

# Taking personalisation to a whole different level: From customer experience to cancer outcomes

**Andrew Feinberg** (left), Chairman and CEO of Netcracker Technology and BostonGene Corporation, and **Takayuki Morita** (right), President and CEO of NEC Corporation

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# Welcome

Is EU doing a U-turn on telecoms? This year's MWC has something of the feeling of a new era in telecoms due to a number of big trends that are explored in this special edition.

One major turnaround that appears to be on the cards is the European Commission's thinking. The veteran European Commissioner Margrethe Vestager, responsible for Competition and Digital, is calling for a single European telecoms market with only five to 10 mobile operators across the EU's 27 markets. She claimed this is the only way to for telcos to make a return on investment, quoted in the Italian newspaper, Milano Finanza, at the end of January.

The alternative, she said, is excessive competition which has led to a situation in which Australians pay the equivalent of €30 for 40GB of data, whereas Italians pay €5 for the same allowance. This means telcos can't invest enough in 5G infrastructure and other things. Vestager concluded: "investments are now at risk everywhere".

The EC's policy of insisting every EU country, no matter how small, should have four competing mobile operators had a lot to do with that pricing, along with obsessing about the wrong things, for instance, transmission speed instead of reliability and coverage.

So the options are: consolidate at continental level; look to public taxation to fund infrastructure investment; or face "Europe's progressive technological decline".

Fellow European Commissioner Thierry Breton (and former CEO of the French incumbent, France Télécom, now Orange) who is responsible for Industrial policy in the EU reiterated that the Commission's aim is to build a single market for telecoms and a consolidated market.

He was speaking at an event in Helsinki in February and added, "The current fragmentation in Europe with suboptimised business models based on national markets and high costs for national spectrum licences is holding back our collective potential compared to other continents."

Breton noted that discussions about such matters would be part of an industry consultation that would begin this month and would include an examination of whether the hyperscalers and streaming giants, such as Amazon Web Services (AWS), Google, Microsoft and Netflix, should be contributing towards the capex bills of Europe's telcos.

From the operators' point of view, it's been a long, hard road to get to these apparent turning points on consolidation and charging Big Tech for carrying its traffic. It remains to be seen if the old adage of "Be careful what you wish for" ultimately applies here.

We hope you enjoy this issue and MWC.



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# TELECOMS EUROPE TELCO TO TECHCO

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## Learn how operators can transition into techcos

In some ways the last year has profoundly changed the telecoms landscape. The war in Ukraine caused soaring energy prices which have hit telcos' profits and some supply chain issues persist, due to geopolitical and other factors.

Regardless, many of the largest network operators groups are still striving to become techcos – data-driven, deploying more AI and especially machine learning, implementing or moving towards 5G Standalone, embracing disaggregation and cloud-native tech to boost innovation, and more.

But they are yet to figure out how to monetise their massive investment in 5G while their share prices and revenues remain stubbornly static. Some have been forced to admit their transformation strategies have not delivered, so where do we go from here?

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**Andrew Feinberg**, Chairman and CEO of Netcracker Technology and BostonGene Corporation (pictured left), and **Takayuki Morita**, President and CEO of NEC Corporation (pictured above), discuss how intelligent, scalable platforms can help utilise data to deliver new, unique and superior customer experiences for telecommunications service providers to improve society as a whole and even save lives.

**T**he term 'data-driven society' has been in use for several years and defines a world where data is being produced and captured in all aspects of everyday life. With estimates of the amount of data generated predicted to grow from 96 zettabytes in 2022 to almost double that to 186 zettabytes in 2025 (1 zettabyte equals 1 trillion gigabytes), there's the real possibility of not just data overload but a data tsunami. Making sense of this data to provide profitable business outcomes will demand a cutting-edge business platform that is underpinned by advanced analytics and artificial intelligence (AI).

**As the chairman and CEO of two seemingly very different and unrelated companies, can you tell us about the synergies and commonalities between Netcracker and BostonGene?**  
**Andrew Feinberg:** On the surface, you might think that Netcracker – a telecom software company – and BostonGene – a personalised cancer diagnostic and treatment company – would not have very much in common. What draws them together, however, are key factors that are critical for companies of all sizes and in different fields: customer experience, personalisation and powerful analytics.  
The success of both companies depends on cutting-edge

business platforms that use and analyse extraordinary amounts of data to provide exceptional value to their end customers. For example, at Netcracker we leverage data and analytics to improve communications service providers' (CSPs') networks, services and customer experiences. At BostonGene, we use data and analytics to fight life-or-death battles against cancer. Very different outcomes, but very critical ones in their respective fields.

Netcracker is a pioneer in simplifying operations and helping operators focus on their core business so they can give the best possible experience to their customers. At BostonGene, we are taking the same customer-centric focus but in this case, it's helping doctors focus on each patient with treatment plans that are tailored just for them. Given the complexity of factors and vast amounts of data available, it is impossible for a single doctor, or even a team of doctors, to rapidly and effectively analyse all of the information to come up with optimal treatment plans for every patient.

Similar to Netcracker, a powerful cloud-based enterprise software platform is at the core of BostonGene's operations. Layered on top of it are powerful bioinformatics and comprehensive genomic profiling that transform our entire healthcare ecosystem by providing lifesaving personalised treatment plans for cancer patients.

**Could you give an example of how BostonGene uses technology in cancer care?**  
**Feinberg:** It's truly remarkable what we can do with proper analytics today. Traditionally, a cancer patient would be put on a regimen based on assigned diagnosis. However, no two humans are the same at the molecular level and because of that, a treatment that is successful for one person can be ineffective, toxic or even lethal for another with the same diagnosis.

Consider the case of Eric, a 49-year-old father of three in New York who was diagnosed with non-small cell lung carcinoma in 2021. He was prescribed a frontline chemotherapy treatment that was so toxic he had to take a leave of absence from work. Unfortunately, the therapy was not successful and the disease continued to progress. Over the following nine months, the second and third line treatments proved to be unsuccessful and had a debilitating effect on Eric, who became weak to the point of being completely bedridden.

As his condition worsened, Eric's physician suggested additional genomic testing through BostonGene, which showed a particular mutation missed by the previous testing. Our AI-based technologies provided sophisticated analysis of millions of data points; that is, molecular data specific to the patient, data from clusters of similar patients with lung cancer and treatment study data from around the world. This led to a targeted treatment plan based on genetic insights and correlations to

other cancer types. Scans taken within four months of starting this new, personalised treatment indicated that the tumor shrunk dramatically.

Today, Eric is back at work, playing sports with his kids and living a full life. It is very possible, even likely, that Eric would not be alive if it were not for the incredible technology that combines basic science with powerful bioinformatics. I see Eric and all other patients whose treatment was prescribed or changed with the help of BostonGene as living proof that software and analytics are the future of fighting this insidious disease.

Without advanced genomic sequencing techniques and a targeted, personalised treatment plan, the disease would have continued to progress and worsen instead of being eradicated. The BostonGene platform utilises a vast amount of bioinformatics data, correlation analysis and predictive modeling and real-time decisioning to create the right personalised treatment plan that saved this patient's life.

“ With Netcracker we leverage data and analytics to improve CSPs' networks, services and customer experiences. With BostonGene, we use data and analytics to fight life-or-death battles against cancer. Very different outcomes, but very critical ones in their respective fields

**Morita-san, in the past, NEC was known as a network equipment and system integration services company. How has the company's focus evolved over the years?**  
**Takayuki Morita:** NEC has more than 120 years of history behind it, but we are always looking forward and nurturing world-class technologies and the capabilities to implement those technologies. In 1977, we announced the concept of 'C&C', which is the integration of computer and communications technologies.

In the last 10 years, as different technologies have become widely used around the world and digitisation has progressed, NEC has expanded its business across a wide range of markets, such as smart cities, green technology, healthcare and cancer



treatment. Today we are a truly global business with operations that reach far beyond our home in Japan. Through our relentless pursuit of innovation and uncompromising commitment to research and development, we have grown beyond our roots into new and exciting markets.

NEC has a long history of providing technologies for telecommunications companies. In addition to our significant R&D investments, we are strong supporters of the Open RAN initiative and believe that O-RAN will bring many benefits to the industry. NEC views 5G, 6G and beyond as critical infrastructure for a truly digital society.

NEC has worked with many local governments including Lisbon in Portugal, Tigre in Argentina, Ahmedabad in India, Singapore and throughout Japan to create smart cities using appropriate data sets. These projects include solutions for smart bus systems, public safety and waste management. NEC is also working on environmental issues such as food production. By leveraging data from satellites and sensors, our AI and data analysis solutions are helping farmers achieve higher yield harvests while using less water and fertiliser. And finally, in Japan, we are offering disaster prevention and mitigation solutions as we adapt to more volatile weather patterns due to climate change.

Our philosophy is that we have a responsibility to transform our strengths in the technology area into more concrete results in terms of safety, security, fairness and efficiency from the standpoint of the consumer. In other words, we endeavor to connect digital technologies and the human experience to implement a vision of a brighter future and a more sustainable world.

How can data enable the digital society?

**Morita:** Our vision of the future will not come to fruition without the intelligence and insights gathered from data, but the challenge is to turn that into actionable outcomes that will improve society. Using analytics and our industry-leading AI



solutions, we're able to quickly respond to a number of very diverse situations.

A few examples include using road surface data to proactively maintain sections of a highway to provide a safer driving experience; identifying fraudulent financial transactions in real time; looking at purchasing patterns in stores to optimise product displays and restocking; and improving workflows using chatbots.

In all these cases and many other examples from different industries, the underlying foundation is a vast amount of data that can be turned into real-world solutions that improve efficiencies, decrease costs, optimise processes and simplify transactions.

In your opinion, what technology will have the greatest impact globally in the next five years?

**Feinberg:** Staying with the theme of data, I believe the ability to harness, manage, process and act on massive amounts of data that results in meaningful and actionable outcomes across industries will have a major impact over the next few years. Data and analytics are critical tools that will make it possible to improve lives around the world, and having a next-generation platform to streamline processes, reduce costs and bring in new revenue opportunities will be critical.

But with these advances in technology, we must not lose sight of the human part of the equation, which should always take the lead. Whether it's in telecom or medical research, people are always at the core of our efforts. BostonGene has patented hundreds of innovations for software analytics that can take the massive complexity of each case and create the right personalised treatment plan that will be most effective. This is the future of fighting cancer.

Similar to the BostonGene example, the ability to leverage BSS/OSS data to create digital twins of networks, services, subscribers and even competitors is required for telecommunications service providers to effectively compete, drive profitable growth and create the best customer experiences in every single interaction.

Digital twin data is fully separated and anonymised under GDPR rules to ensure subscriber privacy is upheld while providing a valuable resource to enhance deep-level analysis. Netcracker is taking the innovations and insights from the work within BostonGene to enhance BSS and OSS capabilities in processing the oceans of data service providers collect to effectively model, predict and take the right actions in real time. This is the future of telecom systems.

Can you please share how NEC is pioneering the use of AI to advance various healthcare initiatives, leading to improved outcomes for patients?

**Morita:** NEC has a proud 50-year record of contributing to



the medical field, and in 2019 we amended our Articles of Incorporation to include the promotion of business related to drug discovery and medical systems. NEC invested in BostonGene and acquired Oncolmmunity in Norway (now known as NEC Oncolmmunity), a leader in using AI to develop cancer immunotherapy.

Today, NEC companies and partners are conducting personalised cancer vaccine trials that utilise NEC's AI-driven neoantigen prediction technology. I'm excited to announce that preliminary results are quite encouraging. We have also nurtured a strong partnership with the Coalition for Epidemic Preparedness Innovations (CEPI) to leverage our AI-driven biotechnology to develop next-generation vaccines that are effective against various coronaviruses.

Moreover, we have entered into a partnership with Shionogi – a global pharmaceutical company based in Japan – to collaborate on a therapeutic vaccine for hepatitis B. Going forward, we will continue to collaborate with medical institutions and drug manufacturers in our efforts to improve health outcomes around the world.

How does bringing order to data chaos lead to better personalisation, both in terms of customers of mobile operators and cancer patients?

**Feinberg:** By applying analytics, AI, machine learning and real-time decisioning to the large volume of data, Netcracker has led the way in helping telecom service providers deliver the best experience to their customers. We can create unique,

compelling and personalised journeys that are meaningful and help with retention and loyalty. BostonGene is also making its mark in the area of personalised customer journeys, but in this case, it's life-saving diagnostics that bring individualised and personalised cancer treatments to patients. So rather than treating the disease, we treat the patient.

The challenges our businesses and society face today are complex, and that complexity is continuously increasing as we are flooded with more and more data. Technology is a tool, and like any tool it can be used for the greater good or for less than noble purposes such as spreading misinformation or maliciously manipulating data for personal or political gain.

Our role, and I would argue our responsibility as technology and business leaders, is to leverage data in a positive fashion – to improve our society, to enrich our experiences and of course to save lives. This is where both BostonGene and Netcracker are investing: creating the software platforms and technology solutions to manage, process and act on massive amounts of data to deliver the best possible results.

Regardless of industry, market or geography, in everything we do at Netcracker and BostonGene our first and last thoughts are reserved for the customer. We founded Netcracker 30 years ago and BostonGene just a few years ago, but in both cases the driving force and reason for our success over the years has been our never-wavering focus on the customer. As long as we keep that in mind, we will be able to continue delivering the best possible outcomes for our customers and, by extension, society in general. 



# Virgin Media O2's plans are ambitious in scale, scope and speed

CTO **Jeanie York** talks to Annie Turner about her vision as the UK operator strives to become *the* alternative network provider.

**J**eanie York became CTO at Virgin Media O2 when Virgin Media, owned by Liberty Global, merged with Telefónica's O2 in June 2021. Previously she was CTIO at Virgin Media in the UK, located in London. Before that, York was Managing Director of Core Network Planning, Engineering and Operations across 10 European countries at Liberty Global, based in Amsterdam.

**AT: What new responsibilities have you faced since your role began as CTO of Virgin Media O2?**

JY: It's wide ranging. We are converging fixed and mobile services which naturally brings complexity at a technical, product-consolidation level across our network platforms and services, but fundamentally it's about making sure that the network is performing to its best level, providing a consistent and reliable customer experience.

On a day-to-day basis, I manage a huge team of talented engineers, operators, technicians, project managers and many more specialists. We set the technical strategy for fixed-mobile convergence and build and run a set of fixed and mobile services. We are rolling out new technologies across fixed and mobile across the UK, laying fibre while expanding and upgrading our mobile network, and deploying spectrum bands to serve customers.

Telecoms has a massive responsibility to deliver the services required by and expected from consumers, businesses and the Government as it drives its digital infrastructure agenda. It's a huge but incredibly rewarding undertaking.

**AT: Is the role of CTO shifting and how will it evolve?**

JY: It's critical to move forward and evolve in such a role. The technology and telecoms evolutionary cycle used to be every five or so years; now it's two to three years and innovation is accelerating, exacerbated by the pandemic and people working remotely.

We are striving to build, expand and maintain a reliable service for millions of customers who rely on us every day...Whether that's 5G services or a specific product for business, it can't just be tech for tech's sake. There must be tangible benefits for customers and commercial gains for the operator.

Customers are demanding a different level of experience from us. How they use our services has changed, with far fewer phone calls and SMS, but much greater levels of data. It's essential to support this: we're a vital utility in homes across the UK.

Finally, it's imperative that any CTO leadership team sends the right messages top-down, but it has never been more crucial than when bringing together two large technology companies. In my role I work closely with our Director of Network Expansion, Chief Information Officer and our Chief Digital Officer. Having this group on the most senior team in our business gives us the expertise, speed and agility we need to drive digital transformation, which determines where we sink or swim.



**AT: What were your career highlights before your current role?**

JY: In the 24-plus years I've been in telecoms, the breath-taking pace of our industry has provided me with lots of highlights. When I first joined Quest, which was acquired by CenturyLink, broadband roll-out was just beginning. Most people couldn't take a phone call and use the internet at the same time. Imagine.

I like to think that in my time at CenturyLink, Liberty Global and Virgin Media (pre-merger) I've played a role in our collective progress. As the Vice President of Network Operations and then as a Managing Director at Liberty Global I was responsible for the core network planning, engineering and operations across 10 European countries. I got to see first-hand the difference that connectivity makes to people's day-to-day lives. This remains one of my favourite and most satisfying parts of the job.

**AT: What are your priorities for the fixed network in the coming years?**

JY: We've achieved a lot in a relatively short space of time. In

15 months, we closed the joint venture, secured funding to upgrade our fibre network and we are expanding that network to new territories, but really we've just begun. I'm incredibly proud of our ambitious roll-out; already, we are the UK's largest gigabit broadband provider, passing 15.9 million premises with speeds of 1.1Gbps.

We've set bold ambitions and targets, not least via two recent announcements: to upgrade our fixed network to full fibre to the premises (FTTP) by 2028; and in July our shareholders, Liberty Global and Telefónica, alongside investment firm InfraVia Capital Partners, announced an investment of about £4.5 billion with the creation of a fibre joint venture. We will pass up to 7 million premises with a new, wholesale fibre network – a significant commitment and a boost to the nation's digital economy at a crucial time.

This investment will extend our fibre footprint to 80% of the UK, strengthening our position as the biggest challenger in the market. We'll not only provide our build-out talent and expertise to the new venture, but offer other operators a sizeable, attractive wholesale opportunity too. This will enhance competition and choice like never before.



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On the mobile side, we continue to invest to bring crucial connectivity to all parts of the UK. 5G services are available in more than 800 towns and cities, and roll-out is on track for 5G to hit 50% population coverage in 2023. Boosting 4G remains a key focus for investment: 4G capacity was upgraded in 460,000 postcodes in the past 12 months.

We're looking at how to streamline our networks and make them more operationally efficient, investing in technologies such as AI and automation to minimise disruption for customers and provide faster, more reliable services. This all sits under our wider goal of building a network fit for the future, in response to and with the intention of exceeding customers' expectations.

## How is Virgin Media O2 building a sustainable network and transitioning to 5G Standalone?

Sustainability is at the core of our network. Our network is powered by 100% renewable electricity where we control the bill, and we've lowered energy consumption with smart sensors, intuitive software and free air cooling. This means our mobile network is 88% more energy efficient than in 2015.

Technology is at the heart of tackling the climate crisis. We've committed to helping our customers avoid producing 20 million tonnes of carbon through our products and services.

We recently updated our ambitious commitments to strive for net-zero carbon across our operations, products and supply chain by the end of 2040, committing to the Science Based Target initiative's (SBTi) Net-Zero Standard.

Looking specifically at Standalone 5G, it will help us deliver ultra-fast connectivity to consumers and develop advanced enterprise use cases, laying the foundations for techniques like network slicing, ultra-low latency and the ability to handle unprecedented volumes of data. The Standalone network will support applications like virtual reality (VR), augmented reality (AR) and other immersive experiences, some of which were part of our recent 5G Festival project with the DCMS.

Work is underway with Ericsson to unify our non-standalone 5G and Standalone 5G into an integrated, dual-mode, core network.

## How important is the Shared Rural Network and what is Virgin Media O2 currently involvement?

It is integral to what we do: at the time of the merger, we announced our intentions to create a connectivity champion for everyone – and rural areas are a substantial part of that. We've rolled out new sites in areas such as Cumbria, South Knapdale, Elvingston, Hamnavoe and the Isle of Harris, providing fast, reliable 4G coverage.

Some challenges cannot be tackled alone, and we continue to collaborate with the wider industry to support consumers and businesses up and down the country. Whether that's




through building the Shared Rural Network, delivering 4G on London Underground, or inviting operators to join our National Databank, we strongly believe that together we can achieve great things.

## You're passionate about cultivating future talent in the industry. How are you addressing this within Virgin Media O2, both personally and companywide?

Encouraging young people into our industry from different backgrounds is a passion of mine. As an industry we must continue to promote STEM [science, technology, engineering and maths] careers in schools, colleges and universities, and make it clear this is a career path for absolutely everybody. There's a huge need for fresh talent but it's simply not there and we're reacting too slowly.

We need to collaborate across the telecoms sector and with external partners like the Prince's Trust, which is amazing at getting young people into work but we need to do more to encourage them into STEM careers. We need to start sooner, empowering boys and girls of all ages to think about STEM subjects from an early school age, and encouraging parents and communities to support them.

When I started my career, as a woman I was often in the minority and it wasn't easy. I want to ensure that nobody has to feel like that. I work closely with universities, implementing apprenticeships and reviewing recruitment processes to achieve a more diverse intake. I coach and mentor women across our business and I am a member at the Aspire to Inspire women's network across Liberty Global.

In the past two years we've created 1,000 apprenticeships across the company, from networking and engineering to customer installation and project management and have 160 volunteer ambassadors promoting STEM careers to young people. The next step is ensuring that every intake reflects the diversity of our wider society, which is a cross-industry challenge. 





# 2023 promises a global changing of the guard

This year will be wild and uncomfortable with war in Europe, a global energy crisis, and the highest inflation for years which is disrupting financial markets, according to John Strand, Founder & CEO, Strand Consult. Also, China menacing Taiwan has the world's leaders on edge and imperils the global supply of 90% of semiconductor manufacture.

**T**his uneasy geopolitical reality affects the mobile industry. Rising interest rates depress returns on capital, and the willingness to invest in infrastructure. Relationships with authoritarian governments pose reputational risks.

Operators that opted out of equipment from Huawei and ZTE will gain an advantage over those claiming there are no risks attached to using Chinese network equipment. Smart operators can say, "Maybe we can't offer you a better price, but we can offer you a clean network with reduced risk of Chinese government intrusion."

Strand Consult closed out 2022 with a new report *The Market for 5G RAN in Europe: Share of Chinese and Non-Chinese Vendors in 31 European Countries*, which is making

an impact: the European Union's Vice President, Margrethe Vestager, has asked Germany to clean up its act on telecommunications infrastructure.

Increasingly, companies will be obliged to run stress test scenarios vis-à-vis China. What will they do about financial assets and revenue streams dependent on China? How much cloud will they lose? How much will be written off? German leaders' acquiescence to China has become an unaffordable political liability.

## Spectrum

While we find fault with the Chinese government for authoritarianism, it deserves credit for allocating the radio spectrum frequencies to their best technological use for 5G. Simply put, 5G needs mid-band spectrum in the 2.6-6 GHz range to maximise data transmission across larger distances.

This is a matter of physics and good management, but US policymakers are failing on this front.

At the time of writing, US Congress still had not reauthorised the Federal Communications Commission (FCC) to carry out spectrum auctions, whereas we argue the FCC should have perpetual auction authority to align incentives and economics to best serve Americans. So far, the FCC's authority to hold such auctions had only been extended by three months, to March 2023.

It's hard to contemplate a modern nation being so irresponsible, putting the US government's opportunity to raise hundreds of billions of dollars on ice, because the Department of Defense is resisting modernisation in this direction at least (see page 26). The situation is that the US military lost its spectrum edge by waging wars with non-peers for two decades.

Instead of upgrading to the most spectrally-efficient tools on the appropriate frequency, the Pentagon is entrenched with legacy systems on the mid-band beachfront hogging 12 times the spectrum available for 5G. The US' wireless success is incredible given its limited access to frequencies but to compete with China in future, the US must make mid-band spectrum available for telecoms' exclusive licensed use.

China does not squander its spectrum resources. It has just unveiled a high-power, low-frequency P-band (216-450 MHz) satellite-hunting radar, reportedly to detect and track low-Earth orbiting satellites' (LEOs) progress and functions around the clock in all weather conditions. Observers dubbed it the Anti-Starlink system.

## Broadband fair-cost recovery

Countries must look at their citizens who lack digital equity, which in many geographies typically means people of colour, those on low incomes and the elderly. Clearly, the traditional concept

of universal service should end. Taxing broadband subscriptions to raise money for infrastructure does not scale when it comes to closing the digital divide.

Making broadband more expensive makes it less affordable for the digitally poor and disenfranchised, where available. Countries will increasingly look to Big Tech to foot the bill for the unrecovered costs they impose on networks. Closing the digital divide globally and getting some 3 billion people online for the first time are the goals of the United Nation's agency which sets global telecoms standards, the International Telecommunication Union (ITU). It's worth noting that in September 2022, the ITU elected a



“ **South Korea's SK Broadband sued Netflix to pay costs created by surges in network traffic caused by content including Squidgame** ”

woman to lead it for the first time in its 157-year history.

South Korea, the world's #1 broadband nation, has long recognised that content providers have a financial responsibility to ensure the quality and delivery of their data and has had operated a cost recovery regime since 2016. South Korea enjoys the highest adoption of FTTH (86%) and 5G (47%) in part because end users are not forced to bear the full burden of the cost of broadband.

South Korean Internet service provider SK Broadband sued Netflix to pay costs created by increased network traffic, like the Squidgame surge, and for maintenance work

Google's gambit to undermine the policy of good faith negotiation for cost recovery backfired. Google Korea launched a series of Google ads against Korean National Assembly bill and Asia-Pacific Vice President for YouTube, Gautam Anand, warned that the bill would "penalize the companies that provide the content, and the creators who share a living with them." Some 265,000 YouTubers signed the petition against the bill.

However an Assembly hearing revealed that South Korea's leading internet advocacy non-profit OpenNet, which was founded with Google as the sole sponsor, received \$10 million to espouse policy favourable to the search giant. Lawmakers questioned its activities which looked like lobbying and are outside the organisation's remit. An official financial disclosure from the organisation had recorded a far lower figure for the amount than the actual gift from Google. A perceived attempt to hijack democratic process is a bad look for the company which is the single largest source of traffic in South Korea.

## Fair payment doesn't damage profit

Big Tech might grumble about having to pay for access to networks in South



Korea, but the companies are enjoying record profits. Google Korea reported its 2021 sales grew almost a third over the previous year to 292.3 billion won (€219 million) with an 88% operating profit.

Netflix, another *persona non grata*, is enjoying record profits in South Korea but declares it has “no obligation to pay for or to negotiate for the use of” another’s network. Strand Consult has detailed the Scrooge-worthy saga of Netflix’s litigation against a local broadband provider in *Netflix v. SK Broadband – The David and Goliath Battle for Broadband Fair Cost Recovery*.

### US explores fair-cost models

In the US, there is bipartisan Congressional support for the FCC to investigate the feasibility of a fair-cost recovery regime. Congress failed to rein in Big Tech on the anti-trust front, so fair-cost recovery remains one of the few rational, evidence-based methods to address Big Tech’s alleged abuse of market power, namely its perversion of public policy to achieve corporate goals and the free use of public and private resources.

Economists will have a field day exploring cost recovery business models: market-based pay as you go (PAYG), ad taxes, usage fees, universal service fund surcharges and so on. No one size fits every country but increasingly there is recognition that broadband policy must evolve: the prevailing models of broadband access were enshrined when email was the internet’s killer app more than 30 years ago. Now video accounts for 80% of internet traffic. It’s time policy reflected that reality.

This year Strand Consult will launch an update to its report *Middle Mile Economics: How streaming video undermines the business model for broadband*. This describes an investigation into 50 broadband

## “ Second Life ultimately flopped big time, having failed Clay Christiansen’s milkshake test



providers in 24 US states and finds that:

- are growing two to three times faster than household broadband revenues;
- traffic from Big Tech consumes as much as 90% of network capacity; and
- few, if any, broadband providers have been able to monetise the increase in video streaming on their networks.

### Metaverse: Second Life 2.0?

Meta (formerly Facebook) calls its metaverse, “the future of digital connection...moving beyond 2D screens and into immersive experiences in the metaverse, helping create the next evolution of social technology.” It’s all very exciting, the dream (or nightmare) of science-fiction turned into a commercialised reality of being ever closer to people you don’t know in a digital world.

The big question is whether it will become a [digital] reality or a replay of Second Life, which flopped big time, having failed Clay Christiansen’s milkshake test – a way of gauging whether a new product or service can become a reliable, affordable substitute.

More interesting questions are

whether Meta will pay for the spectrum and infrastructure required by the next-generation mobile networks needed to support the metaverse? Meta announced a \$19.2 billion investment in the new online universe for 2023 which equates to about half of what the world’s mobile operators collectively spend on RAN in a good year.

Few of the people gushing about the marvels of the metaverse have stopped to think about infrastructure costs, along with the other proposed online “verses”. It is a huge issue for operators that streaming video consumes as much as 90% of internet bandwidth today, how will broadband providers recover costs when even more data is pumped into their networks? How will broadband subscription pricing work then in today’s framework? Will some users want every meta bell and whistle, or just some of the experience? There will need to be policy innovation and a business model upgrade before the metaverse is real.

### The titanium economy

We are excited about 5G and the mobile industry’s continuous improvement of its networks. 5G for home broadband – Fixed Wireless Access (FWA) – is a game changer and can substitute wireline broadband in many cases. FWA is expected to account for 10% of all US broadband connections soon.

What’s beyond home broadband is the bigger question for 5G? Many want to see 5G transform industrial sectors, bringing a new era of advanced healthcare, transportation and manufacturing. Some leading manufacturers already integrate 5G into their production lines, like John Deere, Bosch, ASML and some carmakers.

The manufacturing renaissance afoot in US is even more exciting. It is led by small and mid-cap companies earning returns that rival the online tech and software sector. They are not widely known or discussed, but there

are about 4,000 of them, driving about \$200 billion in revenue. Their start-up costs are relatively low, and they take advantage of 5G and technologies it enables like AI, robotics, automation and cloud computing.

### Value and consolidation

Strand Consult’s recommended reading on this is *The Titanium Economy: How Industrial Technology Can Create a Better, Faster, Stronger America*.

We are keenly interested in the 5G value chain, where monetisation will occur and who will win. The major issue is whether operators are positioned to capture the value in applications or services or yet again the OTT third parties will win – in the 4G era, content and application providers won.

Network monetisation has long dogged the mobile telecoms industry. In 2009, GSMA launched a supplement to premium SMS, a reboot of SMS payment introduced in 1999. It was not successful. Strand Consult’s report *OneAPI – Next Generation Value Added Services in the Mobile Industry* described many of the challenges to launching these kinds of mobile network business models.

The long-term trend for monetising mobile consumer services is that customers get more for less. It may be a boon for consumers that broadband prices have stayed constant (if not fallen) during this cost-of-living crisis, but in the long term mobile operators cannot continually upgrade networks with better technology for declining returns.

The situation can be improved through consolidation, enabling operators to lower costs and gain a better case for investment. We think countries should move from having four to three mobile network operator within markets, as we explain in detail in *Understanding 4 to 3 mobile mergers*. This includes undue concern by regulators that less competition will result in rising prices.

### Mobile ESG practices mature

Green energy consumption is a huge issue in broadband. Many mobile telecom operators have formalised environmental, social and governance (ESG) goals in key performance indicators. This has led to “greenwashing” by some corporations, that is, deceptive marketing to create the illusion of goodness and to hide malpractice perpetuated by ESG practices and regulation.

Politicians, regulators, and business leaders often claim to be focused on sustainability. In practice, few really appreciate the difference between



### Net neutrality

Net neutrality is another policy ripe for modernisation and Strand Consult predicts policymakers will pick this up in 2023. The UK regulator Ofcom intends to modernise its rules regarding network neutrality and we predict that other European and Latin American regulators will issue a call for evidence about the impact of net neutrality regulation.

Invariably they will find that the policy is failing consumers, innovators, and investors. These countries want to move forward with 5G smart networks, but they have policy designed to maintain a dumb pipe. This can’t be resolved, even with 5G slicing techniques.

being sustainable and “less bad”. Established ESG metrics of CO2 emissions, energy consumption and so on are used as proxies for progress in sustainability, but often performance is just incremental improvement dressed up as sustainability although the negative impact is still there.

The Future-Fit Business Benchmark has emerged to provide clear, actionable guidance on how to operate without negatively impacting people, society and the planet. European solar power producer Better Energy uses Future Fit in its provision of Purchasing Power Agreements for certified green energy to mobile telecom operators, and content and application companies. Its performance model is likely to be adopted even more widely.

Finally, another key lesson is that operating parallel small cell infrastructure is not sustainable: the business case for small cell lies in network sharing. Mobile operators in the UK have trials of a shared small cell network which hosts all four mobile operators. It’s the way forward.

More importantly, consumers are denied freedom of choice as they are forced to value all data uniformly and equally when their preferences show that they have different values – for some, price, reliability or latency is more important than speed, for instance.

Policymakers will see that they are trading away billions of dollars in network investment for the sake of a “look good, feel good policy” which does not serve consumers, start-ups, or investors. No leading 5G nation has hard net neutrality rules, yet regulators and legislatures protect consumers and the ecosystem with competition law and transparency rules. 



# SEGRON'S SUCCESS STORY

## CS LAB REGRESSION TESTING

### CHALLENGE

A Tier-1 mobile operator needed to ensure the availability and correct functionality of all circuit switched services after parameter or software changes in the network.

A set of 400 complex test cases needed to be executed on a regular basis covering services such as 2G/3G or VoLTE calls, call forwarding, SMS, eCall and multiparty, including the verification of the audio quality and automated signalling analysis on several Core and RAN interfaces.

### SOLUTION

The SEGRON ATF provides the ability to perform testing using real end user devices and can also integrate and analyse the interfaces needed to ensure the correct testing result.

Specifically, we delivered an on-premises installation including real mobile devices and an audio quality analysis solution. The ATF Host also accessed the existing trace solution to perform detailed signalling analysis.

### BENEFITS

#### *Increased Productivity*

Prior to the deployment of SEGRON's ATF, several weeks of testing efforts were needed to manually execute the 400 test cases, including all necessary verification steps (audio and trace analysis). After deployment of the ATF, the fully automated execution of these 400 test cases, including automated result analysis and documentation, took less than 15 hours and could run overnight.

#### *Improved Efficiency & Accuracy*

Customer Quality of Service and Experience has improved because problems are identified early in the service acceptance phase and are not impacting customers. The remote testing capability of the ATF added further benefits, especially during COVID restrictions.



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of Active Testing



# How inflation and the global downturn is impacting telecoms

As the global economic crisis rumbles on and energy costs soar, telcos that fail to respond face a sharp decline in profitability. Fortunately, they have many options.

**C**onsultancy firm Kearney predicts that as inflation passes 9% in many countries, unresponsive telcos could lose up to 6 percentage points of earnings before interest, tax and amortisation (EBITDA). If the inflation trend continues, the situation is likely to get worse, Kearney says, resulting in even bigger drops in profitability.

Rising energy costs are an important factor and are at an all-time high in Europe and networks account for 2

to 3% of energy use globally and so are exposed to price fluctuations, says Andy Walker, Senior MD and Global Communications and Media Industry Lead at Accenture.

## Increased costs

Last year, Vodafone said it was facing an additional €300 million in energy costs and warned of price rises. Several operators are protecting themselves via hedges and power purchase agreements – a factor which, according to S&P Global Market Intelligence,

helped the industry in Europe largely insulate itself from surging electricity costs in 2022.

Surging labour costs will also have an inflationary impact, says Kevin Billings, Director and Industry Principal for Communications at Pegasystems. He says becoming more efficient by digitally transforming in-house operations and spreading costs “will be critical” for telecoms operators.

Increased costs can hit all areas of operators’ businesses including the networks, call centres and retail stores.

At the same time, within the supply chain, the cost of network equipment, handsets and transportation is soaring. This is worse in the UK because it manufactures very little equipment locally, says John Burton, CEO of MDS Global. “The COVID lockdowns in China are interfering with manufacturing, which is also driving up costs.”

Operators are in the throes of building advanced networks, which require heavy investment. “They have to build 5G; they have to roll out fibre across their footprints – and that’s expensive,” Walker says. “It puts service providers in a really tough spot, so they need to look at where the opportunities lie and make some smart moves.”

## Squeezed margins

Operators often bake inflationary increases into contracts, but this is unlikely to cover all costs, says Burton. “They can increase fees in line with inflation so revenues will likely go up in the short term. However, this may not cover all costs and vendors will find their margins further squeezed as operators seek to reduce costs from the supply side.”

At the same time, consumers are starting to cut back, for example not upgrading their handsets as often. This will leave mobile operators needing to further monetise services, says Kester Mann, Director, Consumer and Connectivity, at analysts CCS Insight. “They are getting more clever with packages and upselling and content”, he says citing the example of EE’s cyber security services.

Industry consolidation could also be affected by rising living costs, says Mann. “We could start to see more sympathy from regulators for mergers, but cost of living could work against the operators, if competition authorities decide mergers could mean higher prices.”

This is something that will be front of

mind for the latest mobile operators to announce plans to merge, Three UK and Vodafone UK. With 4G and 5G use still increasing, mobile networks operators must invest, says Iain Milligan, Chief Network Officer, Three UK.

“Regulatory obligations, such as the removal of high-risk vendor equipment, compliance with the UK Telecoms Security Act and continued Shared Rural Network roll-out will also increase costs,” adds Milligan.

Unsurprisingly, given its merger plans, Three UK is calling for consolidation in

“Some plants are now almost entirely fully automated leveraging 5G and IoT, providing operational efficiencies and safer working environments

the market: “Scale would prevent mobile operators from having to make tough investment decisions and allow them to continue on all fronts, generating innovation and growth in the market,” Milligan adds.

## The rise of MVNOs and sub-brands?

As tough conditions continue, rising costs will filter down to consumers. “The future looks likely to present continued cost increases,” says Burton, adding that this could see more consumers moving to low cost mobile operators.

“This may trigger additional marketing investment in operator sub-brands, more innovation in propositions or even

additional consolidation and acquisition of low cost MVNO brands by their host operators,” Burton predicts.

Taking this into account, the future “won’t be a walk in the park”, says Walker. However, there are areas where operators can drive growth, he says. “In the consumer space, there is an opportunity to use their ecosystem and data better to create a greater set of products and services.”

## Growth opportunities

At the same time, he says, the SMB market is “still ripe for the picking”, adding that small companies “are in dire need of technology services and support including packaged connectivity, technology services and software”.

Meanwhile, Walker points to an opportunity in the enterprise: “Every major company in the world uses telco services but while it was historically about having desk phones, they are pivoting their businesses to provide advanced products and services, utilising new methods of connectivity.”

He cites the example of the manufacturing sector. “Some plants are now almost entirely fully automated leveraging 5G and IoT, providing operational efficiencies and safer working environments.”

As 2023 kicks off, conditions will continue to be challenging but one thing is certain: operators need to accelerate plans to become more agile to succeed in this complex environment. “Operators are trying to become more streamlined, efficient and agile but they have historically been quite bloated,” Mann says.

He predicts more acceleration around strategies to lower overheads and run better with reduced legacy cost. “It’ll be a tough year ahead with a lot of pressure as costs are under the microscope. The mobile operators that rise to this could be the winners in this environment.”



# Operators square up to O-RAN challenges including cost and integration

Kate O’Flaherty writes that O-RAN trials ramp up as operators ready and test their networks and start small-scale commercial deployments



Open RAN (O-RAN) offers multiple benefits, including lower costs and a network performance boost. O-RAN will also enable the ultra-reliable low-latency communications needed by many 5G applications, so it’s no surprise that operator trials are ramping up.

Vodafone is launching a commercial pilot of 5G O-RAN in two rural areas in Germany, starting in early 2023. The mobile operator is also set to launch a “golden cluster” of O-RAN sites in the UK.

At the same time, Telefónica is working on an 800-site pilot across Spain, Germany, the UK and Brazil. Meanwhile, Deutsche Telekom has switched on an entire “O-RAN town” in Germany.

O-RAN also has the backing of the UK government, which this year announced industry guidelines to help roll out the technology quickly and attract new telecoms vendors to the 5G supply chain.

Momentum is certainly growing, but there are still multiple challenges to overcome as operators’ ready and test their networks. According to a

report by Analysys Mason, operators are concerned about the potential for increased costs that will not be outweighed by a more competitive supply chain.

Many operators have questions around ease of integration and cost, says Richard Webb, Director of Network Infrastructure at CCS Insight. “How easy is it to deploy O-RAN solutions that combine elements from multiple vendors? Yes, there are O-RAN standards, but that does not necessarily mean integrating different parts of a solution is as straightforward as plug-and-play.”

In addition he asks: “Will an O-RAN solution be more cost-effective than an end-to-end RAN solution from a single vendor – or at least comparable?”

### O-RAN challenges

There are also concerns about how to get the most value from the technology. Even when O-RAN is deployed, understanding how to open up the value of app-based RAN functionality remains a new exploration for operators, says Webb.

Other issues include immature standards and solutions; migration and coexistence with legacy architectures; inability of smaller vendors to support large-scale deployments; and performance trade-offs in heavily loaded networks – especially those with Massive MIMO, says Analysys Mason Research Director, Caroline Gabriel.

In addition, while trials in Europe are driving the Open RAN ecosystem, these are “well behind” parts of Asia including Japan, India and North America, Gabriel points out.

Another challenge centres around the fact that Open RAN is not a plug-and-play technology, says Viplob Syngal, Head of Business Development – Global Open RAN Centre of Excellence, NEC Europe. “Some operators expect to take any product from any vendor, interface it with another product from a different vendor, and want it to work out of the box at the same level of performance and stability. But the reality of our industry is, this does not happen today – even for non-Open RAN products.”

### Accelerating O-RAN progress

It’s true that O-RAN trials are gaining pace, but common testing and integration processes will be important to accelerate progress, says Gabriel. She cites the need for robust standards in all the O-RAN interfaces, but concedes, “these are still a work in progress”.

Currently, says Gabriel, most near-commercial trials are focused on open

fronthaul alone and many are single-vendor in the first phase. However, she points out, a few operators – such as NTT Docomo, AT&T, Vodafone, Reliance Jio and TIM – will have macro networks ready to deploy by 2024.

Yet progress will not continue unless operators take a “leap of faith” and look to deploy O-RAN more widely, says Paul Rhodes, Open RAN and 5G Lead, GSP International, at World Wide Technology. “The true test of O-RAN’s progress will come during roll out across countryside locations through private networks and metro cells, where high performance solutions will be field proven.”

“One single-vendor Open RAN network cannot be considered a viable test case as this doesn’t address interoperability

This requires investment – which is “essential” in order for O-RAN to continue to develop, says Maria Lema, Co-Founder of Weaver Labs. “The current deployment model is still under-investing into Open-RAN, which is failing to encourage competition.”

### Collaboration is key

Going forward, industry collaboration is key across the entire ecosystem. This will help to address integration and interoperability challenges, Lema says. “We’re still far from where we want to be when it comes to open and interchangeable networks, because the traditional model is still very much present.

“There’s no possibility to evolve in

higher layers because the technology is still facing a lot of integration problems. Standards must play a stronger role, and for that we need the industry to work together.”

### Need for strong ecosystem

Paul Miller, CTO at Wind River agrees. “Some may argue that Open RAN potentially increases the possible integration cost efforts. Fundamentally, success in integration is enabled by strong ecosystem partnerships between the vendors offering solutions to the carriers.”

Lema says telecoms operators, network equipment vendors and systems integrators must now work together to further develop and test true Open RAN in realistic settings. They should do so via a truly diverse supply chain, she adds. “One single-vendor Open-RAN network cannot be considered as a viable test case, since this doesn’t address interchangeability.”

Operators are aware of O-RAN’s potential but they are also conscious of the multiple challenges they face. It might sound obvious, but time is needed to allow projects to grow and develop.

The next stage is for the industry, especially via groups such as the Telecom Infra Project, to accelerate work on a “deployable and affordable architecture”, says Gabriel. “This will enable larger deployments and add scale and confidence, but all these milestones are complex and require two or three years of close cooperation.”

Over the next few years, Webb expects most operators to apply a phased approach to the technology: “Roll out O-RAN over a modest proportion of base station sites, see how that goes and then expand to more. Operators are more likely to experiment with new vendors and innovative architectures in underserved areas, where the pressure for high performance is lower.”



# How far away are commercial network slicing services?

Trials are proliferating and expanding, so when will the promise of network slicing become reality, asks **Kate O’Flaherty?**



**N**etwork slicing – which sees a portion of the network allocated to a specific use case – offers the potential to substantially boost mobile operator revenue.

As each slice can be customised to fit specific needs, the technology stands to benefit multiple use cases and applications. According to ABI Research, 5G network slicing will generate \$66 billion in value for enterprises in verticals including manufacturing, logistics and transportation by 2026. Consequently,

trials are ramping up across the globe.

In July, Telefónica, Ericsson and Google claimed to have automated the process of end-to-end network slicing needed for the mass provision of a 5G Standalone (SA) network, including lifecycle support and radio resource portioning. The successful lab test demonstrated the ability to provision a network slice from the core to the radio access network (RAN) in 35 minutes.

In September, Vodafone Netherlands said it had become the first telecoms company in the country to introduce network slicing. Earlier this year, A1

Telekom Austria Group’s trial with software provider Amdocs showed how 5G network slices could be deployed and generate revenue.

Yet despite the obvious benefits, the technology still faces multiple regulatory, business and technical challenges. When will the promises of network slicing become reality?

**The reality of network slicing**

The reality of network slicing depends on a number of factors; one is the standalone version of 5G. Very few mobile operators have so far invested

in 5G standalone networks, says Aaron Partouche, Global Vertical Principal Director, Colt Technology Services.

As a result, the ecosystem and use cases are still emerging. “If operators are going to deliver all of the promises 5G brings – particularly ultra-reliable low-latency communications – network slicing and a developed ecosystem will be critical,” says Partouche.

Adding to this, there hasn’t been much promotion of network slicing from mobile operators – nor have they been defining how they are going to deliver solutions from a commercial point of view, says Adrian Belcher, Solutions Architect at Gigamon.

“While the technology is certainly ready and embedded into 5G network equipment, 5G itself faces delays and therefore so do all the components that go with it. There are of course a few fully formed 5G Standalone networks being deployed now, but a lot more are still in late lab trial phase,” he notes.

**Complexity is the enemy**

The complexity of network slicing is another big challenge. “Slicing runs across domains, from RAN to transport and core, and it needs complex vertical and horizontal integrations,” says Manish Mangal, Global Business, Head of 5G and Network Services at Tech Mahindra.

“There is also a need for virtualisation, software defined networking (SDN) and orchestration capabilities. Resource allocation, sharing and Isolation among slices adds to the complexity.”

Security also needs to be resolved

and is a tricky matter due to resource sharing among slices, says Deepak Sharma, Senior Manager, Product Portfolio at Tecnotree. “Network slices serving different types of services may need to adhere to different levels of security policy requirements. Therefore, while designing network slicing security protocols, it is necessary to consider the impact on other slices – and on the entire network.”

Implementation of end-to-end network slicing requires a redesign of the RAN and currently, there is no consensus for the best way of doing this, says Richard Webb, Director, Network Infrastructure, CCS Insight.

He adds deploying more network slices over the same physical infrastructure can create added difficulties for operators in maintaining service level agreements, quality of service and security assurance for each individual slice.

Taking this into account, Webb says network slicing is “in its relative infancy” with successful examples “yet to be established for all live deployment use cases”. For example, he says, one of the more challenging scenarios could require network slices to be maintained while roaming between private and public networks. “Establishing best practice for this type of requirement will be an important driver of market maturity.”

**Progress and trials**

Progress might not be rapid, but network slicing trials and projects are gaining

pace this year and into next. Mika Uusitalo, Head of New Technologies and Innovations at Nokia, thinks “real momentum” has started to build on the network slicing journey.

He cites the example of several deployments and trials with Nokia’s customer base including Telia, A1, Orange, Mobily, Proximus, Safaricom, Cellcom and VI. “While there is always buzz and anticipation around new technologies, in practice it takes time to put the key building blocks in place,” Uusitalo concedes.

At the same time, network slicing is a focus for the industry as 5G Standalone enters the fray. Standards body the 3GPP has recognised network slicing to be an essential overall component of 5G. Working groups are developing 5G core architecture with network slicing as an integral feature, says Webb.

**Slow standardisation**

Standardisation of network slicing by 3GPP only happened “quite recently” at the beginning of 2020, points out Williams Tovar, 5G Media Streaming Solutions Director, Ateame. “It takes some time for infrastructure and application vendors to adapt.”

And progress could happen as quickly as next year, Tovar predicts. In 2023, he expects “a few” standalone 5G networks to be deployed, slicing to be tested, and commercial proposals for the first adopters. “In 2024 and beyond, I expect the growth of slicing adoption and the development of new applications,” Tovar adds.

There’s no doubt network slicing is a complex concept and for it to work from a business point of view, operators need to get it right. While network slicing is already a reality, it will take time to evolve, says Webb. “Standards should help this evolution, as well as the continuing development of some of the network environments in which slicing will be deployed, such as 5G private networks.”

“Standards should help this evolution, as well as the continuing development of some of the network environments in which slicing will be deployed, such as 5G private networks



# Is multi-cloud a sensible strategy for the reasons you think?

**Annie Turner** mulls multi-cloud through the lens of the Pentagon's decision to spend up to \$9 billion between four cloudcos – what does it mean for the wider market?

**T**he Pentagon put multi-cloud firmly in the spotlight when it awarded contracts collectively worth up to \$9 billion for its Joint Warfighting Cloud Capability (JWCC) in December. The JWCC is the multi-cloud successor to the Joint Enterprise Defense Infrastructure (JEDI) – the IT modernisation project awarded solely to Microsoft Azure in 2019 that was supposed to run for 10 years. The remit was to build a massive, common commercial cloud for the Department of Defense (DoD).

## JWCC takes over from JEDI

The choice of provider was controversial from the start. AWS started legal proceedings almost immediately, claiming the award was influenced by President Trump's very public dislike of Amazon and its founder Jeff Bezos. Other parties expressed concerns about such a big contract going to a single provider, hence JEDI was officially terminated in July 2022 and a multi-cloud approach taken this time.

The JWCC contracts went to the world's largest three cloud providers, Alphabet's Google Cloud, Amazon Web Services (AWS) and Microsoft plus Oracle. The separate contracts will run until 2028 and provide the DoD with "enterprise-wide, globally available cloud services across all security domains and classification levels", according to the official announcement.

The ideas behind having more than one supplier for government agencies to choose from is that it will help keep prices down and spur innovation. Also, few organisations are more concerned

about security, resilience and scale than the DoD and, on the face of it, multi-cloud ticks all those boxes and diversifies risk, but does multi-cloud really deliver?

## The failings of failover

Ross Brown, SVP of Partners and Services, at Oracle tweeted in December 2021, "Failure is inevitable, planning for it shouldn't be held back because of an anti-customer strategy to hold their systems hostage by artificially high egress and inter region transfer costs to spur single cloud development models."

In other words, if one cloud fails, organizations need to have failover to another. What Brown perhaps somewhat disingenuously calls "anti-customer strategy" could also be seen as each cloudco differentiating its offerings with different network architectures and attributes, and varied storage, security and Platform-as-a-Service capabilities. Presumably the government agencies covered by the contract will choose the cloud platform that best meets their needs.

Opponents of failover argue that among other things, it imposes an immense burden on application developers and running everything in parallel just in case is horrifically expensive, time-consuming and wasteful. One approach to make the failover as straightforward as possible would be to keep to the lowest common denominator of cloud offerings, but of course this also minimises the advantages and innovation.

Some industry commentators argue regulators' enthusiasm for failover is due to poor understanding of how big public cloud platforms work. Gartner's Distinguished VP Analyst, Lydia Leong, think cloud failover is "almost always a terrible idea" and outlines her reasons in this blog. She uses the analogy of insisting on failover to another cloud like forcing commercial airlines to maintain backup fleets of aircraft from a different manufacturer in case a software glitch should ground its fleet.

Leong argues, "The huge cost and complexity of a multi-cloud implementation is effectively a negative distraction from what you should actually be doing that would improve your

**“The huge cost and complexity of a multi-cloud implementation is effectively a negative distraction from what you should be doing**

uptime and reduce your risks, which is making your applications resilient to the types of failure that are actually probable.”

## Reinforcing dominance

Yulia Gontar, Strategic Growth Executive at Super Protocol, doesn't think inoperability is the main worry regarding the JWCC, so much as "the threats it may open up." Super Protocol is built as a massive ecosystem of interoperable solutions and services, with the aim of decentralising cloud computing and giving it back to the community, enabling

any party to communicate with any party securely, using confidential computing everywhere (see below).

Gontar says the Pentagon's contract will reinforce the immense market dominance of the companies involved. Already, the four cloudcos chosen by the Pentagon control over two-thirds of the global market and just two of them – AWS and Microsoft Azure – account for over 60% of it, according to Gartner and others (Oracle has about 2% as of Q3 2022, according to Insider Monkey).

On the other hand, we have other US government departments, the European Commission and regulators the world over on a mission to curb Big Tech's overweening market power because it is seen as a bad thing, stifling competition and innovation. For example, on the day this article was completed, the US Department of Justice sued Google over its dominance of digital advertising and stated its intention to break the company up to counter that dominance.

## Central problem of centralisation

As well as so much being in so few hands, there is also the issue of them being centrally controlled. "These large





Company	2021 Revenue	2021 Market Share (%)	2020 Revenue	2021 Market Share (%)	2020-2021 Growth (%)
Amazon	35,380	38.9	26,201	40.8	35.0
Microsoft	19,153	21.1	12,659	19.7	51.3
Alibaba	8,679	9.5	6,117	9.5	41.9
Google	6,436	7.1	3,932	6.1	63.7
Huawei	4,190	4.6	2,681	4.2	56.3
Others	17,056	18.8	12,697	19.8	34.3
Total	90,894	100.0	64,286	100	41.4

Worldwide Infrastructure as a Service (IPaaS) public cloud services market share 2020-2021 in millions of US dollars

Source: Gartner (June 2022)

public cloud providers have a lot of servers and data centres distributed all over the world but they are all interconnected to one closed platform... and have some central authority that decides what’s can and cannot be done,” Gontar states.

Also on the day this article was completed, Microsoft Azure suffered an outage, potentially impacting millions of people around the globe who couldn’t access applications like Teams and Outlook. At the time of writing, it wasn’t clear how many people had been affected, but CNN reported Microsoft had identified a network connectivity issue with devices across its wide area network which affects connectivity between clients on the internet and Azure, and connectivity between services in data centres.

**A kick up the breaches**  
Outages aren’t the only concern about centralisation. Nowadays even the largest data breaches no longer attract the headlines and outrage they used to. Instead, they are regarded as a regrettable but unavoidable a fact of life. Nor are data breaches only caused by cyberattacks. Deliberate data leaks, such as that perpetuated by whistle-

blower Edward Snowden, was nothing to do with cloud, but underlines what a sitting duck massive, centralised caches of data can be.

Nor are all leaks deliberate, Gontar points out. In summer 2022, it was reported that details about more than 1 billion Chinese citizens were leaked from the Shanghai Police’s repository on Alibaba cloud, which is part of the Chinese government’s private security network. The cache was offered on a cybercrime forum for 10 Bitcoins, the equivalent then of about \$200,000.

Likewise, “The Microsoft data leak in

2022 was due to the misconfiguration of a server,” she adds. More than 65,000 companies had their data exposed because an endpoint was publicly accessible over the internet without requiring proper authentication. This would seem to undermine a key selling point of cloud; that even if another cloud tenant’s data or other resources are breached, every tenant is insulated from the others.

Yet researchers made a frightening discovery about Microsoft Azure in August 2021, described in *Protocol* magazine in summer 2022: “They reported gaining access to databases in thousands of customer environments, or tenants, including those of numerous Fortune 500 companies. This was possible because the cloud runs on shared infrastructure – and as it turns out, that can uncover some shared risks that cloud providers thought were solved problems.” And cloud users too.

Fortunately, those who hacked Microsoft’s Cosmos DB service were not cybercriminals, but researchers from Wiz, a cloud security start-up. They called the vulnerability ChaosDB. According to Shir Tamari, Head of Research at Wiz, a cross-tenant flaw like ChaosDB is “the most severe

“ Cloud runs on shared infrastructure – and...that can uncover some shared risks that cloud providers thought were solved problems

vulnerability that could be found in a cloud service provider”.

So far, there has not been a multi-tenancy cyberattack – or not one that’s been made public – but that could change. A cross-tenant vulnerability was also discovered in Oracle Cloud in September 2022, by some of the same researchers. This weakness would have allowed an attacker to gain read/write access to the disks of other customers. The vulnerability was mostly caused by a lack of permissions verification in an API for storage expansion.

Zero-trust approach

Obviously, security is top of mind for the Pentagon and in 2022, ahead of awarding the \$9 billion contracts, the DoD announced in it would adopt a zero-trust strategy, which it defines as an “evolving set of cybersecurity paradigms that move defenses from static, network-based perimeters to focus on users, assets, and resources. At its core, ZT assumes no implicit trust is granted to assets or users based solely on their physical or network location.”

ZT relies on general purpose computing, which requires confidential computing as the baseline. Confidential computing is technology that isolates and encrypts data while it is being processed through exclusive control of encryption keys. Data has been protected by encryption when at rest (in storage or databases) or in transit for years, but not during processing or runtime.

Confidential computing makes the data itself, and the tech used to protect it, invisible and unknowable to anything and anybody else, including the cloud provider. It is intended to inspire greater confidence about how well data in the public cloud is protected, but it is not universally available nor uniformly deployed, and lacks standards. Work to address these issues is underway in the Confidential Computing Consortium,

but AWS, which has about 40% market share, is conspicuous by its absence.

Confidential computing offers a way to secure data in the public cloud as required by regulations like Europe’s General Data Protection Regulation and the US’ Health Insurance Portability and Accountability Act.

Gontar concedes that the cloudcos awarded the JWCC Pentagon contracts offer confidential computing in a sense already but argues “because they are so large and centralised, with a very long history of developing infrastructure, they would not be able to transform their whole global whole infrastructure into

“ Confidential computing makes the data itself, and the tech used to protect it, invisible and unknowable to anything and anybody else

this kind of confidential continuity quickly and it is not yet in place [holistically]”.

She also looks ahead to the potential of the metaverse largely being controlled and run on a handful of platforms and says this “huge scale personal data, which combines the real and the virtual worlds, including data about behaviours of people in a digital environment. This will pose a significant, even larger threat to the people’s privacy and identity if breached.”

Gontar’s view is that the only way to overcome the potential threats of these big trends is to ensure people own their decentralised, digital identities, and indeed governments are moving in

that direction, including the US. “They have understood and are at the stage of piloting decentralised identity projects. If identities are owned by people themselves and are verifiable and trustworthy, then mass attacks will not happen and the national threat would be much lower,” she says.

“Unless you become decentralised and include open source you will be exposed to these vulnerabilities and it’s just a question of time before a data leak happens, accidental or malicious.”

Trusting nobody is the best option

Gontar is not arguing for private cloud in preference to public cloud because “with private cloud, you still have massive amounts of sensitive data, which is vulnerable to attack or a leak or breach without decentralisation”. Super Protocol’s world view is a trustless and permissionless cloud infrastructure where there is no central control and any party can interoperate with any other party, so long as both sides agree. They just develop their own solution and use decentralised IDs.

In a decentralised, confidential computing cloud, although no-one ‘trusts’ anybody else, parties can work together because they don’t share the data which speeds things up. For example, if you’re a government agency, wanting to interact with a small business, and a citizen wants to use the services of that small business supplied on behalf of the government, the firm must verify the user is who they claim to be. In a decentralised environment running open source this can be done without recourse to the government for documentation.

She says, “The whole infrastructure is being developed for everybody, at scale and... is much more advantageous than closed, centralised cloud providers and their markets, and the economies they create and impose on the whole world at the moment.”



# Mobile roaming is coming to a standstill

Dario Betti writes that roaming is falling apart as operators decommission older networks, deliver poor customer experience and create uncertainty about charges

Many mobile operators are in the process of decommissioning their older networks (2G and 3G), in favour of more efficient 4G and 5G networks, but the newer networks are not yet fully supported for roaming by all operators.

Hence we appear to be going backwards, not forwards, to the point I'm wondering if roaming can survive. Here's my list of what they need to do for roaming to thrive again:

**Support VoLTE roaming**

A lack of international roaming has multiple effects for high-value customers: not receiving an SMS can block a bank transaction or a payment, and phone calls are still an important part of business and private communications. Patchy or non-existent coverage while roaming is unacceptable.

Mobile operators are reducing their value by not providing a consistent connection. Support for 4G and 5G roaming is essential – or customers will go elsewhere.

**Build services**

Operators must build a robust and reliable network to provide universal service and sign commercial deals that will get customers connected overseas. If customers can reliably travel to any country and use their mobile phone for voice and SMS, they will likely be happy to pay the premium.



Low-cost operators should not spend time, money, and resources building a universal network, they could build packages of OTT services, such as free WhatsApp messaging and voice calling, so users can use their data allowance via the 4G network.

Pricing strategy will be very important and must reflect the market, competition and the level of service customers can expect. If prices are too low, they could make the market unviable, but if too high, customers will find workarounds.

**Create easy packages**

In the age of apps, self-service and high customer expectations, some mobile operators are struggling to share information and build packages that allow users to feel in control during international trips. Daily passes, capped spending and many other tools are attempts to provide transparency and worry-free billing. Operators should copy best practices.

A few operators give roaming a

bad name; it is every operator's duty to control and manage their roaming prices. Prices are negotiated by the originating and the visited network and it must be a common goal to set a fair, affordable price for roaming. Operators must ensure roaming services work effectively. If a customer is paying a premium, they had better receive the service they expect.

**Keep it simple and be clear**

Whatever solution an operator chooses must be clearly communicate with the customer to ensure they know what they need to do, such as download configuration settings before they set off. Inform them about exactly what is included in the package and which services work in which countries. Some countries love WhatsApp, others have their own equivalent; like KakaoTalk in Korea.

Keeping track of tech can be tricky: in South Africa, most mobile users use 3G, with many still on 2G whereas the US, 3G networks are largely decommissioned. Technology is no excuse for poor service. Customers can easily compare services across different operators to find one that works, is reasonably priced, and helps rather than hinders them while travelling.

To futureproof the mobile industry, it must give customers what they want and need in a way that is easy and accessible for them.

The author is CEO of the Mobile Ecosystem Forum (MEF). A longer version of this article is online.

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