a lot of testing and pre-production, so it can be months before you are in the field.” He feels that community members, such as Red Hat, need to be better aligned with field operations, where the community’s work is operationalised by operators.

Taylor said all the testing is, “partly because a new release of software on a traditional network function has hundreds of changes in it and any one could disrupt something. If you’re in a microservice environment where the piece of software you’re changing is individual and small, and

you haven’t changed the API [application programmable interface], the chances of a disruption are much lower. So instead of having this massive amount of testing in one go, you still have to test it before putting it into production, but you can mitigate by doing ‘canary testing’ and that sort of thing.”

“ This raises some additional challenges, not least of which is that we don’t have an industry standardised agreement on what ‘cloud-native’... means for telco.

Pods and interfaces

The consensus around the table was that the industry will come to a decision to meet the need for more than one interface for pods, which was recognised long ago. At MWC 2018, Telenor and Metaswitch published a white paper to demonstrate that containers are the only viable route to building and scaling 5G networks, based on a proof of concept (PoC) and a live trial that delivered voice-over-LTE (VoLTE) at a remote location in Norway. In a commentary on the conference, *Container Journal* concluded, “Containers as a technology may have caught many network



L to R Richard Miedzinski, Red Hat, Martin Taylor, Metaswitch



L to R Virtyt Koshi, Mavenir, Hans Hammar, Ericsson, Giles Heron, Cisco Systems, Gary Ashworth, Red Hat

service providers off-guard. But the days when network services took weeks to months to provision are now officially over.”

The Telenor PoC integrated technology from multiple vendors, including Metaswitch’s containerised virtual IMS deployed on Red Hat OpenShift Container Platform, which performs container orchestration and has tools to automate the building and delivery of applications over public, private and hybrid cloud infrastructures. The participants used the multi-cloud network interface, Multus, which provides multiple interfaces into a container pod and was originally proposed by Intel.

Jokiahho noted, “That PoC is a good example of how feature development in open source communities – Kubernetes in this case – works. We were looking at interfaces and we realised Multus was gaining the most momentum. That drives features to accelerate the data plane, which is what happened in OpenStack earlier and now is happening in Kubernetes too.”

CNTT’s mission

Still, progress on interfaces has not been as fast as some would like. The Common NFVI Telco Taskforce (CNTT) was set up in June 2019 to create a standard set of infrastructure profiles to streamline the many versions of NFV infrastructure (NFVi), so vendors won’t have to generate a different version of their VNFs for each one.

There is some confusion about the relationship between the Cloud Native Computing Foundation Telecom User Group (CNCf TUG) and CNTT, and each group’s purpose, Taylor explained that CNCf specifically hosts Kubernetes’ development – in the same way that the Linux Foundation oversees development of the open source kernel. CNTT, at

least initially, is focused on OpenStack.

Although CNCf TUG appears to have limited traction, perhaps surprisingly, CNTT latest statistics show there is the equivalent of 280 full-time people contributing to it, according to Taylor. For some attendees, this begged the question of whether so much effort is best spent on OpenStack rather than cloud-native infrastructure.”

Crowe sees real benefit in CNTT’s work to create profiles that enable the VNF’s decoupling from the infrastructure and to introduce more standard interfaces or APIs that allow multiple vendor implementations. These efforts enable differentiation and innovation, which creates a model around compliance and testing.

He said, “We view these efforts as important steps in the right direction. Once these models are adopted and implemented by the industry, it will give the telco ecosystem the potential to ingest new technologies at a pace similar to the major public cloud providers and enable the industry to address the automation – Opex – challenges.”

The CNTT profiles will be tested by the Open Platform for NFV (OPNFV) Verification Programs (OVP) and will benefit all parties, from NFVi vendors to VNF suppliers, service providers and their customers.

Crowe was optimistic: “For the initial wave of NFV enablement, the industry didn’t have a chance to immediately re-architect existing physical functions software or VNF software. Our initial goal with NFV was to work within OpenStack to expose many platform features that the VNF and orchestration layer needed to integrate with. Learning from the past, and benefiting from new technologies available, we are working with partners to enable this functionality in Kubernetes, but in a way



L to R Martin Taylor, Metaswitch, William Crowe, Intel

that is architecturally much more rigorous on how platform details are exposed, with the goal of getting us to a simpler and easier onboarding and lifecycle management model!”

He compared this to what has gone before: from the outset, NFV was designed to use volume x86-based IT hardware and many workloads were duly moved, but by and large they were virtualised versions of the physical appliance, still running legacy software. He said, “The service providers have seen limited value from it as they haven’t been able to address the Opex challenge – with virtual appliances, there’s no common way to drive a horizontal infrastructure agenda. To date, the service providers have largely experienced Capex benefits from being able to consolidate hardware vendors between the IT and network domains.”

“ There have already been rumblings in the industry about telcos swapping dependence on vendors for one on system integrators.

The disaggregation opportunity

Hans Hammar, head of radio for Europe and Latin America at Ericsson, noted, “The disaggregation of hardware and software in the core network has been ongoing since 2012, but still the implementation of cloud-native core applications is not widespread. Now the industry is talking about Open RAN, and how to repeat what has been done in the core network in radio.

“Needing to lower the entry barrier [in the RAN] has been on the agenda for a long time and I think it actually could open up a bigger market for Ericsson software. Based on our experience from the core network, it will be a long journey though. Ericsson is partnering and collaborating to make this happen, but realising the efficiencies is less certain. There have already been rumblings in the industry about telcos swapping dependence on big vendors for one on system integrators – that wouldn’t make anyone happier.”

Jokiaho suggested radio units and radio-related software at the edge were two fundamentally different things, saying, “The main motivation for disaggregation of the base station is to move functionality from the antenna site to the edge data centre so the antenna site only has radio units, making it as simple as possible, cheaper and more energy-efficient. That’s one part of Open RAN and ORAN.

“The other advantage is to establish a standard interface between the remote radio and software functionality at the edge, so operators can acquire radio units and radio-related software from different vendors. I like to talk about this as the disaggregation of base stations rather than virtualising RANs, because vRAN puts the mindset back to virtualisation. It might not necessarily have anything to do with this whole disaggregation trend which, incidentally, represents an interesting opportunity for Red Hat and other software companies.” 



Virtyt Koshi, Mavenir

7 critical ingredients to service assurance in the 5G era

Mounir Ladki, President and CTO, MYCOM OSI

5G is live today. At the time of writing, according to Ookla's 5G Map 107 Telcos around the world have 5G networks live across over 6800 areas, a significantly faster rate of roll-out versus 4G and earlier wireless generations.

Success in the 5G era requires urgent, wholesale digital transformation by:

- adopting agile ways of working to rapidly bring compelling services to market
- innovating within new partner ecosystems
- delivering guaranteed carrier-grade quality of service (QoS) differentiation

Service assurance is critical to this. MYCOM OSI, the Assurance Cloud™ Company and leading independent provider of Assurance, Automation and Analytics solutions to the world's largest Communications Service Providers (CSPs), is pioneering the enablement of guaranteed carrier-grade differentiation through integration of 7 critical building blocks into its platform and applications:

- 1. AI/ML-driven, automated assurance:** AI/ML underpins predictive assurance automation, which is critical to cost efficiency and customer experience. It reduces manual operations beyond what can be achieved with rules-based workflow automation and it enables the pre-emptive resolution of faults and issues
- 2. Cloud native software architecture:** Containerized microservices-based applications, supported by a shared platform of models and services, enable assurance systems to operate from any infrastructure. This brings the potential to leverage the scalability, availability, security and cost advantages of the public cloud. MYCOM OSI's Assurance Cloud™, powered by AWS, does just that
- 3. Outcomes-based use cases:** Assurance systems must support increasingly fluid and configurable / programmable networks while simplifying the task of operating these



Mounir Ladki, President and CTO, MYCOM OSI

networks for the NOC/SOC. MYCOM OSI's catalogue of 200+ digital transformation solutions, including the recently launched 5G Roll-out Accelerator™ solution, enables CSPs to procure business outcomes, rather than satisfy increasingly detailed and complicated technology requirements

- 4. Support for multi-, hybrid and edge cloud:** In advanced 5G scenarios, service assurance must operate in a distributed cloud environment. Only when monitoring and orchestrating the network from the very edge can the Telco ensure it is anticipating and responding to changing conditions at the millisecond level. MYCOM OSI's involvement in Red Hat's Virtual Central Office (VCO) is one example of how our applications are evolving to support edge cloud scenarios
- 5. Datacenter assurance:** With the advent of 5G, networks are increasingly virtualized, cloudified and operated from the data-center, so it's essential that service assurance capability correlates infrastructure, Virtual Infrastructure Manager (VIM) orchestration

layers and virtual network functions (VNFs). For example, our solutions are used today to support Telco Cloud assurance, including at Three UK (the world's first Telco Cloud)

6. Zero-touch assurance and orchestrator interoperability: Interoperability with NFV and SDN orchestrators, which enables service auto-discovery and real time assurance-driven orchestration with zero manual intervention, is critical to closed loop automation. MYCOM OSI's support for auto-discovery of VNFs and service chains in OSM and integration with VMWare's SD-WAN orchestrator are two examples of this

7. SaaS and the public cloud: According to TM Forum's report "Public Cloud: An essential but not singular solution for CSPs", the industry is recognizing the structural advantages of running OSS – including mission-critical service assurance – in the public cloud. MYCOM OSI's Assurance Cloud™ - the world's first carrier-grade service assurance SaaS - has delivered consistently better TCO, speed and reliability to its customers. It also delivers advanced features only available in the Assurance Cloud™ such as on-demand elastic scaling and advanced AI/ML enabled through services from the underlying public cloud platform provider such as AWS

Through its Experience Assurance & Analytics™ (EAA) suite of applications and Assurance Cloud™ SaaS offering, MYCOM OSI provides the above capabilities to many of the world's fastest, largest and most complex networks. It plays a key role in enabling the transformation of Tier 1 CSPs globally, including the world's first carrier-grade telco cloud Three UK, with the first service assurance SaaS deployment in South East Asia at Globe Telecom, and also at Vodafone.

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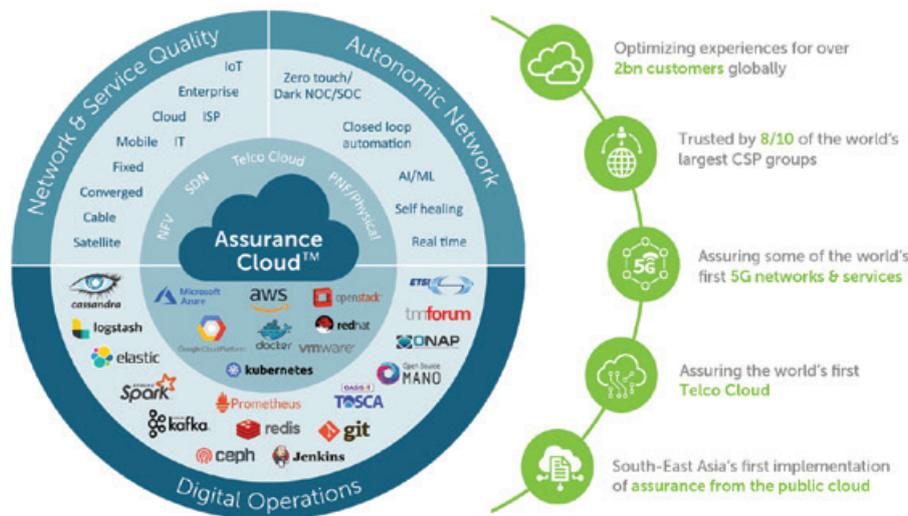
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- Visualize, automate and optimize experiences across **hybrid telco** and **IT networks**
- Leverage the cloud to achieve **business agility** and eliminate **infrastructure costs**

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A call to the help desk may be in order for the telcos industry, as most telcos saw their brand value decline this year, despite strong investments. Over the past year, the combined value of the world's top 50 telcos brands included in the Brand Finance analysis declined by 12% to a combined value of \$589 billion (€534.36 billion), compared to \$670 billion (€607.84 billion) in 2019 – while all other major sectors recorded significant increases.

Over the past years, we've seen big telcos being squeezed from all sides as messaging apps like WhatsApp impact voice and SMS revenue, while challenger brands offering comparable data services at below market rates leads to fierce price competition and decreasing margins.

Deutsche Telekom still Europe's most valuable

Despite its 14% drop in brand value, Deutsche Telekom retains its place as the most valuable European telcos brand in this year's *Brand Finance Telecoms 50* report. As Deutsche Telekom is one of the biggest investors by capex across telecom infrastructure, it would be worth monitoring precisely how the brand will leverage its leadership position to gain advantage in 5G deployment and future applications, which may create additional value over time in terms of both brand and business. For now, the company remains true to its aspiration to be seen as Europe's leading telco.

Spectrum's brand value rises

US brand Spectrum has cause for celebration having seen a 25% brand value growth driven by great performance alongside a share price bump. In the last months of 2019, it reported the highest broadband subscriber growth for the third quarter in four years (quarterly net additions were up 32.2% year on year at Q3 2019 in the Internet primary service unit). Spectrum is currently the fourth most valuable telco player regarding brand value in the US.

Despite launching Spectrum TV in 2018, the Spectrum brand doesn't appear to be focusing on content and streaming as much as its

competition. After the acquisition of TWC, its strategy is more to create a national platform – a state-of-the-art network infrastructure – to deliver superior performance. Ultimately, Spectrum's long-term growth opportunity comes from its powerful, easy-to-upgrade network that allows it to offer data-rich wireline and wireless products that consumers want and businesses need.

“ Europe snapshot: All of the European telcos brands in the top 50 have lost brand value in 2019 with an average drop of 13%

Viettel fastest growing in top 50

Of the handful of telcos operators that grew in brand value last year, the top spot goes to Vietnamese telco Viettel, which recorded an impressive 34% growth to \$5.8 billion. The state-run telcos provider announced mid-2019 that its consolidated revenue had

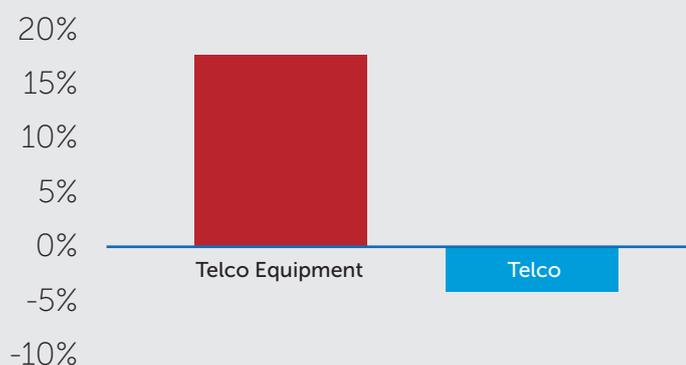
increased 7.4% year on year. In addition to improved revenue in 4G services and overseas markets, the brand oversaw the largest number of customers registered for mobile number portability services, an impressive 53% of total demand in the market. As the first telcos brand to successfully test a 5G network in Vietnam, it is clear that Viettel is planning for the future.

AT&T fell fastest

US giant AT&T, on the other hand, is the fastest-falling telcos brand this year, down 32% to \$59.1 billion. Just like its biggest rival, Verizon, AT&T finds itself outside the top 10 most valuable brands in the world for the first time in nearly a decade and also loses its leadership on the telco top 50 – to Verizon. Over the last few years, the brand has diversified its entertainment portfolio, culminating with the acquisition of WarnerMedia, as part of a plan to move away from reliance on the traditional telco business and paid TV, as both revenue streams have been drying up lately.

The upcoming launch of HBO Max with WarnerMedia, which will compete with streaming brands like Netflix, should help propel the company forward. AT&T recently announced a plan to drive significant growth through 2022, including limiting acquisitions, paying off debt to improve its balance sheet and investing in strategic areas, such as 5G infrastructure, to enable innovative services far above and beyond data.

Historic CAGR 3 years (2017-2020) – Top 15 players



Source: Brand Finance

2020 Rank	2019 Rank	Rank Change	Brand name	Country of operation	2020 Brand Valuation (USD billions)	2020 Brand Rating	2020 BV/ EV	BV Change	BSI Change	EV Change	BV/EV Change	2019 Brand Value (USD billions)	2019 Brand Rating	2019 BV/ EV
1	2	1	Verizon	United States	63.7	AAA-	18%	-10%	-2%	10%	-19%	71.2	AAA	22%
2	1	-1	AT&T	United States	59.1	AA+	16%	-32%	-3%	-11%	-24%	87.0	AA+	21%
3	3		China Mobile	China	49.0	AAA	40%	-12%	-3%	-17%	6%	55.7	AAA	37%
4	4		Deutsche Telekom	Germany	40.0	AA+	22%	-14%	-1%	16%	-26%	46.3	AAA-	30%
5	5		NTT Group	Japan	36.4	AA	20%	-13%	-6%	1%	-14%	41.7	AA+	23%
6	6		Xfinity	United States	28.8	AA	17%	6%	0%	28%	-17%	27.1	AA	20%
7	9	2	China Telecom	China	20.1	AAA-	39%	-3%	-1%	-9%	7%	20.6	AAA-	36%
8	12	4	Spectrum	United States	19.3	AA	11%	25%	2%	16%	8%	15.4	AA-	10%
9	7	-2	Vodafone	United Kingdom	19.1	AA+	23%	-10%	-1%	-12%	2%	21.3	AA+	22%
10	8	-2	Orange	France	18.1	AA+	21%	-14%	-3%	5%	-18%	21.0	AA+	26%
11	10	-1	SoftBank	Japan	16.2	AA	18%	-16%	-10%	-26%	13%	19.3	AA+	16%
12	11	-1	au	Japan	15.7	AA+	25%	-11%	-4%	-4%	-7%	17.6	AAA-	27%
13	13		Movistar	Spain	9.6	AAA-	17%	-10%	1%	-1%	-9%	10.7	AA+	19%
14	16	2	China Unicom	China	9.4	AA+	28%	-9%	-1%	-19%	13%	10.2	AA+	25%
15	15		Sky	United Kingdom	9.3	AA+	20%	-11%	-3%	0%	-11%	10.4	AAA-	22%
16	19	3	Etisalat	Uae	8.5	AAA	31%	2%	2%	-5%	8%	8.3	AAA	28%
17	14	-3	Telstra	Australia	8.1	AAA-	20%	-24%	2%	5%	-28%	10.6	AAA-	28%
18	24	6	STC	Saudi Arabia	8.0	AA+	16%	13%	1%	26%	-10%	7.1	AA+	18%
19	17	-2	TIM	Italy	7.3	AA+	15%	-16%	-3%	7%	-22%	8.7	AAA-	20%
20	21	1	Bell	Canada	7.1	AA	10%	-11%	-5%	18%	-25%	7.9	AA+	14%
21	20	-1	3	Hong Kong	6.7	AA	35%	-17%	3%	11%	-26%	8.2	AA	47%
22	25	3	Telus	Canada	6.6	AAA-	19%	-4%	-2%	11%	-14%	6.9	AAA-	22%
23	22	-1	O2	United Kingdom	6.3	AA+	18%	-14%	-3%	8%	-21%	7.4	AAA-	23%
24	32	8	Telenor	Norway	6.3	AAA-	18%	9%	11%	12%	-2%	5.7	AA	19%
25	30	5	Claro	Mexico	6.1	AAA-	14%	4%	4%	2%	2%	5.9	AA+	14%
26	23	-3	Sprint	United States	6.1	A+	9%	-17%	-6%	14%	-27%	7.3	A+	13%
27	18	-9	BT	United Kingdom	5.9	AA-	25%	-28%	-1%	-29%	1%	8.3	AA	25%
28	37	9	Viettel	Vietnam	5.8	AAA-	22%	34%	16%	22%	10%	4.3	AA	20%
29	27	-2	Rogers	Canada	5.6	AA+	14%	-15%	-5%	5%	-20%	6.7	AAA-	18%
30	31	1	SFR	France	5.6	AA+	24%	-4%	-1%	14%	-16%	5.8	AA+	29%
31	26	-5	SK Telecoms	South Korea	5.2	AAA	22%	-23%	8%	1%	-24%	6.8	AAA-	29%
32	29	-3	Swisscom	Switzerland	5.1	AAA	20%	-14%	0%	-4%	-11%	6.0	AAA	22%
33	36	3	Telkom Indonesia	Indonesia	4.8	AAA	14%	3%	2%	21%	-15%	4.6	AAA	17%
34	35	1	Telia Company	Sweden	4.5	AAA-	20%	-5%	-1%	-13%	9%	4.7	AAA-	18%
35	34	-1	Airtel	India	4.5	AA+	10%	-7%	-4%	35%	-31%	4.8	AAA-	15%
36	28	-8	Centurylink	United States	4.4	A-	9%	-31%	-14%	-15%	-19%	6.4	A+	11%
37	38	1	AIS	Thailand	4.1	AAA+	17%	3%	2%	18%	-12%	4.0	AAA+	19%
38	39	1	KT	South Korea	4.1	AAA-	37%	3%	14%	1%	2%	4.0	AA	36%
39	33	-6	Chunghwa	Taiwan	3.8	AA	14%	-32%	-2%	7%	-37%	5.6	AA+	22%
40	45	5	Singtel	Singapore	3.8	AAA	17%	8%	1%	8%	0%	3.6	AAA	17%
41	41		Ooredoo Group	Qatar	3.5	AA+	33%	-7%	0%	5%	-12%	3.8	AA+	37%
42	49	7	UQ Communications	Japan	3.4	A+	15%	1%	2%	-3%	4%	3.4	A+	14%
43	48	5	MTN	South Africa	3.4	AAA	16%	0%	7%	8%	-8%	3.4	AAA-	18%
44	40	-4	Optus	Australia	3.3	AAA	14%	-15%	4%	7%	-21%	3.9	AAA-	17%
45	44	-1	Jio	India	3.2	AAA	34%	-10%	2%	-29%	26%	3.6	AAA	27%
46	51	5	Telcel	Mexico	3.1	AAA-	16%	-4%	1%	9%	-12%	3.2	AAA-	19%
47	43	-4	kpn	Netherlands	3.0	AAA	16%	-15%	2%	10%	-23%	3.6	AAA	20%
48	46	-2	Free	France	2.8	AAA-	23%	-17%	-3%	12%	-26%	3.4	AAA	31%
49	42	-7	EE	United Kingdom	2.8	AA+	37%	-22%	-3%	-21%	-2%	3.6	AAA-	38%
50	52	2	Bouygues Telecom	France	2.8	AA+	23%	-2%	1%	5%	-7%	2.9	AA+	25%

Demand for data grows and the future is mobile

Faster data speeds, smartphone adoption, mobile apps, social media, video messaging on demand and smart wearables drove and will continue to drive data consumption. Industry experts are predicting data will grow substantially by 2023; the GSMA expects that most of the expanding base of mobile internet users are mobile-only, with no PC access, so we should expect the growth to be moving in a mobile-only direction for the medium to long term. An example of this is Netflix, which is launching a mobile-only version across India – a testament to the subscription-based streaming service's popularity for people on the go.

Analysis this year has revealed that telecoms infrastructure providers, such as Ericsson, Nokia and Samsung, have amplified their global presence and are playing crucial roles in helping behind the scenes, for example, with IoT.

Interestingly enough, the compound annual growth rate over the last three years in terms of brand value sees telecoms equipment coming out on top, with players like Nokia, Ericsson and Huawei really

delivering value through their expanded capabilities.

Decline in voice, SMS and data erodes prices

While some telecom brands tried to build global brands and some enjoyed considerable initial success, it now looks like the mission may be unsustainable as we've seen major carriers such as Telefonica and Telenor pulling back from global markets.

While voice and SMS revenue were declining in the wake of instant messaging and free services like WhatsApp and Skype, 3G and 4G have compensated for this drop, despite the big investments required to develop them. It is also worth noting that wide Wi-Fi coverage is eroding connectivity revenues in developed markets.

TIM and Vodafone in Italy have taken a multi-brand strategy, launching mobile virtual network operators (MVNOs) Kena Mobile and Ho respectively in an attempt to limit churn, but while the two (especially TIM) retained some of their customers, many switched to lower-priced products, adding to the difficulties of finding revenue growth and sustaining profitability.

“Faster data speeds, smartphone adoption, mobile apps, social media, video messaging on demand and smart wearables drove and will continue to drive data consumption

On top of that, competition from new, more agile networks and/or MVNOs has ignited a real price war. Reliance Jio is the biggest and most extreme example of this, having all but bankrupted its rivals in India. Closer to home, Italy has seen average revenue per user (ARPU) undermined by Iliad's launch there.

Brand Finance methodology notes: January 2020

Every year, the valuation and strategy consultancy Brand Finance values the world's biggest brands. The 50 most valuable telecoms brands in the world are included in the Brand Finance telecoms 2020 league table.

Brand value is understood as the net economic benefit that a brand owner would achieve by licensing the brand in the open market. Brand strength is assessed through a balanced scorecard of factors (such as marketing investment, stakeholder equity and business performance) and is used to determine what proportion of a business's revenue is contributed by the brand.

Additional insights and more information about the methodology, as well as definitions of key terms, are available in the *Brand Finance Telecoms 50 2020* report, available at www.brandirectory.com. Brand Finance helped craft the internationally recognised standard on brand valuation, ISO 10668, and the recently approved standard on brand evaluation, ISO 20671.

Methodology

Definition of brand: Brand Finance was involved in crafting ISO 10668, the internationally recognised standard on brand valuation, which defines a brand as a marketing-related intangible asset, including, but not limited to, names, terms, signs, symbols, logos and designs, intended to identify goods, services or entities, and creating distinctive images and associations in the minds of stakeholders, thereby generating economic benefits.

Brand strength: Brand strength is the efficacy of a brand's performance on intangible measures, relative to its competitors. In order to determine the strength of a brand, Brand Finance looks at marketing investment, stakeholder equity and their impact on business performance.

Each brand is assigned a Brand Strength Index (BSI) score out of 100, which feeds into the brand value calculation. Based on the score, each brand is assigned a corresponding rating up to AAA+, in a format similar to a credit rating.

Brand valuation approach: Brand Finance calculates the values of the brands in its league tables using the Royalty Relief approach, a brand valuation method compliant with the industry standards set in ISO 10668. It involves estimating the likely future revenues that are attributable to a brand by calculating a royalty rate that would be charged for its use, to arrive at a 'brand value' understood as a net economic benefit that a brand owner would achieve by licensing the brand in the open market.

About Brand Finance

Brand Finance describes itself as the world's leading brand valuation and strategy consultancy, with offices in over 20 countries. It aims to bridge the gap between marketing and finance by quantifying the financial value of brands. Drawing on expertise in strategy, branding, market research, visual identity, finance, tax and intellectual property, Brand Finance helps brand owners and investors make the right decisions to maximise brand and business value. 



5G brings new opportunities to operators

Leverage Embedded Experience from Wind River to Connect with New 5G Markets

Emerging 5G opportunities

5G technology, bringing improved latency, capacity, and speed, is expected to enable new business models and use cases in a wide range of market segments. Clearly the most impacted market is telecom, which will be required to deploy large amounts of networking infrastructure, such as virtual radio access networks (vRAN) to support the new spectrum and resulting use cases.

It's expected that the automotive industry will become the largest market opportunity for 5G Internet of Things (IoT) solutions, representing 53% of the overall 5G IoT endpoint opportunity in 2023 1, according to Gartner. The company also forecasts strong demand for 5G-enabled outdoor cameras used by city and building operators to enhance physical security.

Other 5G-relevant market segments are factory automation and logistics, in which robots perform manufacturing tasks and carry materials around warehouses. In medical, ultra-low latency 5G networks will support remote, collaborative surgery with doctors and patients in different geographic locations. Agricultural use cases include automated tractors and drones helping to plant and harvest crops. And these are just a handful of the emerging opportunities.

Cultivating new 5G markets

Network operators will invest up to \$1 trillion in 5G networks between 2018 and 2025 2, and, of course, they are looking for ways to maximize the return on this enormous expenditure. This effort includes offering new revenue generating services in emerging 5G markets such as the aforementioned. With nearly 40 years of embedded experience, Wind River® provides the cross-industry expertise and worldwide presence to help operators gain a strong foothold in new market segments. Companies around the world, such as Ericsson, Nokia, Boeing, GE, and Ford Motor Company, trust Wind

River as the foundation for their innovation in the telecom, aerospace and defense, industrial, medical, and automotive industries.

Addressing 5G industry challenges

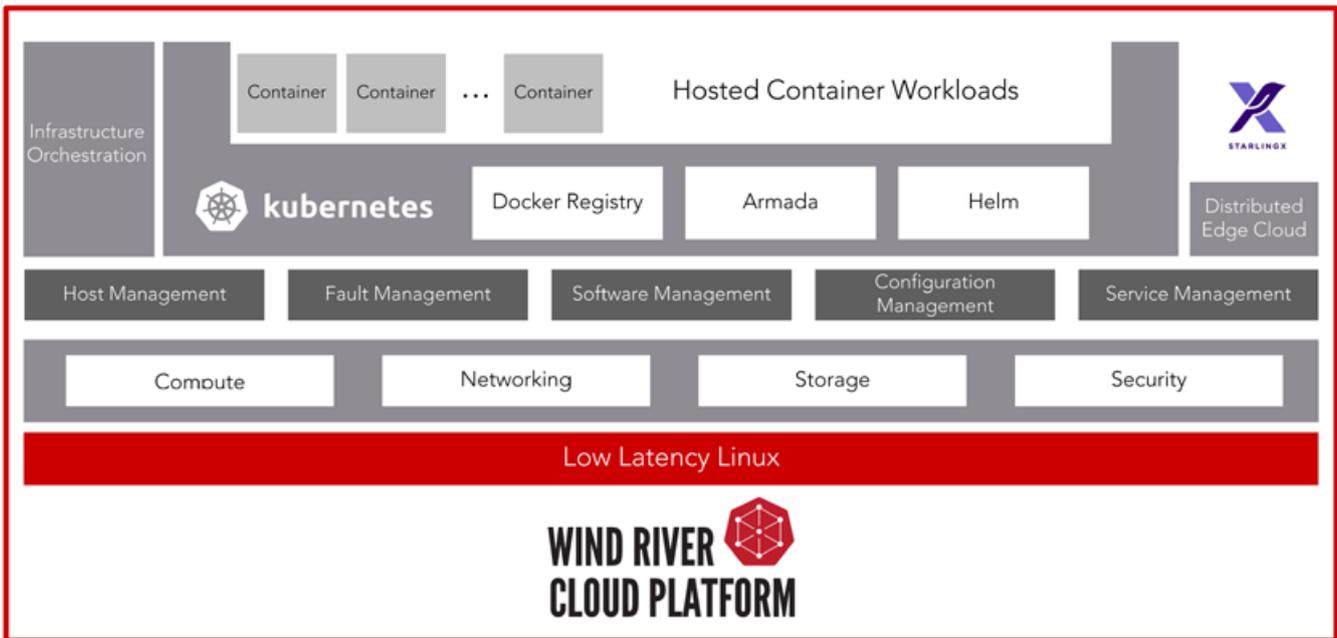
Before network operators can pursue new markets with 5G, they need to deploy equipment at the network edge that allows them to overcome some key challenges, such as:

Managing complex, distributed networks

Since 5G uses a smaller wavelength than 4G, it will be necessary to deploy many more base stations than with 4G, making network management more complex. Adding to the complexity is the need to dynamically scale services as needed. Helping to simplify network management, Wind River Cloud Platform provides live scalability (from one to many nodes and from edge to core) and a single pane of glass interface that can be used to manage thousands of remote systems. The platform is highly reliable and telecom grade, supporting 99.9999% (six nines) guaranteed uptime.

Delivering high levels of performance and extremely low latency

5G standards and technologies enable performance that is several orders of magnitude greater than 4G, presuming 5G network infrastructure is adequately designed for the task. Engineered to satisfy stringent 5G performance demands, Cloud Platform ensures ultra-low latency in virtual radio access networks (vRAN), which is critical for supporting real-time applications such as voice over LTE (VoLTE) and enabling future 5G services. Wind River Linux, based on a Yocto Project implementation, is carefully tuned to deliver deterministic, low-latency performance, matched to the use case in a small code footprint, enabling it to be deployed in both small (i.e., single device) and very large network infrastructures.



Transitioning from 4G to 5G

Network operators are looking for network solutions that deliver carrier grade performance, massive scalability, and rapid service instantiation for 4G networks while laying the foundation for 5G networks in the future. Already successfully deployed in existing 4G networks and the majority of early 5G rollouts, Wind River Linux helps ensure a smooth and cost-effective transition for telecommunications equipment manufacturers (TEMs) and network operators.

Maintaining security throughout lifecycle

Operators need to ensure that their network remains secure over the entire lifecycle. Helping to continuously safeguard deployed network systems, Wind River provides ongoing threat mitigation against common vulnerabilities and exposures (CVEs). The Wind River security team is constantly monitoring security vulnerabilities, including specific security notifications from U.S. government agencies and organizations such as the National Institute of Standards and Technology and the United States Computer Emergency Readiness Team, as well as public and private security mailing lists and the CVE database.

Minimizing cost

The operating cost to support and maintain a roll-your own or commercially available operating system can be significant. Lowering the TCO for building, deploying, and maintaining network infrastructure, Wind

River open source products such as Cloud Platform and Wind River Linux provide a fully supported solution, including:

- Commercial hardening and packaging, including a full set of user documentation, installation, and configuration
- Long-term support for the lifecycle of an operator's network infrastructure
- Continuous monitoring and fixes for security vulnerabilities
- An extended list of Linux board support packages (BSPs) across a variety of architectures
- IP compliance with reporting and OpenChain Conformance
- Customer-specific capabilities and alignment with upstream services

New 5G services at the edge of the network

Delivering low latency and high speeds at the network edge, wireless 5G networks are a promising alternative to wired networks, particularly for mobile use cases found in manufacturing, transportation, healthcare, energy, and agriculture. As a trusted supplier in these market segments, Wind River can help network operators efficiently develop and deploy new revenue-generating services.

To learn more about Cloud Platform or Wind River Linux, visit www.windriver.com or contact salesinquiry@windriver.com or meet Wind River at MWC 2020, in Hall 2, stand 2K63.



5G Base Stations
Boosting data throughput



Autonomous Vehicles
Navigating streets



Untethered Robots
Working in warehouses



Surgeons
Operating on patients remotely



Drones
Planting and harvesting crops

5G cellular networks and KVM matrix solutions will deliver new work methodologies to future generations



Fifth generation cellular network technology will bring a new level of mobility to users, and with it, new ways of working. **Enno Littmann**, CEO of IHSE, explains how the combination of 5G cellular networks and KVM matrix switching systems will improve users' workflows across a range of application sectors. It examines some of the radical new work methodologies that could be created in the future.

Fifth generation, 5G, technology offers higher quality and more reliable connectivity to mobile users than 4G. In combination with KVM technology, mobile users will benefit from ultra-secure, delay-free connectivity to remote computers. This will enhance existing work procedures and enable new work methodologies that are currently unachievable with existing 4G network capabilities.

Combination of 5G networks and KVM switching technology

KVM switching and extension solutions provide direct connection for multiple users to physical and virtual computers; securely, quickly and on-demand. Users enjoy unconstrained direct, latency- and artefact-free access to dedicated applications running on hardware resources hosted in remote centralised secure equipment rooms. It is a well-proven technology that serves many mission-critical applications across different market sectors, including broadcasting, security and process control and air traffic management.

New mobility, collaboration and new work methodologies

New methods of working will be created through greater levels of access, resource sharing, convenience and collaboration, benefitting many commercial sectors:

Design and production facilities

Large, complex CAD projects rely on powerful computers housed in secure environmentally controlled equipment rooms. KVM matrix switches enable engineers and designers to access these computers from any convenient keyboard, video and mouse workstation. 5G adds mobility, giving roving engineers and designers universal mobile access to office systems.

A wide range of KVM matrix switches suits different installation requirements



Office collaboration

Staff want to communicate and collaborate with colleagues with ever-greater convenience. Enhanced connection to a single set of source computers, running standardised in-house collaboration and videoconferencing systems from mobile devices will enhance their productivity and effectiveness. In addition, individual computers can be shared amongst colleagues to enable new ways of collaborative working.

Emergency mobile command centres

The reliability, speed and wider availability of 5G networks will enhance the capabilities of command centres; greatly improving incident management by directly linking onboard systems directly into headquarters equipment.

Maintaining complete security

Mobile networks are less secure than fixed networks. However, KVM technology incorporates extensive inherent security to allay fears of unauthorised access over that part of the network. SecureCore technology within the KVM switch blocks external attack on individual computers, whilst encrypted data transmission negates attempts at eavesdropping.

A mobile connectivity solution for the future

5G communication networks coupled with KVM technology will undoubtedly enable new and enhanced communication and collaboration services in the future.

Today, many of these concepts are unidentified. Future generations will select the tools, like 5G and KVM, that will enhance their business skills and effectiveness, improving their lives and the economy for the better.

Digital Transformation

Insight report

34 Readership survey:

What a difference a year makes. This time last year, 5G deployment was just getting underway in earnest. Now the technology is rolling out in all over the globe. There are troubling signs that deployment could be slowing due to geopolitical concerns, the difficulties developing profitable business models and securing 5G and IoT networks. Telcos also need to transform their culture to become much more agile.

41 Culture shift: lessons from Europe's telcos

Company culture is notoriously hard to change, but many of Europe's telcos are making it their priority, recognising that it not so much a barrier to be overcome as a huge enabler of digital transformation, writes Sarah Wray



2020 reader survey: operators' digital transformation is advancing, but security is a growing challenge

What a difference a year makes. This time last year, 5G deployment was just getting underway in earnest. Now mobile operators are rolling out the technology in all corners of the globe. There are some troubling signs that deployment could be slowing amid several challenges, namely geopolitical concerns, difficulties developing profitable business models and securing 5G and internet of things (IoT) networks, and the need for telcos to transform their culture to be much more agile (see article on page 41).



A year ago, about 20% of respondents to our survey said that they or their customers were already deploying 5G and 44% were participating in trials.

This year we asked about future deployment and found that close to half intend to deploy 5G this year.

Where is 5G available?

Mobile operators have deployed 5G in more than 6,500 locations worldwide, according to the Ookla 5G map, which is updated weekly to track deployment in cities around the world. The screenshot on page 40, captured in late January, shows Europe as a hotbed of activity.

As Kester Mann, Director, Consumer and Connectivity at CCS Insight, noted in his recent *Mobile Europe* blog, “One trend that has taken many by surprise is the strong progress of 5G in Europe. During the build-up to the first launches, much was made of the region trailing the US and developed Asian markets, yet Europe now accounts for almost half of all 5G network launches.”

Indeed, all four UK mobile operators have launched 5G. Deployment continues apace in Asia as well, but in the US, where carriers have been aggressively rolling out 5G technology, deployment has slowed somewhat unexpectedly. Shares in 5G equipment provider Ericsson dropped 7% in January on this news.

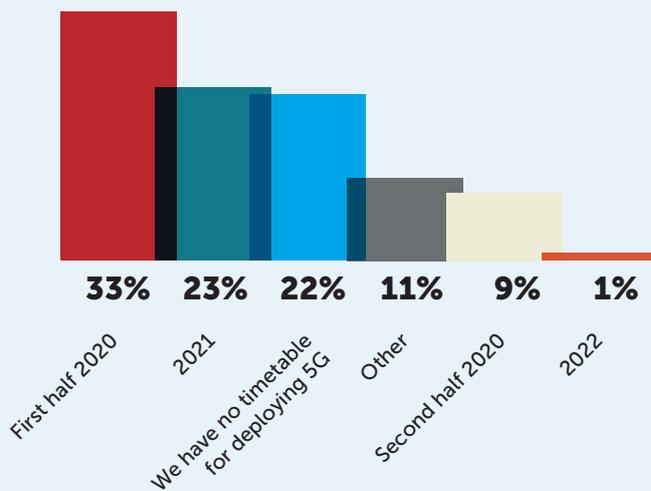
Ericsson CEO Börje Ekholm blamed the slowdown in the US partly on a holdup in the merger between T-Mobile and Sprint, but he also told *The Wall Street Journal* that 5G is slowing in many countries because of geopolitical concerns about the use of Huawei equipment.

“That has created more uncertainty for our customers,” he said. “This whole notion that this was a win for Ericsson and Nokia so far has not materialised.”

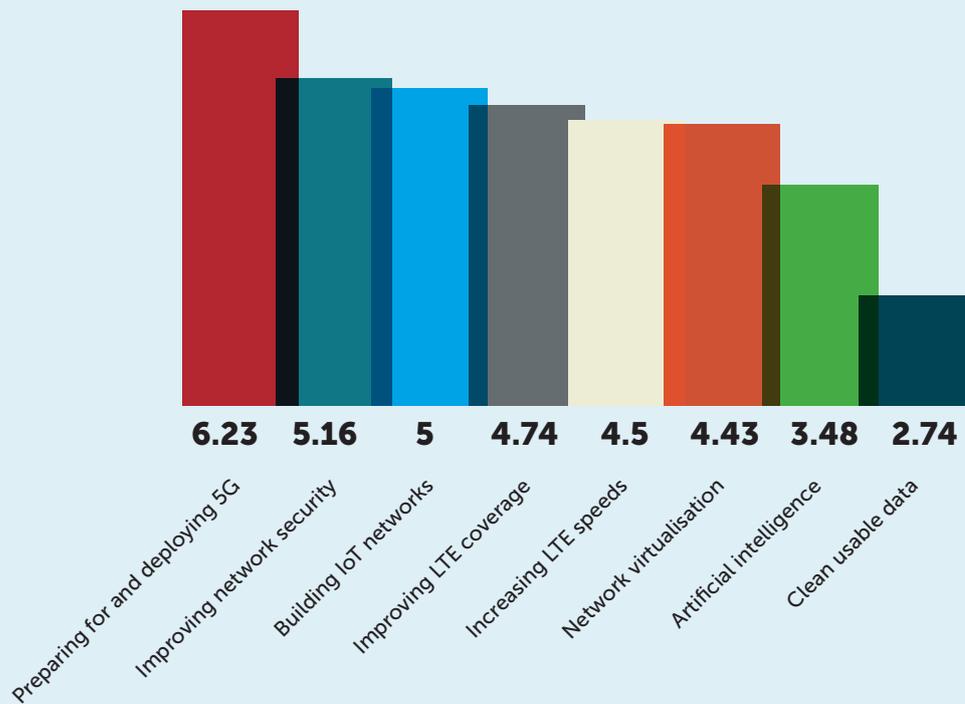
The US continues to push hard to try to keep other countries from using Huawei 5G technology, but it may be losing the fight. In late January 2020, the UK, for example, decided in favour of allowing limited non-core deployment of Huawei 5G technology.

In the same month, German Chancellor Angela Merkel also implied tacit support for Huawei during the World Economic Forum Annual Meeting in Davos, Switzerland. Although she did not name Huawei, she said,

When will you deploy your first commercial 5G services?



Which technologies will be the biggest priorities for mobile operators in 2020 (please rank in order of importance)?



“How do I make myself secure? I think I make myself the most secure through diversification and redundancy where it is necessary; those are the technical approaches to secure myself. I don’t think I make myself particularly secure if I completely eliminate providers in their entirety and then don’t know how they develop – I am sceptical about that.”

What’s most important?

Deploying 5G technology is, in fact, the biggest priority by far for the mobile operators and suppliers we surveyed. A full 91% put it in their top three priorities for 2020, a huge leap from our 2018 and 2019 surveys.

The next most important priority is improving network security, with just over half of respondents putting it in their top three. It’s good to see this rising as a priority. Last year only 15% of respondents cited security as a significant challenge.

More than half of respondents said they believe 5G networks are more difficult to secure than mobile networks that use previous generations of technology, and 60% have already started making critical improvements to network security. This can include implementing a comprehensive cybersecurity risk assessment, setting policies and processes for data governance, and ensuring data integrity

in partner ecosystems.

5G networks are harder to secure because the number of endpoints in networks, including Internet of Things (IoT) devices and sensors, is growing rapidly and promises to increase exponentially as 5G is deployed. In its first worldwide 5G forecast, issued in December 2019, International Data Corporation (IDC) projected that the number of 5G connections will grow from 10 million in 2019 to 1.01 billion in 2023, a staggering compound annual growth rate of 217.2%. By 2023, IDC expects 5G to represent 8.9% of all mobile device connections. The research firm also estimates that there will be 41.6 billion con-

nected IoT devices generating 79.4 zettabytes (ZB) of data in 2025.

Survey respondents are concerned about how to authenticate and secure all these IoT and edge devices – 70% cited it as the biggest security challenge. A larger attack surface because of increasing connectivity is also viewed as a significant obstacle.

Security as a differentiator

“Security is becoming an area where leading CSPs [communications service providers] can distinguish themselves from competitors,”

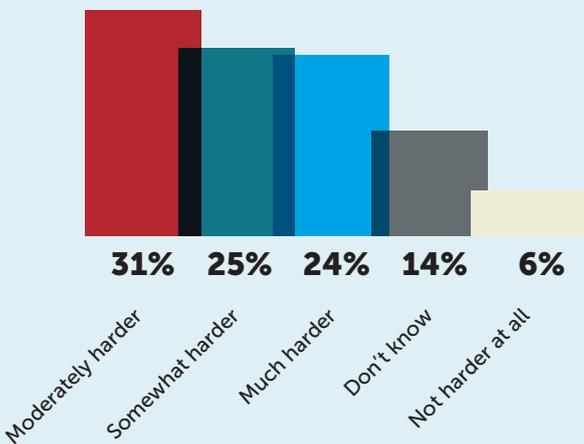
wrote Patrick Donegan, Founder & Principal Analyst, HardenStance, in a recent blog for TM Forum. “Ambitious operators should invest in security as a differentiator, especially for 5G vertical industry use cases. Operators should target a highly automated and orchestrated security model comparable to that practised by leaders in the airline industry.”

To do this, he suggested they must adopt agile DevSecOps practices. “In the development environment, telcos should have a roadmap for incentivising teams to embed security earlier and earlier

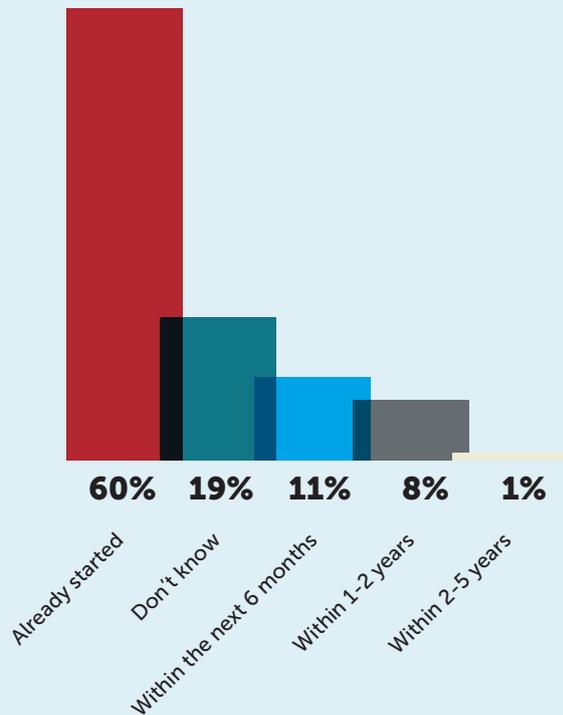
in the development cycle by upskilling development and operations teams with security best practices,” he explained. “For some services, this should lead to security being on a par with functional design and performance right at the outset of the design process.”

Mobile operators are, indeed, adopting agile DevOps practices: 64% of respondents to our survey said their companies are using them, up from 54% last year. A larger number of respondents’ companies are merging their technology and IT organisations as well, and

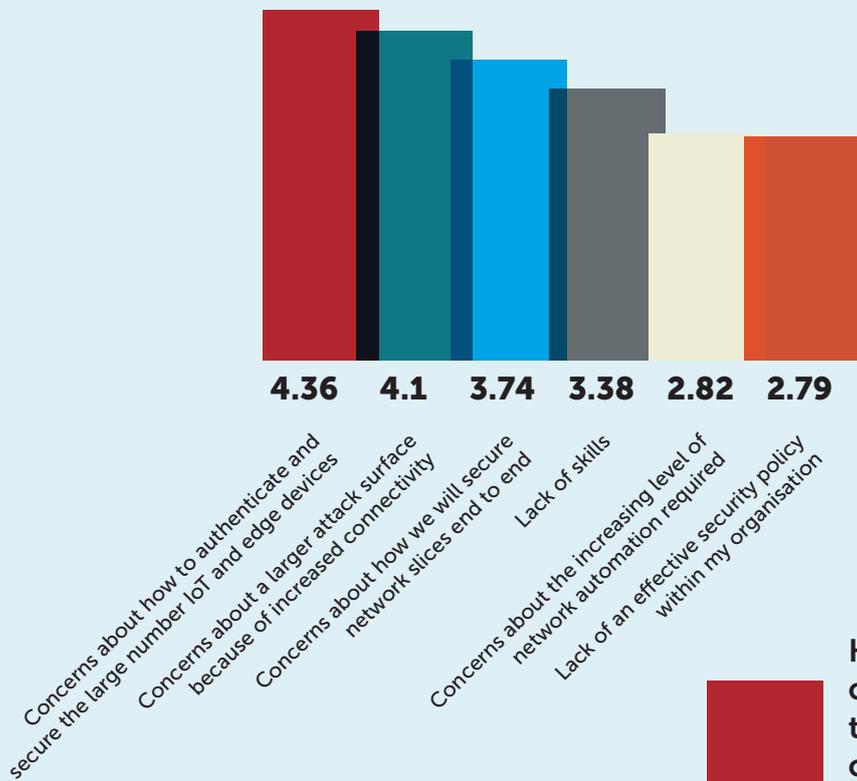
Will 5G networks be harder to secure than other networks?



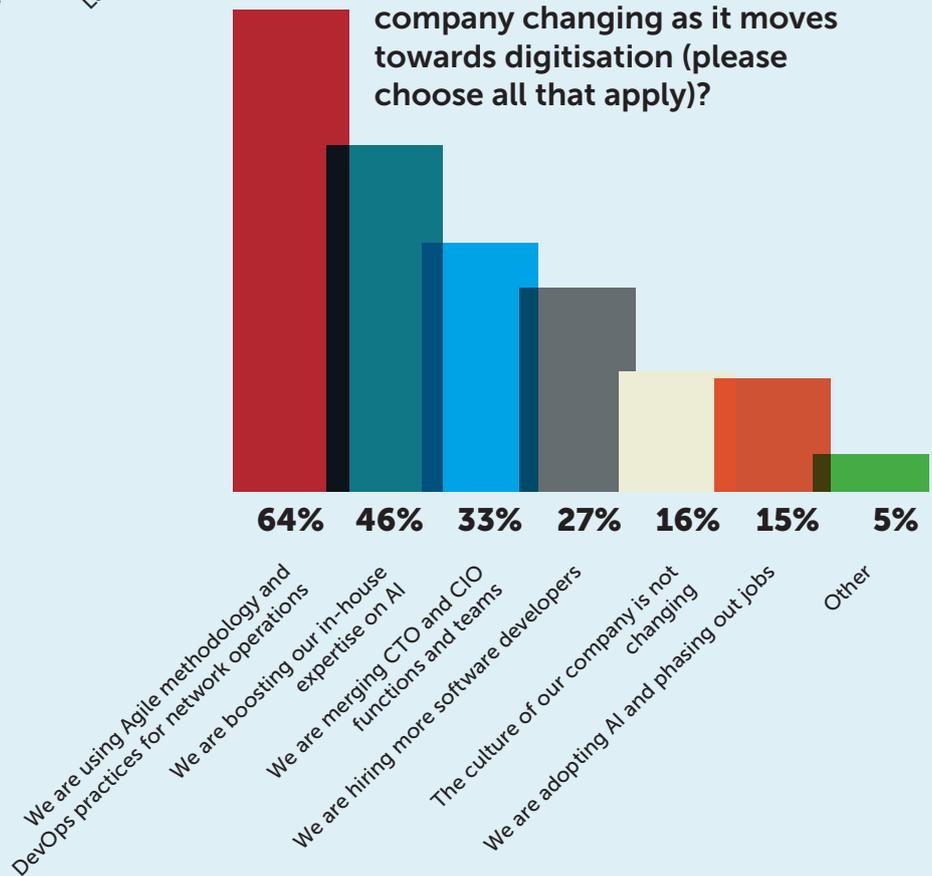
When will you begin making changes in the network to improve security?



What are the primary challenges when it comes to 5G security (please rank in order of importance)?



How is the culture of your company changing as it moves towards digitisation (please choose all that apply)?



about half continue to invest in AI skills and technology. However, with software skills in short supply none of this is easy.

IoT and the edge

A year ago, a healthy majority of respondents (65%) said that lack of use cases, or hard-to-develop business models, was an important obstacle for mobile operators to address. This is still a challenge, but operators seem to be growing increasingly confident that IoT services can succeed. Nearly half of respondents said that building IoT networks is a significant priority (see graphic on page 36).

Recent research from Research and Markets projected that 5G and IoT-enabled smart machines will be a \$1.2 billion global opportunity by 2024. The firm also found that device-level service level agreements will be critical for ensuring enterprise and

industrial quality of service requirements and that 5G is necessary for in-building private wireless networks that support ultra-reliable IoT applications.

Many IoT applications require that data processing power be moved closer to subscribers. Doing so reduces latency, and improves reliability and security, because data is localised. We asked survey respondents about plans to deploy multi-access edge computing (MEC) capabilities and found that only a small percentage (7%) have no plans to do so.

That's where the consensus ends, however. About a third of respondents said they don't know how they'll deploy edge infrastructure, and nearly equal percentages said they will build their own facilities or work with a partner (for example, lease facilities or buy managed services). We allowed respondents to choose all that apply, believing it's likely most

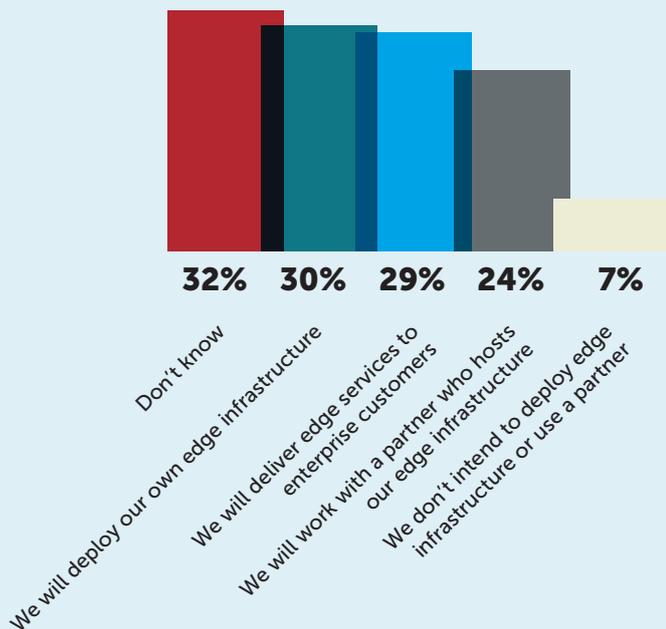
operators will use a hybrid model of owned and leased facilities.

Some large operators are working with public cloud providers to deploy edge facilities. As part of the announcement this summer that it will become a 'public cloud first' company, AT&T, for example, said it is working with Microsoft to deploy edge computing capabilities in data centres.

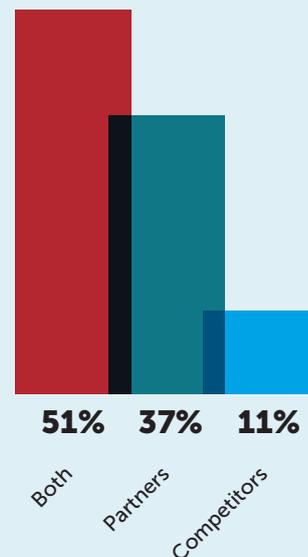
The dynamics between mobile operators and cloud providers are likely to get more complex in the 5G era. Microsoft has said it does not intend to build edge facilities to compete with telcos; rather it will only seek to partner with them to address enterprise use cases. But cloud providers ostensibly could compete with telcos at the edge.

We asked respondents how they view public cloud providers – as partners or competitors – and while most see them as

What are your plans for edge infrastructure (please choose all that apply)?



Do you view hyperscale web providers as potential partners or competitors (choose one answer)?



both, a small percentage do see them as competitors only.

Make or break

Many mobile operators and suppliers believe 2020 will be a pivotal year for 5G because the technology will be deployed at scale, allowing customers to experience the advantages of the new technology. This ostensibly will lead to the development of new services, which, based on our research, is a key critical success factor.

Indeed, how operators and suppliers rank critical success factors has changed

little in the last six months. Quick development of new services, understanding the technology and potential business models, and concerns about whether there is sufficient fibre infrastructure for backhaul are still the top three factors.

As noted in our Q2 2019 survey analysis, backhaul networks are not equipped to meet 5G's stringent requirements of ultralow latency (1 to 10 milliseconds), peak data rates of 1-20Gbps and a connection density of up to 1 million devices per square kilometer. Improving fibre connectivity is the obvious solution, but it requires huge capital invest-

ment, which is leading some operators to consider wireless backhaul.

About this survey

Mobile Europe & European Communications conducted its reader survey in January 2020. Of 98 respondents, 53% were network operators, 24% were suppliers and 23% represented other types of company, such as consulting companies, systems integrators, analysts and regulators. A large majority of respondents (70%) were from Europe, 12% from the Asia-Pacific region, and 8% from the Middle East and Africa. The remaining 10% were from the Americas. ■■



Culture shift: lessons from Europe's telcos

Capturing what company culture means, let alone identifying the specific culture within a company, is difficult, but it can perhaps best be summed up as, 'The way we do things around here'. Telcos now almost universally understand that to survive and compete in a fast-changing world, they cannot continue to do things the way they always have. But, says Sarah Wray, the question is whether they can really change – and fast.

Culture constantly ranks high among the challenges of digital transformation. In TM Forum's *Digital Transformation Tracker*, for instance, telcos have identified culture as a 'very serious' barrier to transformation in the last three surveys.

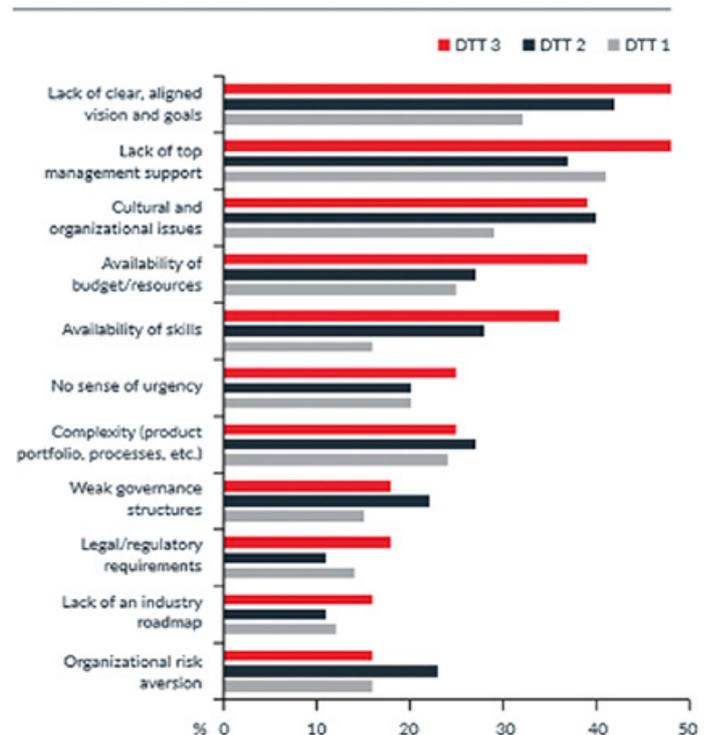
Changing things in large companies that are, with good reason, risk averse is clearly tough. People are far more complex than any technology and culture is fluid compared to the more certain worlds of facts, figures and key performance indicators. Still, such a big barrier cannot be ignored and several European telcos are working to shift the dial. They have gleaned a number of takeaways.

Learn from mistakes and success

The preliminary results of ongoing analysis by research and consultancy firm STL Partners (based on a survey carried out among 168 telecom industry executives) pinpoint key factors perceived to lead to a successful organisational culture. They include: an ethos of learning from mistakes; collaborative leadership; a sense of openness and psychological safety; and a motivating purpose.

The research also highlights telcos that appear to be making real strides when it comes to culture. For example, Elisa's culture is perceived as significantly more effective than that of most other telcos. Almost two-thirds (65%) of respondents from within Elisa said their company's culture is an enabler of

'Very serious' barriers to digital transformation



TM Forum, 2019

success, compared to 28% in other organisations. Only 20% of Elisa respondents said the culture is a barrier or significant barrier to success, compared to 62% from other telcos.

A key factor that stood out was that 89% of respondents from Elisa said mistakes are treated as something to be learned from, compared to 24% at other operators. No one at Elisa believed mistakes are treated as something to be punished, compared to 12% elsewhere.

Elisa has implemented regular assessments of day-to-day work and team projects at every level in the organisation. Once a team has concluded a project, regardless of whether it was a success or a failure, they collectively assess the outcomes and approaches. These assessments are then shared on Elisa's public SharePoint site, available to anyone in the organisation.

Andrew Collinson, Partner & Research Director, STL Partners, said, "If you could change only one thing in telco culture, I would say changing your approach to making mistakes and learning is a must. You must – at leadership level – demonstrate, tangibly, that you're not going to punish people for making mistakes."

Maintaining momentum

Another of the biggest challenges can be sustaining commitment towards change over the long term. On maintaining momentum, Veli-Matti Mattila, CEO, Elisa, said, "We have to deliver what we promised – the better we fulfil our promises, targets and expectations, the more space we are given to guide our strategy and the choices we have. We have been a good bet in terms of dividends and total shareholder return. Proven success builds freedom and autonomy."

Belgian operator Proximus is moving away from the traditional hierarchical organisation towards "a network of empowered teams". Peter Vandermaesen, Director, High Performance Organisation Programme, Proximus, said, "[Leaders] have to delegate and push the decisions down because it's much quicker – this is a complex world and it's changing so fast."

This is one of nine overarching strategic objectives to help Proximus transform to a digital service provider over the next three years. Each is steered by a director and sponsored by a member of the executive committee. While his peers may be looking at, for example, what the network infrastructure

will look like in the future, Vandermaesen is focused on how things are done to achieve these goals.

Agile methodologies

Agile methodologies are part of this, alongside design thinking and 'lean business', as well as rethinking HR, budgeting and prioritisation. The operator is also exploring 'enablers', including collaboration tools such as Office365 and new physical layouts.

Proximus' strategy is trying out new ways of working in smaller domains before scaling up the successful ones. For instance, Vandermaesen says the MyProximus app and Proximus' TV offering were delivered much

“ Leaders have to delegate and push the decisions down because it's much quicker – this is a complex world and it's changing so fast

faster through agile methodologies compared to traditionally run projects.

New ways of working are also being tried out in operational domains. From March, 180 people in Proximus' contact centres will be organised into multidisciplinary teams which include representatives from ordering, billing, technical support and so on. When customers call with a problem or query, between them the team should be more able to solve the issue immediately, from end to end, in most cases without waiting for approvals or passing the enquiry between departments, which is always unpopular with customers. Proximus is creating a 'blueprint' to support wider roll-out of initiatives like this.

Leadership is critical

Vandermaesen notes that leadership is key in driving a company's culture, but for those at the top delegating decisions can be difficult.

Common concerns include people's future roles and relevance, and fears about chaos if traditional structures are removed.

Proximus introduced delegation boards to map out decision-making processes and roles in detail. Furthermore, quarterly business reviews will set the priorities for the coming months, rather than leaders being given a budget for a project to be delivered over several years. Vandermaesen is designing the business review process collaboratively with the leadership team and will introduce it gradually. He said, "This reassures everybody about the process; it is not sudden chaos."

Giving people the right tools to adapt to a changing world is also key. Luciano Sale, Chief of Human Resources & Organisational Development at Italy's TIM, said, "Training plays a crucial role... because the competence of the entire workforce is a company's greatest wealth."

He added, "Cultural aspects boost the transformation strategy... People who are engaged in the transformation most frequently turn into positive tellers of their experience and accelerate the transformation process."

Lifelong learning

In 2016, TIM launched the TIM Academy, its 'corporate university', to support the transformation and evolution of the company in terms of technology, marketing and culture.

Based across nine physical locations in Italy and online, the Academy offers personalised learning plans for staff, and partners with universities and research centres. The company reports that in 2018, the Academy provided 1.2 million hours of training involving more than 42,000 people.

In 2019, the Academy focused on what TIM calls the gigabit society, which led to the development of modules such as agile, smart home, mobile messaging, lead generation, artificial intelligence and design thinking. Cross-functional working groups review operational models, processes, organisation and tools in line with digital transformation objectives. "TIM becomes thus a place of learning, more and more oriented towards the technological and business future," said Sale.

Similarly, Orange's Orange Campus Group training centre will be re-launched to enable the company to train at least 20,000 Orange employees in new digital skills by 2025, said



Source: The GC Index

Gervais Pellissier, Delegate CEO, Group Transformation, and Chairman of Orange Business Services.

“In the digital world, we are particularly exposed to accelerating change – of our environments and markets – which impacts how we have to anticipate, act and react: we have to constantly adapt. Therefore, empowering our people to learn, adapt, reinvent, test, try, draw conclusions from successes and from failures is the most important aspect,” he said.

Combining talents

The mixture of people and how they work together can also be a critical consideration in transformation. “To get the best out of their people, organisations need to create a culture that embraces change and recognises everyone’s role in that change,” commented Nathan Ott, Chief Polisher, The GC Index, which has been used by telcos, including Orange, T-Systems and Telus.

The Index is delivered through partners, and measures and describes five “proclivities, not personalities” for how people make an impact and contribute. This approach can help with recruitment as well as team

selection and modification towards transformation goals.

Those five proclivities are: strategists (who see the future and drive others towards those goals); game changers (who generate potentially transformational ideas); play makers (who focus on getting the best from others); implementers (who get things done); and polishers (who focus on continual improvement). Individuals typically have more than one proclivity.

Telcos have suffered such disruption to their business models over the last decade and the industry often thinks that game changers are what they need, but that’s not necessarily true. Game changers are a key part of the mix, but telcos still need people to drive big ideas through and refine them.

“There’s no such thing as a perfect team,” said Ott. “People need to be aligned to the desired business outcomes – in some scenarios, change is by nature linear and incremental.” Automating back-office processes could be one example of this.

Overlooked abilities

Ott noted, “Often the talent is there, but the culture hasn’t allowed people to play to their

natural energies or fulfil their potential. There is always a way someone can add value to a task, process or objective.”

Pascal Viginier is Special Advisor and former Group CIO, Orange. In a webinar, he highlighted that applying The GC Index to the operator’s Global IT leadership team part-way through a digital transformation project had produced interesting results. It was used in combination with the TM Forum Digital Maturity Model, which is a transformation-mapping tool. Viginier said that, as a result, team members gained more self-confidence and it improved the acceptance of diversity.

“If we have a proper cocktail of The GC Index [types] in the teams, it brings superior performance,” he explained. “Were I to do it again, I would first use the TM Forum Digital Maturity

“ Organisations need to create a culture that embraces change and recognises everyone’s role in that change

Model to assess our situation and the target. I would immediately assess my future team before selecting my team now, or [assess] just after selecting it, to ensure it is the right team.” He added that he would also extend the use of The GC Index to his business partners and to all operational teams in all countries.

Like digital transformation, a company’s culture will never be ‘done’ because new challenges and opportunities emerge, making it an ongoing cycle. Even so, there are some definite factors that have a profound impact, in particular strong leadership, trust and a willingness to learn continuously. It’s also worth thinking about culture as an enabler that can make digital transformation happen instead of as a barrier that has to be overcome. ■■■

The Wireless World

Our quarterly round-up of news and innovation from around the globe

CES 2020 takeaways

ABI Research noted that 2020's show was dominated less by the usual big transformation announcements and was more representative of the external factors buffeting the tech sector, including macroeconomics, global political challenges and an uncertain consumer environment. The research house said the show was more about what 'should', rather than 'could', be done, and provided a new dose of realism. For example, 5G was not positioned as a panacea, as it has been previously, but instead as a required investment that could be recouped. Likewise, the obsession with autonomous cars shifted to greater interest in the infrastructure for electric vehicles and how the automotive industry might fit into wider developments, such as smart homes and smart cities.



Worldwide RAN

Dell'Oro Group predicts total revenues from radio access networks (RANs) will reach \$200 billion between 2019 and 2024, with growth driven by 5G. This includes expectations that: 5G New Radio (NR) RAN investments will surpass \$100 billion; the 5G NR small cell market will account for 10% to 20% of the overall 5G NR sector; global macro and small cell transceiver shipments will approach 700 million; and millimeter Wave (mmWave) 5G NR will equate to about 17% of overall small cell investments.



Mexico

Red Compartida

Mexico's Red Compartida open access 700MHz network has achieved the coverage specified in its licence for the period to 30 January 2020. Red Compartida provides coverage to 50.18% of the population, about 56.3 million people, including 10.5 million in communities of fewer than 10,000 inhabitants. The most recent deployments brought coverage to the northern border cities of Tijuana, Mexicali and Ciudad Juarez, and ALTAN Redes, the consortium behind the rollout, said the target was hit more than a month before the deadline. The network must cover 92.2% of the population by 2024.

South Africa

Liquid Telecom

Liquid Telecom South Africa is to launch a 5G wholesale network in early 2020, following an agreement with Vodacom to use Liquid's 3.5GHz spectrum, which, according to Liquid, will cover all the country's major cities. Liquid has 56MHz of spectrum in the 3.5GHz band; the only other operators with access to the band are Telkom and Rain. Telkom has not yet announced its 5G plans, but Rain launched a commercial fixed-wireless 5G network in September 2019.

Tanzania

Tanzania Communications Regulatory Authority

The Tanzania Communications Regulatory Authority (TCRA) is blocking unregistered customers' mobile services after completing its biometric SIM registration programme on 20 January 2020. In the first week, over 656,091 SIMs were barred by network operators; more will follow as the regulation is enforced in phases. Market leader, Vodacom Tanzania, has barred 157,000 of its unregistered customers and its managing director, Hisham Hendi, is advising customers who are affected to visit one of Vodacom's more than 35,000 service points across the country to register.

South Korea

SK Telecom

SK Telecom said it has conducted the world's first standalone (SA) 5G data session on its multi-vendor commercial 5G network. It described this as a major breakthrough and now intends to provide standalone services on the network, launching a new 5G SA service in the first half of the year. SKT's standalone 5G data call took in Busan, the second largest city in Korea. It applied the SA New Radio (NR) software to its existing non-standalone (NSA) 5G base stations, while completing interoperability tests between network equipment provided by Ericsson and Samsung. The operator said it also has new 5G technologies, such as network slicing and mobile edge computing, in the SA environment.

Japan

Ministry of Internal Affairs and Communications

The Ministry of Internal Affairs and Communications (MIC) is considering a scheme by which mobile operators and fibre-based ISPs will charge their customers a small additional fee each month to cover the cost of deploying fibre in hard-to-reach areas such as mountain ranges and remote islands. The ministry is particularly keen to ensure fibre is in place to support 5G. A review panel will be set up this spring to look at how the system could be implemented by the middle of this decade. NTT Corp's NTT East and NTT West already collect a universal service-based monthly fee of JPY2 (USD0.02) from every mobile and fixed subscriber towards the maintenance of their fixed networks across Japan.

Singapore

StarHub and M1

The city state's second and third largest mobile operators - StarHub and M1 - are to submit a joint bid for one of the four 5G licences available. The closing date for licence applications is 17 February 2020. The regulator, the Infocomm Media Development Authority (IMDA), delayed the deadline to allow domestic operators more time to submit their proposals, but this is not expected to impact the timing of rollouts. The IMDA said these can begin this year, but will initially be limited to two networks. It expects the provision of nationwide coverage to be a lengthy process due to the lack of suitable spectrum, although wider coverage will be possible from 2022.

What does 2020 have in store for the worldwide telecoms market?



2020 will be a good year for many in the industry as services continue to deploy and expand, but some key issues still remain to be resolved, says Stephen Sale, Research Director, Analysys Mason.

Across the telecoms, media and technology landscape, much of the focus and hype in 2020 will remain on 5G, but the experience is still likely to be '4G-plus'. The full 5G experience of speed, reliability and low latency remains a few years away, but network upgrades are taking place faster than expected. We should also see real signs of traction in many other networking and

connectivity technologies, such as software-defined wide-area networking (SD-WAN) and narrowband Internet of Things (NB-IoT).

Based on our industry research and consulting, these are some of the key areas that we think will shape the outlook for the industry in 2020.

All eyes are on 5G

Telecoms providers have upgraded networks to 5G more quickly than expected in 2019, but 'full 5G', which promises improved reliability and latency as well as speed, will be limited to pilot trials in 2020 and we are unlikely to see many radical new use cases. In the coming year, 5G will look more like a gradual evolution of 4G rather than anything revolutionary.

When it comes to devices, there are indications that 5G might move beyond flagship smartphones, thanks to Chinese vendors such as Oppo and Xiaomi, which are promising handsets in the range of \$250–300 by the end of 2020. This is a key determinant of the rate of adoption of 5G services. Likewise, many potential consumer 5G use cases are reliant on the emergence of new device categories (such as portable VR headsets and smart glasses) and new content types (such as Tetris Effect and Beat Saber games), which are coming to market and improving all the time.

Paid-for mobile cloud gaming is key

Mobile cloud gaming is a key 5G consumer use case and many mobile operators are already offering these services on their newly launched 5G networks, often in partnership with providers such as Hatch or Microsoft. Casual users account for most of the mobile gaming revenue, but will they want to pay for subscription-based gaming services? The industry will need to have a clearer view of demand

before investing heavily in edge computing to improve performance.

A boost for IoT

We expect to see signs of greater investment in widespread public sector IoT programmes, which will give the technology a much-needed boost. Likewise, NB-IoT will have a make-or-break year in 2020. The networking technology should finally start to deliver, but if it does not gain traction in 2020, then operators and vendors may question whether demand will ever emerge.

The Wi-Fi 6 opportunity

The launch of Wi-Fi 6 will be an opportunity for operators to revamp and enhance their smart and connected home services. Many are adding Wi-Fi 6 to their in-home connectivity portfolios to address quality-of-experience issues and to improve multi-device entertainment and connected home propositions.

New video streaming services, such as Disney+ and HBO Max, will launch in 2020, but the market will struggle under the weight of competition. We expect the average number of services used by one person will continue to increase in 2020, but this trend appears to be unsustainable in the longer term.

Strategy shifts

Operators are shifting strategies, adopting new operating models and automation technologies to cope with financial pressure and digital disruption. SD-WAN will move beyond early adopters to the mass market and more service providers will offer them, but although operators were originally seen as being in the best position to offer SD-WAN services, others companies, such as cyber-security and software vendors, are quickly muscling in on this market. ■■

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