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THE GLOBAL VOICE OF TELECOMS IT

TALKING HEADS

iconectiv explains why CSPs must adopt a common language to ensure optimised operations

PLUS IBM bolsters 5G telecoms consulting with Sentaca acquisition • Teoco buys Software Synergy to strengthen North American market presence • Vodafone partners with Amdocs for African Centre of Excellence • Why you need to know what you have, what you need and what you don't want • Our MWC22 Barcelona event preview • How data infrastructure can improve fixed asset management • Gurobi reveals three ways decision-making AI is transforming CSP operations • VIAVI explains how network disaggregation is driving flexibility and expanding the potential to optimise operations • How to make open and virtualised 5G pay • Lakshmi Mandyam on monetising 5G without the costly metal • Latest news, features and interviews at **www.vanillaplus.com**

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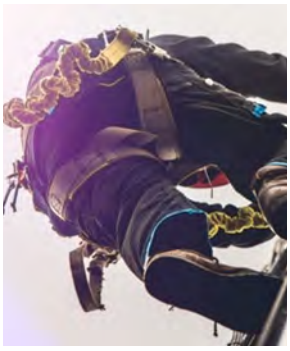

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Many happy returns to MWC

I'm expecting a retro-vibe at MWC22 Barcelona. I haven't been to the event since 2019 as the pandemic scuppered mine, and about 100,000 other people's attempts to attend in 2020, and two years is a long time in telecoms. 5G has gone from something talked about as years away to an altogether more immediate prospect. It seems the world's telecoms engineers made the most of their key worker status to get out and install relatively large volumes of radio equipment and 5G has accelerated as a result

George Malim
managing editor

This is to be celebrated but it leaves MWC22 scrabbling to re-establish itself as a focal point for the industry. Thinking back to past glories, while acknowledging there's no prospect of attendee numbers in the six-figures, has caused me to consider what a show like this should be. Certainly, I've always categorised myself as an attendee that believes more value is created by what you don't see than what is right in front of you.

It isn't who has the largest stand, the flashiest entertainment, the most famous rented celebrity or even the best on-stand catering – thanks, **Ericsson**. It's the meetings behind closed doors, the chance links that are made at social events and the chance to re-ignite old associations that really drive business value.

For so long, the expectation has been that all in the industry should attend so to find a situation in which everyone has a perfect excuse not to, really tests the worth of the event. The days of having to attend because it looks bad not to are over but still tens of thousands are flocking to Barcelona. That speaks volumes for both the goodwill towards MWC people have and the value it is still expected to provide.

This year, there will be fewer people in evidence but a significant portion of those who make it – including me – will simply be pleased to be there. I'll probably still swerve the tortilla sandwiches but there will be other memory-jogging aspects that will give this year's event a retrospective flavour. As an Englishman, I'll be reintroduced to the thrill of navigating international roaming charges because the UK has left the EU.

I'll also pass a personal cellular milestone. 3G, the first cellular generation that I have covered from its start, is beginning to be retired. Vodafone UK and others have already announced plans to retire the technology to free up spectrum for 4G and 5G so it's only a matter of time before 3G is consigned to history.

Although MWC has had to sit on the sidelines of the pandemic, the industry has continued to progress and that's something that should be celebrated at MWC22.

Enjoy the magazine!

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IBM takes on the 5G era with acquisition of Sentaca

IBM has acquired **Sentaca**, a telecoms consulting services and solutions provider. The acquisition will accelerate IBM's hybrid cloud consulting business, adding critical skills to help communications service providers (CSPs) and media giants modernise on multiple cloud platforms, innovate and transform their businesses.

Headquartered in Boston, Massachusetts, Sentaca's team of highly experienced technology consultants across the US and Canada build and migrate mission-critical applications on cloud service providers and open-source platforms like **Red Hat** OpenShift and OpenStack. Sentaca has supported digital transformation, next generation networks and improved consumer experience for CSPs and media companies since its founding in 2008.

Sentaca will join IBM Consulting's Hybrid Cloud Services business to solve clients' strategic and technology challenges such as cost-of-ownership, monetisation, scalable and secure architecture, and address opportunities including 5G, IoT and streaming that can accelerate the creation and delivery of new services. Sentaca's domain expertise, assets and client relationships will help IBM meet industry demand and strengthen its position as a prime systems integrator for the emerging network and 5G market.

John Granger, IBM

"Our goal is to help modern networks thrive in an open, hybrid cloud environment that will bring edge and 5G to life for enterprises and consumers," said John Granger, a senior vice president at IBM Consulting. "The proliferation of mobile devices, wireless connectivity and new media platforms is driving convergence among telco, media and entertainment, which makes our acquisition of Sentaca all the more valuable for our clients."

Phil O'Neill, the chief executive of Sentaca, added: "We are very excited to join the IBM team and to be in a position to access additional resources and platforms to deliver on even larger and more ambitious enterprise cloud transformation projects within the telco and media industry."

Teoco acquires routing and optimisation solution provider Software Synergy

Teoco, a provider of analytics, assurance and optimisation solutions to more than 300 communication service providers (CSPs) worldwide, has completed the acquisition of **Software Synergy** (SSI). Terms of the deal have not been revealed.

Established in 1990, SSI provides automated, intelligent network-wide routing and optimisation solutions for the planning and management of CSP networks. The acquisition will bring SSI's configurable Universal Routing Solution (URS) under the Teoco brand, complementing its existing business analytics product suite.

"As we look to strengthen Teoco's presence in the North American market, we are proud of our strategic acquisition of SSI to enhance our routing solutions portfolio," said Atul Jain, the founder and

Atul Jain, Teoco

chief executive of Teoco. "I'm pleased to welcome the SSI team members, customers and partners to Teoco and we look forward to serving them."

NEWS IN BRIEF

Optiva grows partnership with Google Cloud

Optiva has announced a multi-year strategic partnership with **Google Cloud** to help communications service providers (CSPs) accelerate their digital transformations and journey to the cloud, private and public, and deployment on the edge. Through this collaboration with Google Cloud, Optiva customers can purchase its flagship products, Optiva BSS Platform and Optiva Charging Engine, via Google Cloud Marketplace as a SaaS solution.

Optiva's distributed solution deployment creates new ways to monetise 5G networks by focusing on use cases that enable enterprise, private 5G networks, IoT, ultra-low latency use cases and industry vertical solutions. Optiva will use Google Cloud and Anthos to enable CSPs to seamlessly deploy and operate BSS applications across public clouds, on-premise data centres and at the network edge.

Mobileum receives a strategic investment from H.I.G. Capital

H.I.G. Capital, a global alternative investment firm with more than US$47bn of equity capital under management, has entered into a definitive agreement through an affiliate of H.I.G. Technology Partners to make a strategic investment in **Mobileum**, to help accelerate technology investments and growth enabled by the roll-out of 5G technologies and private networks across the world.

Following the transaction, H.I.G. will be the majority owner of Mobileum alongside previous owner **Audax**, which will retain a minority stake. The transaction is subject to customary closing conditions and required regulatory approvals. Terms were not disclosed.

NEWS IN BRIEF

Ethio Telecom selects HyperSense for 5G business assurance

Subex has announced a partnership with **Ethio Telecom**, the CSP in Ethiopia, to provide its Business Assurance solution on its Enterprise AI platform, HyperSense. Through this engagement, Ethio Telecom will expand its revenue assurance practice into business assurance using the system's control building framework and enhanced decision-making through the platform's ability to operationalise artificial intelligence (AI) at scale.

Ethio Telecom has more than 50 million subscribers and is undergoing network infrastructure and system enhancements to pilot 5G networks in the coming year. Subex's 5G-ready Business Assurance offering has been chosen to enable Ethio Telecom to pioneer risk management automation.

Norlys expands wholesale business with new launch on Cerillion

Cerillion has announced a significant step in the successful deployment of its Enterprise BSS/OSS suite at Norlys in Denmark, enabling **Norlys** to expand its market reach through connectivity into the country's open access wholesale platform. The Cerillion solution automates service fulfilment for new fibre services, enabling Norlys to seamlessly grow its addressable market as it invests in further network roll-outs.

As an infrastructure owner with fibre to more than 700,000 homes, connecting into the national wholesale platform provided by OpenNet makes the Norlys fibre network accessible to other Danish service providers through a standardised wholesale gateway.

Vodacom Group partners with Amdocs to create African Centre of Excellence for 5G customer experience

Amdocs has partnered with **Vodacom Group**, an African connectivity, digital and financial services company, to create an African Centre of Excellence (COE). The COE will enable Vodacom to deliver experiences to its customers in Tanzania, Mozambique and the Democratic Republic of Congo (DRC) by introducing standardised, flexible configuration, monitoring and monetisation of differentiated services while providing a unified IT architecture across the three countries.

The COE will be launched as soon as all operational and commercial details have been finalised. It will also enable Vodacom to achieve greater operational efficiencies by launching new products, services and tariffs more quickly, including bringing 5G services to its customers, by harnessing Amdocs' **Openet** charging solutions.

"Vodacom will continue to seek strategic partnerships as we evolve from a telco to a techco," said Dejan Kastelic, the group chief technology officer of Vodacom. "This will allow us to realise our Tech 2025 strategy by investing in modern network technologies and digital IT systems to scale our products and services. Vodacom's partnership with Amdocs enables us to move to a cloud-native, standardised

Anthony Goonetilleke, Amdocs

architecture and develop a single Centre of Excellence in Africa which will in turn allow us to deliver a consistent, next generation customer experience across our operations."

Anthony Goonetilleke, the group president of technology and head of strategy at Amdocs, added: "We're passionate about creating the best-connected experiences, and Vodacom's adoption of a unified, 5G-ready architecture means more rapidly bringing those experiences to life for customers in Tanzania, Mozambique and the DRC."

Netcracker extends strategic relationship with T-Mobile US

T-Mobile US has extended its BSS and managed services partnership with **Netcracker Technology** for its wholesale business, which includes the MVNO and IoT markets.

Netcracker Digital BSS, including Netcracker Partner Management, and Netcracker Managed Services will help T-Mobile continue to utilise capabilities for revenue management while optimising a range of operations, such as reduced bill run times and improved billing accuracy.

The complete BSS suite will allow T-Mobile to enhance customer experience across all channels. In addition, Netcracker will provide a comprehensive set of services, such as Agile and DevOps methodologies for development, configuration and delivery.

"We are pleased to renew our partnership with Netcracker to help us realise current and future goals for our wholesale operations, including our industry-leading MVNO business as well as our IoT business, along with seamless operations and onboarding," said Dan Thygesen, the senior vice president and general manager of wholesale at T-Mobile.

Frank DeTraglia, the chief customer officer at Netcracker, added: "We are extremely proud to be the strategic partner of an industry trailblazer like T-Mobile, which continues to lead the increasingly competitive North American IoT, MVNO and wholesale markets with best-in-class technologies and differentiated service offerings for enterprise customers, partners and consumers."

Christel Heydemann

Orange's board of directors has appointed **Christel Heydemann** as chief executive officer of Orange with effect from 4 April 2022. In appointing Heydemann, **Schneider Electric**'s current executive vice president of Europe Operations, the board has selected a candidate who has experience in the telecoms sector and in managing business transformations. The board has asked **Stephane Richard** to continue as chairman and chief executive until Christel Heydemann takes up her role,"to safeguard the continuity of the Group's operations and to ensure the smoothest possible transition."

Given the board's decision to separate the roles of chairman and CEO, on the new chief executive's arrival, Richard will continue in the role of non-executive chairman until a new chairman is in post and at the latest until 19 May 2022, the date of Orange's Annual General Meeting. The board thanked Richard for his dedication at the head of Orange over the past twelve years where he has restored employee confidence after the social crisis and embarked on a wide-ranging transformation of the Group, positioning it as a multi-service operator in Europe and Africa.

"I am delighted to welcome Christel Heydemann and wish her full success as CEO of Orange," said Richard. "Working alongside the Group's employees, I am convinced that her personal and professional qualities will enable her to meet the challenges the future holds for the Group. Christel's involvement as a board member and her long experience at **Alcatel** and then Schneider Electric means she has an excellent understanding of the challenges and opportunities of the digital future and the critical role this will play in the decades ahead. I am certain that her vision, her pragmatism and her ability to bring out the best in every situation will be of enormous value to Orange."

Heydemann added: "As a member of the board for nearly five years, I have gained a solid understanding of the technological challenges and opportunities that lie before us. I know that these are significant, but it is equally a huge honour to be able to contribute to the development of one of the players in our industry and Orange will have my total commitment as we set about this task. I also know I can count, as my predecessor has been able to, on the dedication of all the company's teams to see Orange through to success."

Tom Guy

BT has announced that **Tom Guy**, the former chief product officer for **Vodafone Smart Tech**, has been appointed as managing director of incubation. Joining with him are four members of his team, **Jess Kyte**, **John Gutch**, **Zoe Dyer** and **Michael O'Connell**, who, alongside Guy were part of the founding team of **Hive**, the smart home provider in the UK.

The team brings a wealth of experience in product leadership, design, building an agile culture, and will help BT create and incubate start-ups and explore new categories and ideas, accelerating the start-up and versatile capabilities across the business.

"I'm looking forward to joining BT Digital at such an exhilarating time for the unit and the business as a whole," said Guy. "Together with colleagues and partners, we'll help to build a customer-centric digital organisation, one which brings new products and services to our customers and creates new opportunities for the business. I'm excited to get started."

Brooke Cunngingham

Datto, the global provider of cloud-based software and security solutions purpose-built for delivery by managed service providers (MSPs), has announced that **Brooke Cunngingham** has been appointed as chief marketing officer. Cunningham brings more than 20 years of experience in the software industry and has held global leadership roles in marketing, operations, partner and programme functions. She has previously worked at **Splunk**, **CA Technologies**, **SAP** and **Qlik**.

At Splunk, Cunningham played a key role in growing the company's revenue from US$650m to more than US$2.5bn by maximising the value of partner ecosystems. She specialises in building for scale, driving partner-oriented marketing models, and delivering go-to-market growth outcomes.

Neville Ray

Wireless cellular industry trade association, **5G Americas**, has announced that **Neville Ray**, the president of technology at **T-Mobile US** has been chosen to serve as chairman of the 5G Americas board of governors for 2022.

With more than 30 years of experience building and operating wireless networks in the US and around the world, Ray is widely recognised for his leadership in the telecoms industry. Ray has been a member of the 5G Americas board for more than 11 years and previously served two multi-year terms as chairman.

"With three years of global commercial 5G network deployments behind us, the industry looks ahead to even more growth powering new experiences for consumers and transforming industries," he said. "5G Americas will continue to play a strategic role, addressing key opportunities in technology innovation, spectrum and new use cases for 5G."

CSPs must adopt a common language to ensure optimised operations

Business strategies that involve 5G, edge computing and virtualised networking demand a universal structure for the deployment, interconnection and management of the physical and virtual assets these capabilities require. Essentially, the same terminology must be used to enable different domains within a communications service provider (CSP) to have visibility into each other and for external organisations, such as partners and vendors, to share the same language. Here, Eyad Alqadi, the regional sales director for EMEA at iconectiv, and John Hayes a senior director at iconectiv, explain to VanillaPlus managing editor, George Malim, how a universal structure has been used by service providers in the past and how it can reduce time to revenue for innovation investments, while offering competitive advantage in the race to expand into key markets.

The company estimates that CSPs have been losing up to 20% of their annual capital expenditure – to the tune of US$65 billion industry-wide – because of poor communication, mislaid assets and mismanaged inventory. These are a direct result of critical data being scattered throughout their organisations in a variety of formats and managed by different business functions. This makes sharing information and effective collaboration difficult, if not impossible. iconectiv's TruOps Common Language was designed to aid communication between systems for CSPs whose operations involve an overwhelming amount of moving parts. Common Language provides a way to standardise how an ecosystem refers to locations, equipment, circuit paths and service use, enabling comprehensive visibility into asset performance and value ►

SPONSORED INTERVIEW

Eyad Alqadi, iconectiv

John Hayes, iconectiv

George Malim: CSPs are under significant pressure to sustain revenue growth and profitability while delivering new digital services. Regulations, technology disruptions, intensifying competition and changing customer demands are also placing them at a crossroads. Business growth increases operational complexity and costs, which in turn increase potential for errors and risk to profitability, so how can CSPs streamline asset management processes and reduce time to revenue?

Eyad Alqadi: From our experience, communication service providers can't manage something efficiently if they have no visibility into it. Having talked to many CSPs around the globe, it's clear that many don't have visibility into their assets because these are in various locations, sometimes in different countries and often managed in siloes. In addition, the industry's past track record of mergers and acquisitions has seen the practices of different companies brought together under a single banner – but not a single language. This is likely to continue in future waves of consolidation and diversification well into the digital era, so making sure there is better visibility into assets remains a number one requirement.

Having visibility is important because it means CSPs can maximise the utilisation of its assets. It's critical and it is where we can be of help to CSPs so they can increase their revenues by creating a unified view of their assets.

John Hayes: If you look at a CSP, it has a number of internal systems that are used in order to operate its business. In finance for example, you have enterprise resource planning (ERP) systems, while in operations there are different inventory management systems and, in planning and engineering, there are network design systems. Each of these systems, while fit for their respective purpose, are the responsibility of different organisations within the company and the ways in which organisations represent assets can vary.

You can readily manage your own domain of responsibility in this way but that variation means you can't manage end-to-end because there is no co-ordination across different domains. You can't get insight into business performance because it's very hard to align different views. Think of three fruit companies, one that values an apple based on the amount of juice that can be squeezed from it, one that values the apple on its total weight and one that considers all of its apples as a single unit with a single value – and then try to decide which offers the cheapest apple.

You could have a financial system that captures all the in-service information and that's valuable because it has information about the assets and what the investment into them has been, but unless you can align financial systems with operational systems you don't get to the picture of how they are used and how they can be maximised. ▶

From a practical point-of-view when you look at CSPs, every stakeholder has different objectives and drivers for how they view their assets

What we are pushing towards is to make sure the information we have is used consistently across the CSP to enable each organisation to manage its part of the asset lifecycle in an appropriate way, and then also to conform to a common platform to enable different views to be seen together.

GM: What variations do you see and how can Common Language help to ensure different domains see assets in the same way?

JH: It depends on how a CSP does things. If, for example, a CSP chooses to describe an asset in one place and then move it to another, visibility is lost as other domains may not be able to track the asset. Another example would be if a financial organisation represents an asset as part of a selection of items – as with the apple wholesaler – rather than an individual asset in its own right. In that scenario, CSPs can't extract that asset-specific information that enables them to optimise.

We also see that each organisation within a CSP tends to have its own way to name items, which is not consistent across the company. At one CSP in the Middle East, we did a location analysis and found 12 different ways in which an asset was represented based on the different organisations with domain responsibility. Naming presents some quite serious challenges for gaining unified visibility across an organisation.

For example, an address could be entered as: One Main Street, One Main St., 1 Main Street, 1 Main St or several other variations. All of these are accurate but not exact so, when systems require exact matches, data can get lost. These types of inconsistencies are ways in which asset information can be lost within a company. When it comes to database hygiene it is understood that without a common nomenclature, errors get introduced by simple inconsistencies such as the address example.

To remedy this, data governance needs to be put in place with the discipline to enforce data standards. If this is done utilising a common platform, when someone within a CSP wants to move an asset from one place to another it can be visible to all. This is in contrast to the current situation in some CSPs where finance, for instance, does not get the same view as operations. That then creates a misalignment between the two and that makes management of the business less efficient. The alignment is essential to maximise efficiency.

GM: CSPs have invested billions in their operational technology (OT) in the form of network infrastructure – both fibre and 5G – but knowing what they have and where it is, is fundamental to being able to deliver the wider array of services that new networks enable. How can CSPs prepare for the new era of dynamic, automated network capacity and maintain an accurate view of their assets across multiple networks and territories?

JH: There are different levels of complexity taking place. If you look at tower infrastructure companies such as **American Tower** or **Crown Castle** in the US, they were originally real estate companies that allowed CSPs to lease space in their towers to place equipment. CSPs then swiftly realised that if you share network components you get economies of scale. Tower companies now are acquiring fibre operating networks and providing services such as backhaul and mobile edge computing.

This introduces a whole new level of complexity because the end-to-end network isn't the CSP's anymore. Within that, the model is not the same as traditional interworking and it's not just a case of having a common language for managing hardware assets because the scope has changed to encompass software as well. Virtualisation of equipment also needs to be considered and taken into this common platform so all stakeholders have visibility and can understand, not only their own domain and business but how it and their resources fit into the complete service delivery and revenue chain.

GM: Do the full benefits of a common platform demand that all players in the value chain utilise the same terminologies?

EA: There are two aspects here. One is internal to the CSP and this definitely needs a common platform that connects all the stakeholders within an organisation so they can have a common view of all their assets. The second aspect is external and centres on location and connection. From an efficiency point of view, understanding locations and availability of resources across different companies is needed and commonality becomes critical because it saves cost for everyone. That has become critical and is a value that Common Language can bring.

GM: What about compliance with regulations such as the Fixed Asset Register requirements; how are CSPs approaching this when it comes to a common platform?

EA: From a practical point-of-view when you look at CSPs, every stakeholder has different objectives and drivers for how they view their assets. Finance organisations are ultimately responsible and have the driver of ensuring that all assets are accounted for and valuation is accurate because they have to comply with regulations, and they are responsible to auditors, the board and shareholders. ▶

We view ourselves as enablers to bridge the gap internally within organisations but also externally with partners and vendors

If we talk to an engineering department, however, you will find that they do not share the same issues and challenges. This is why Common Language is important – because it brings them all together. Stakeholders can then talk together and share the same view of the same assets and that has value in addressing finance departments' requirements but also for partners and vendors.

A common platform helps improve collaboration across the organisation and with partners and vendors so utilisation is maximised and efficiency is improved. Without collaboration, we see the damage of stakeholders working independently of each other in terms of assets. We've seen assets duplicated with a router or switch being ordered that was already available in the CSP's warehouse, for example. iconectiv Common Language enables the utilisation of all assets to be maximised.

GM: What is iconectiv doing here to address CSPs' concerns and enable improved efficiencies in the new era of connectivity?

EA: We view ourselves as enablers to bridge the gap internally within organisations but also externally with partners and vendors. We've created Common Language as the standard, centralised data information solution for vendors to adopt over the years, and it is constantly updated and evolving as new technology and services emerge. We think this is essential to support CSPs and the wider ecosystem as it continues to transform, virtualise and involve greater numbers of stakeholders. To have visibility into this heightened complexity, utilising the same terminology and sharing a Common Language is an essential component for optimised operations.

www.iconectiv.com

Key Common Language benefits

By clearly defining and identifying all the fixed assets and components of a telecoms infrastructure using the appropriate industry nomenclature, CSPs will have better insight into:

Network planning so they can

- Identify and reduce or eliminate unwanted or duplicate assets
- Ensure there are detailed and up-to-date asset records for capacity planning
- Maintain an accurate view of the condition of fixed assets
- Combat fraud and theft by monitoring the actual locations of assets

Network optimisation so they can:

- Optimise the use of available inventory and the spare installed base
- Provide field technicians and network engineers with visibility into network operational data, replacements and upgrades

Critical information to drive financial decisions and ensure compliance so they can:

- Realign purchasing, procurement, inventory and operational management
- Comply with regulatory, reporting, accounting and auditing requirements
- Ascertain the value of assets at different stages of their lifecycles
- Eliminate unnecessary maintenance costs via accurate warranty tracking

Know what you have, what you need and what you don't

For mobile service providers, maintaining an accurate view of the fixed assets across an entire network has always presented a challenge. For group operators, that challenge is multiplied – tracking the value of its fixed assets in multiple networks across different territories, managed, maintained and upgraded locally with equipment sourced from multiple vendors is near impossible using traditional methods

Whether it is across one service provider or a group operator, an accurate Fixed Asset Register allows a service provider to more proactively manage and improve performance across a variety of business, operational and financial metrics. For example, an improved understanding of the capabilities of the assets on the register not only allows for more informed purchasing decisions, it also allows both the operations and finance teams to be more proactive. On top of that, in a group situation it enables information across networks to be consolidated to deliver economies of scale for the procurement team.

The driving factors

From a business perspective, being able to demonstrate that the Group keeps an accurate Fixed Asset Register is essential from a compliance perspective. For many service providers, the audit process usually involves inspectors taking samples from the Fixed Asset Register and then checking the actual locations where the equipment was reported to be held to determine the accuracy of the inventory.

Only if all the assets sampled, in all the locations, delivered an exact match, could the auditors say that the company's assets were properly safeguarded

Only if all the assets sampled, in all the locations, delivered an exact match, could the auditors say that the company's assets were properly safeguarded. The unpalatable truth is that, for many service providers, the mismatch between the data on the registry and the equipment in the field is significant.

What's more, it is vital that the same granularity of detail is held by both the operations and the finance team and that exactly the same descriptions are used across the business. Without that commonality, accurate records cannot be maintained. In addition, given the frequency with which the technology evolves and the constant replacing and upgrading of parts, today's Fixed Asset Register needs to be both dynamic and easily maintained. This will ensure that as assets are added and removed, any changes in functionality are accurately tracked to a granular level. Without that dynamism and accuracy, the register may be behind reality and the auditor's sampled assets may have already been replaced.

An accurate Fixed Asset Register can also be used for both network and financial planning. If the knowledge of the equipment in the field is accurately synchronised between the operational and financial teams it allows for analysis of the historical data to be used to give an overview of performance and capacity and aid future planning. In particular, it can support a centralised procurement process to provide economies of scale on assets required across networks but only if the register can deliver accurate, granular information.

Without Common Language, service providers would not be able to get the certainty of a match between Fixed Asset Registers and the equipment in the field that is required from a compliance perspective; and they would not get the granularity of information about specific network components that they can use to drive their business performance.

Common Language helps service providers meet compliance requirements, it helps measure the return on its capital expenditure on network equipment and it supports operational efficiency in network management and maintenance. No other single solution can help communications service providers (CSPs) meet their regulatory, capex and opex targets quite like Common Language. ▶

Service providers have found that iconectiv's Common Language solution – originally developed to eliminate ambiguity of terminology to support efficient service provider operations and interconnect – can also be used to create an accurate, easy-to-use Fixed Asset Register. By effectively combining operational Common Language data with the information held by the finance team, service providers are able to create a completely accurate picture of the network's assets.

What's more, it became possible to more precisely amortize the cost of network equipment – right down to a single line card within a server or network switch. Common Language allows the Fixed Asset Register to record when a card was installed, the location of the cabinet it sits in and the length of its warranty. The finance team also gets a picture of the typical life cycle before replacement of a particular unit and what it will cost to replace it. This is invaluable from a network maintenance perspective and enables much more accurate financial planning and valuation of network assets.

By effectively combining operational Common Language data with the information held by the finance team, service providers are able to create a completely accurate picture of the network's assets

The value-added benefits

The application of Common Language helps track spending on network equipment and aids in efficient network maintenance. The solution helps reduce the overall spares inventory by identifying compatible equipment. It also helps prevent network downtime by proactively tracking recall notices so that equipment with known faults can be replaced before it fails.

A tier one service provider can buy – 1.5 million pieces of network items each year – as it upgrades and replaces existing equipment. The use of the Common Language solution not only helps drive down the mean time between failures (MTBF) of network equipment, and the mean time to repair (MTTR) that equipment, it also delivers significant financial savings.

Tier one service providers that use Common Language can achieve a 10% saving on procurement costs alone. When operational savings across network and finance functions are added in, the overall savings to the business could be 25% thanks to the accuracy and granularity of the information included in the company's Fixed Asset Register. ■

www.iconectiv.com

MWC22 gets ready to unleash connectivity

MWC22 Barcelona will be held at Fira Gran Via, Barcelona, Spain on 28 February to 3 March with the theme of Connectivity Unleashed. Here, Antony Savvas highlights what the show will offer

"With a multi-layered health and safety plan, the global mobile ecosystem can convene safely to innovate, network, drive meaningful change and get business done"

The unleashed connectivity in question includes the key battle areas of 5G, IoT (Internet of Things), edge, Open RAN, artificial intelligence (AI), the metaverse and even 6G, with the event once against expecting to attract tens of thousands of attendees as we steadily come out of the pandemic.

"With a multi-layered health and safety plan, the global mobile ecosystem can convene safely to innovate, network, drive meaningful change and get business done," say organisers **GSMA**. The deputy mayor of Barcelona, Jaume Collboni, has confirmed the city's "political, institutional and operational support" for MWC22 Barcelona.

In 2021, the GSMA hosted three scaled down MWC events in Shanghai, Los Angeles and Barcelona, but this year's event is the big one. The event includes more than 1,000 speakers, over 1,500 exhibitors, 37 country pavilions, and the Ministerial Programme for policymakers and industry leaders.

Show streams and events this time include 5G Connect sponsored by **Salesforce**, Advancing AI, Internet of Everything, CloudNet sponsored by **Kyndryl**, FinTech, startup innovation at 4YFN (Four Years From Now), discussions around diversity and inclusion at Diversity4Tech, Tech Horizon and Industry City, co-delivered by **Accenture**.

"We're looking forward to spirited discussions, powerful keynotes and seeing the very best of innovation at MWC22," says John Hoffman, CEO of GSMA. "This year you will hear from many industry leaders with one thing in common. Mobile technology is driving their transformation, and to continue on this transformation journey they will use the week to collaborate, share insights, accelerate real change and conduct business."

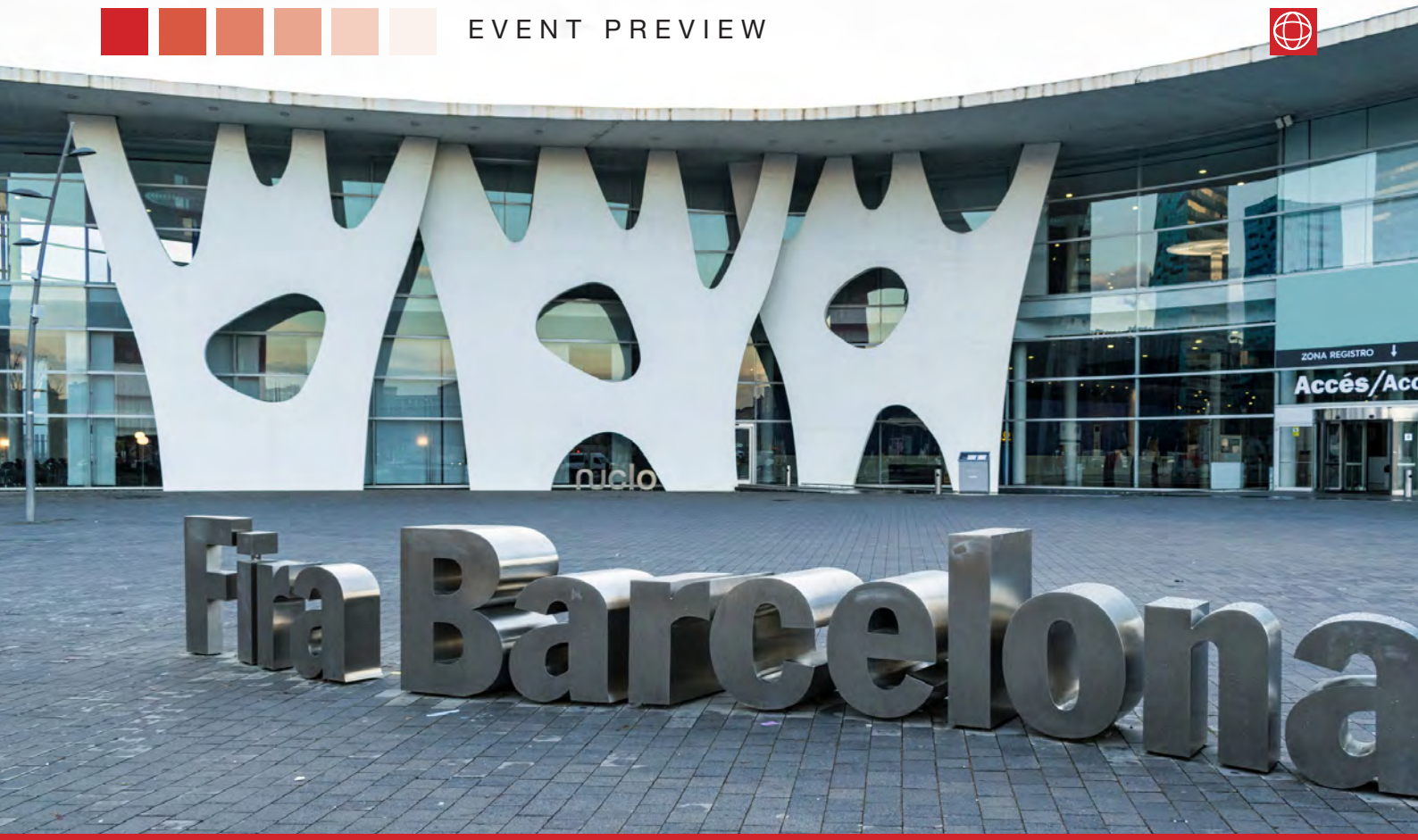
Speakers

He says the event is truly global, with more than 150 countries represented. A wide range of industries, including finance, football and, for the first time, digital art and non-fungible tokens (NFTs), will take part. **Sotheby**'s CEO Charles Stewart will speak about how the convergence of the physical and digital worlds is creating new opportunities for the 277-year-old company.

Other main speakers include Shuky Sheffer, president and CEO of **Amdocs**; Anne Chow, CEO of **AT&T**; Adam Selipsky, CEO of **Amazon Web Services**; Yang Jie, chairman at **China Mobile**; Ruiwen Ke, chairman and CEO of **China Telecom**; LieHong Liu, chairman and CEO at **China Unicom**; Joan Laporta, president of **FC Barcelona**; Cher Wang, chairperson for **HTC**; Mauricio Ramos, CEO of **Millicom**; Pekka Lundmark, president and CEO at **Nokia**; Allison Kirkby, president and CEO at **Telia** Company; Jose Maria Alvarez-Pallete, chairman and CEO at **Telefónica**; Andy Penn, CEO of Telstra; Nick Read, CEO at **Vodafone**; and Cristiano Amon, president and CEO for **Qualcomm**.

Diversity4Tech Summit

The Diversity4Tech Summit will host a range of speakers focused on making a case for greater diversity and inclusion in business and the technology sector. The agenda includes talks, panels, awards and a roundtable all designed to accelerate transformation and inclusion – "inspiring attendees to demonstrate leadership on the issue". ▶



Policy debate

The GSMA Ministerial Programme expects more than 140 delegations. Ministers, policymakers and industry leaders will discuss closing the digital gap, meeting global climate targets, building policies for a digital world, and maximising the potential of 5G. "Political, regulatory and telecom leaders recognise the importance of gathering in Barcelona to debate the issues and steer a course towards economic recovery and a digitally inclusive world," says GSMA.

In addition, pavilions hosted by 37 country delegations from around the world will be on hand, eager to do business and share the latest innovations from their markets.

4YFN at the heart

4YFN will return once again to the heart of MWC, supported by sponsor **Bstartup Banco Sabadell**. In Hall 6, over 500 international startups and over 300 speakers will convene to share insights on how to drive the ecosystem forward. "We anticipate more than €4 billion of potential investment available at this year's event, and 200 startups will pitch to leading funds, VCs and CVCs," GSMA says.

The GSMA also welcomes the WAS#15 event to Barcelona for the first time, which provides a forum for interworking and roaming discussions.

Show perspectives

Dario Betti, CEO of the **Mobile Ecosystem Forum** (MEF), says of some of the key trends: "5G has been marketed for so many years that it shows some fatigue. Which is a real pity, 2022 will be a big year for 5G, but the industry keeps burning out all the marketing power during the technical standards discussions, way before the users can experience and understand benefits."

"5G is bringing faster, reliable data connections with less delay, and is going to reach hundreds of millions of users," he adds. "The marketing from MWC talks about exploring 'what tomorrow's world looks like with 5G' – pity, it would have been nice to talk about the impact on today's world now that 5G is truly live."

Metaverse and cloud

On the metaverse, Betti says: "It's everywhere, but nowhere. Expect the mobile operators to think hard about the metaverse, the 3D virtual universe due to replace the 2D web browsing experience. Unfortunately, the metaverse does not exist yet, but many are working on it. Everybody is interested, but we will see more R&D than real products at MWC. Dazzling demonstrations? Yes. Stunning business opportunities? Not yet."

On cloud take-up, he says: "The cloud should be the most natural element for mobile network operators. Yet they are well behind the adoption of massive connected computing, and this will be one of the most significant themes at the show. For once, the word revolution would not be overused here. The industry is entering a radical change in the way it supports service delivery, but also the way operators could participate in the value creation in the next decade. It might not be as pretty as a new smartphone, but it will give a new structure to this market." ▶

"The cloud should be the most natural element for mobile network operators. Yet they are well behind the adoption of massive connected computing, and this will be one of the most significant themes at the show

Dario Betti, MEF

Andy Leach, Intuita

Peter Ford, iconectiv

Data management

Andy Leach, director of strategic partnerships at data services firm **Intuita**, which works with a number of CSPs, says a "pragmatic data centric approach" will "future proof" the telecoms industry.

"It's no secret that many telecoms organisations have a major focus on all things digital and 5G, as they aim to create a highly connected environment, offering customised rather than generic user experiences, with targeted personalised marketing," he says. "To turn this vision into reality can present business and technology challenges. 5G, IoT and zero-touch digital experiences have one major element in common, data, more specifically growing volumes of data. Its increased availability across multiple platforms can help deliver real-time insights to drive business transformation and a competitive edge."

"But it creates more urgency on delivery time to market, data availability, data quality, data platform scalability and data resiliency, and what about data sovereignty?" Leach adds. "Of course, you need to ensure that you have the correct levels of governance and controls in place."

The main challenge is how to deliver all of this when you have a large number of legacy platforms with potential data integrity and data access concerns across the organisation. Leach asks: "Do you add another layer of complexity to an already over-complicated and costly environment, by introducing something new? Do you take time to simplify your estate and implement fit for purpose solutions and smarter processes?"

These are difficult decisions to make, made even more problematic when many technology leaders face increasing pressure from business leaders to deliver more – faster and more cost-effectively. The scenario can create more short-term focused decisions, and less architected solutions, to deliver the here and now as firms overlook long-term cost impacts.

The opportunity for the industry is to focus on and truly understand the data, says Leach. "It's easy to get caught up with technology, or even become too vendor led. After all, there are beautifully crafted utopian pictures of what products promise to deliver, yet they mask the challenging integration journey you need to take the physical data on, to ensure it's of quality and the platform is cost effective. There is no silver bullet, but a pragmatic approach, with data at its core, will future proof the business for 2022 and beyond."

Transformation and identity

Peter Ford, the executive vice president at **iconectiv**, says digital transformation will have a significant impact on connectivity and communications, along with identity verification. "Both are driving forces behind the acceleration of conversational commerce – completing customer ecommerce transactions through communications platforms likes **Instagram** and **WhatsApp**, for instance – and how businesses communicate with customers and how countries make policy decisions. It is where the money is going and the headaches emerge," says Ford. ▶

"Network operators are under pressure to both grow and save. But when you're under constant pressure to reduce spending, how are you going to fund that growth?," he asks. "Companies are anticipated to spend US$2.8 trillion on digital transformation globally by 2025. At the same time, fraudulent robocalls expect to cost consumers US$40 billion in 2022, and the global scourge of illegal robocalls, spam text and fraud is costing service providers US$29 billion in lost revenues each year. The balancing act of rolling out new services and technology while controlling costs and losses is a significant business challenge today."

Regulations, technology disruptions, intensifying competition and changing customer demands are increasing operational complexity and costs too. "Service providers are investing billions in wireless and wireline networks, and knowing what they have, what they need and what they don't is more complicated than it may seem, but it can be addressed by streamlining the asset management processes," says Ford. "Keeping customers happy, the supply chain moving, and compliance requirements in check means systems must work together across business units, domains and locations. Identifying network assets in a consistent manner to facilitate interoperability is key."

From a customer experience perspective, says Ford, network operators and the ecosystem that makes B2C communications possible, need to make sure their customers have the confidence that the calls and texts they are receiving are from a legitimate company. STIR/SHAKEN protocol-based solutions and verification engines help companies and consumers to keep communicating, preventing unanswered calls from depriving quality brands of essential customer engagement and business.

Disaggregation and onto 6G

The Next Generation Mobile Networks Alliance (NGMN) will be using MWC to outline its strategy around mobile disaggregation, sustainability and 6G. NGMN continues to grow and its membership now includes 80 companies, with further new additions lined up in 2022. Alongside projects supporting 5G's full implementation, the NGMN Work Programme focuses on Mastering the Route to Disaggregation/Operating Disaggregated Networks, Green Future Networks and 6G.

The NGMN Operating Disaggregated Networks Project paves the way for an effective E2E (end-to-end) operation of disaggregated networks, with a focus on Open RAN. It is targeting the generation of E2E blueprints for industry and the identification of potential operating gaps.

Sustainability

"Although many operators have committed to net-zero targets, there is a high potential in improving network energy efficiency and reducing greenhouse gas emissions," says NGMN, which it is addressing with its Green Future Networks' activities. In 2021, the alliance delivered guidance and recommendations to the industry in four areas: Sustainability challenges and initiatives in mobile networks, network equipment eco-design and end-to-end service footprints, network energy efficiency and metering for sustainable networks.

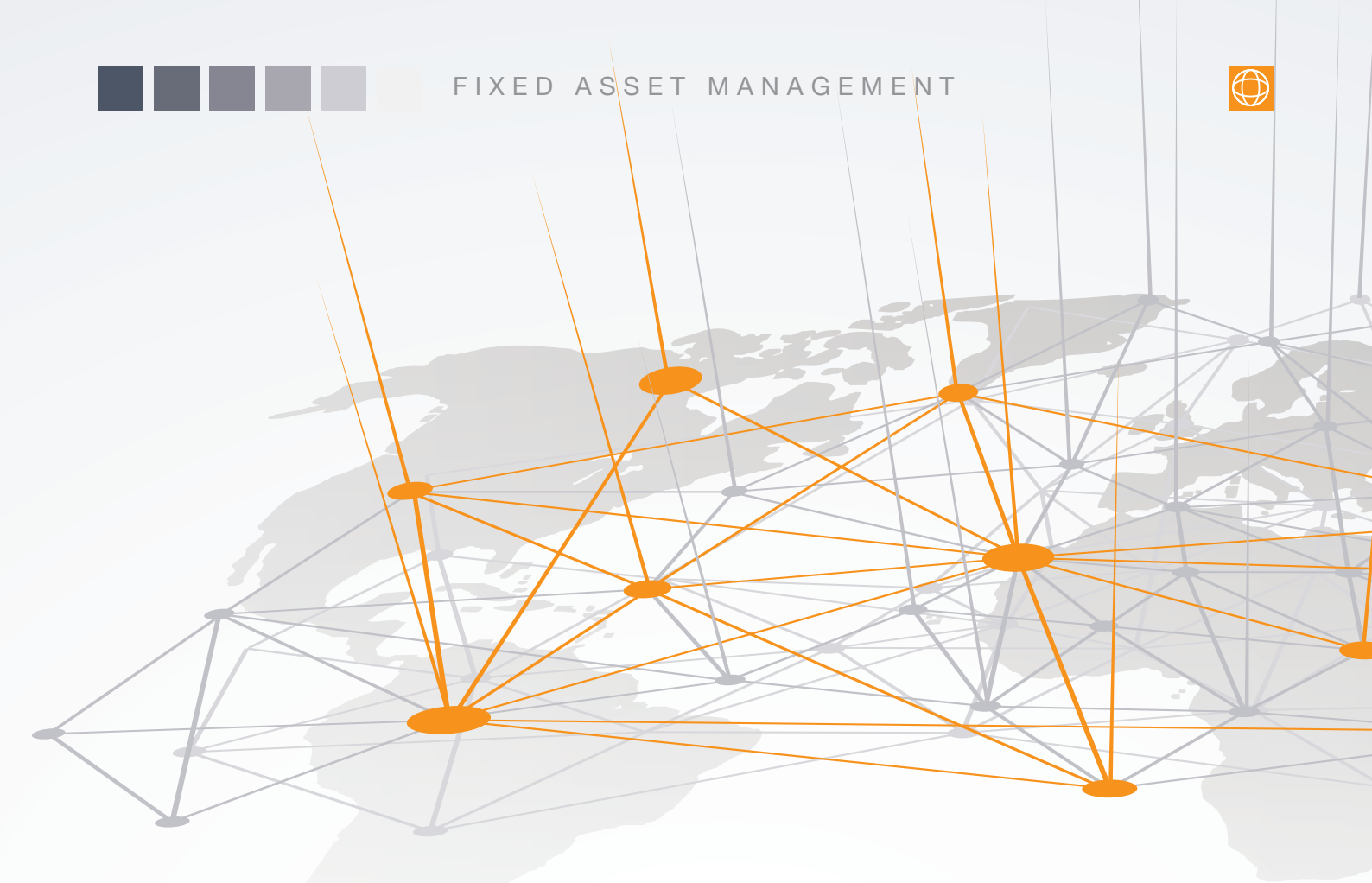
The green programme in 2022 will continue to enable further environmental impact reductions and network energy efficiency improvements, including energy consumption of disaggregated networks. Another key topic is the development of an industry standard for a global green networks benchmark.

As for 6G, the organisation says it is set to "take the lead" in providing "impactful guidance" for global 6G activities, to respond to the needs of end users, mobile network operators and the ecosystem as a whole. The alliance has been working on 6G since 2020, and published its "6G Driver and Vision" report from an operator viewpoint in 2021. "Our first 6G Use Cases analysis has been completed and will be followed by the work on E2E requirements," says the Alliance.

MWC22 is clearly providing the industry stepping stones to get the most out of technologies that have arrived, and others that are still evolving. ■

"Although many operators have committed to net-zero targets, there is a high potential in improving network energy efficiency and reducing greenhouse gas emissions"

www.mwcbarcelona.com



How data infrastructure can improve fixed asset management

Wherever you look in the world of telecoms at the moment, you'll find change. It really doesn't matter how advanced the network and the services are currently – there's always change on the horizon, and that change requires investment

The climate among those charged with making the investments is challenging

Actually, in some parts of the world, the move happening right now is still from 2G to 3G mobile technology – as an example, 3G connections were not expected to overtake 2G on the African continent until 2020. Nevertheless, service providers in Africa are also busy devising programmes to roll out their 4G networks which, let's not forget, require more radio masts, power and access to broadband infrastructure than a 2G equivalent.

In global terms, many nations are looking to roll-out faster, more reliable, fixed fibre networks and there is an industry-led drive to create high performance IoT networks. The most developed nations and service providers are busy developing and testing 5G mobile network solutions.

The need, globally, for investment in telecoms networks at all levels and stages of development has arguably never been greater. At the same time, it is also true that the scrutiny being applied to that investment has never been higher.

Where are the guarantees?

The climate among those charged with making the investments is challenging. They look at the mobile sector in particular as an area where some of the market indicators are tracking in the wrong direction. Average revenue per user (ARPU) is falling even as the size of the investment required is rising. What's more, countries where there was once a seemingly endless supply of unconnected customers are now also approaching a saturation point; a factor that adds to the downturn in revenue growth.

Today's network providers need to have a firm grip on their cost base and where the savings can be achieved, especially as new competitors and internet-scale companies threaten their traditional revenue model. In this climate, one way to bolster confidence and encourage investment is to be able to demonstrate – and prove – the accuracy of your financial and operational performance data. Proof means being able to show that previous investment ▶

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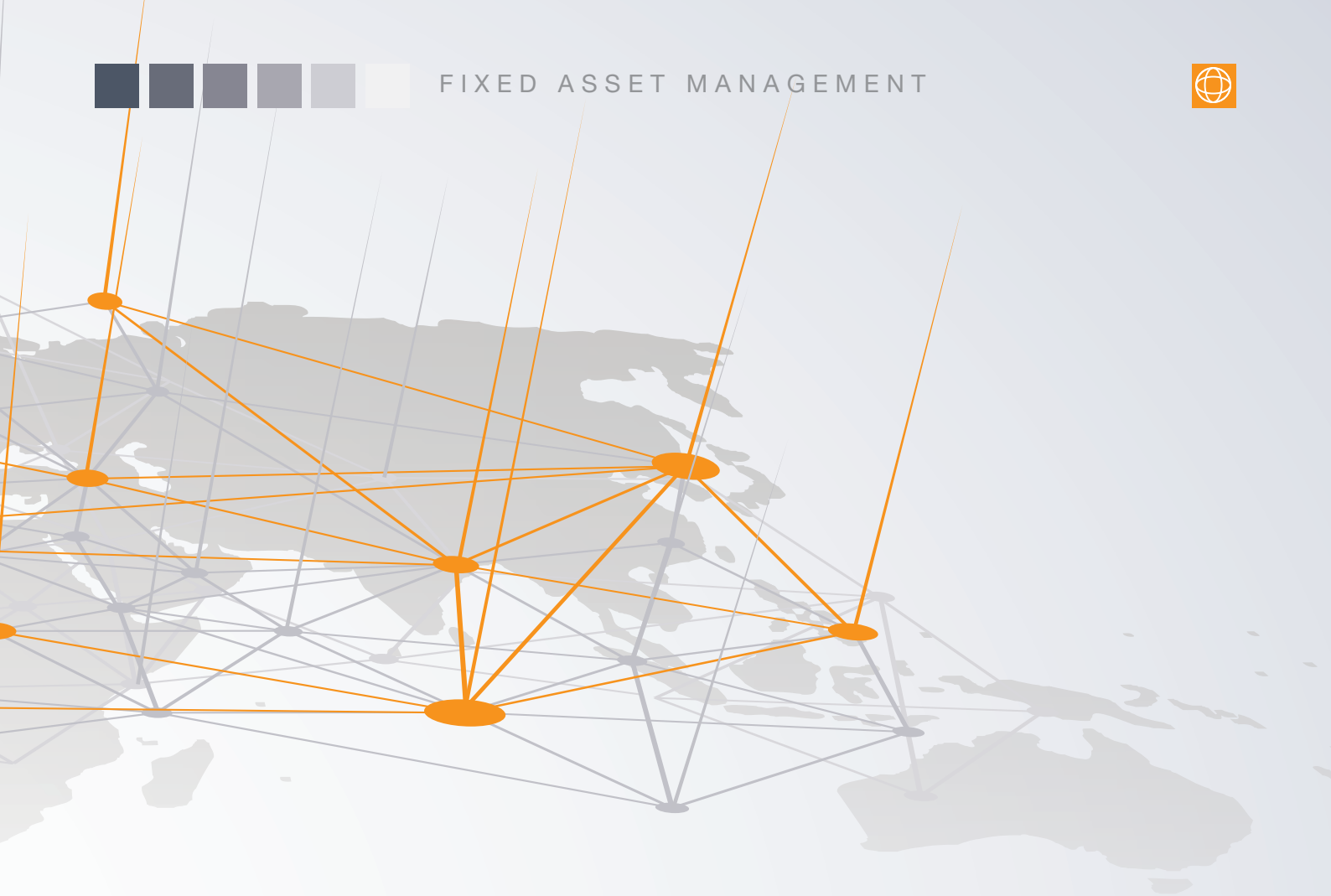


in network equipment has been properly documented and accounted for, and that equipment is not lying as a hidden charge on a balance sheet that is not properly optimised. If there is one thing that investors hate, it is balance sheet surprises. Especially the type of surprise that can turn a balance into red figures.

The rules are also changing

To complicate matters further, the global financial regulators are also becoming increasingly active. The latest International Financial Reporting Standards (IFRS) that regulate international financial reporting include changes that require companies to report their capital and fixed assets at what is termed a disaggregated level.

This means that an international operator group needs to know the value of its assets and network equipment within each individual network it operates; it will no longer be able to simply put all the Group's network assets into one giant pot. However, this isn't as easy as it might appear because most operator groups have grown not just through network deployment but also through acquisition – either of a whole network or a share of one. A Group's ability to accurately value the assets of a shared-ownership network, originally deployed by its partner, may very well be limited.

Across an operator Group, being able to fully document and assess the performance of network assets on a like-for-like basis, can also lead to improved efficiencies and learnings being shared.

A perfect storm

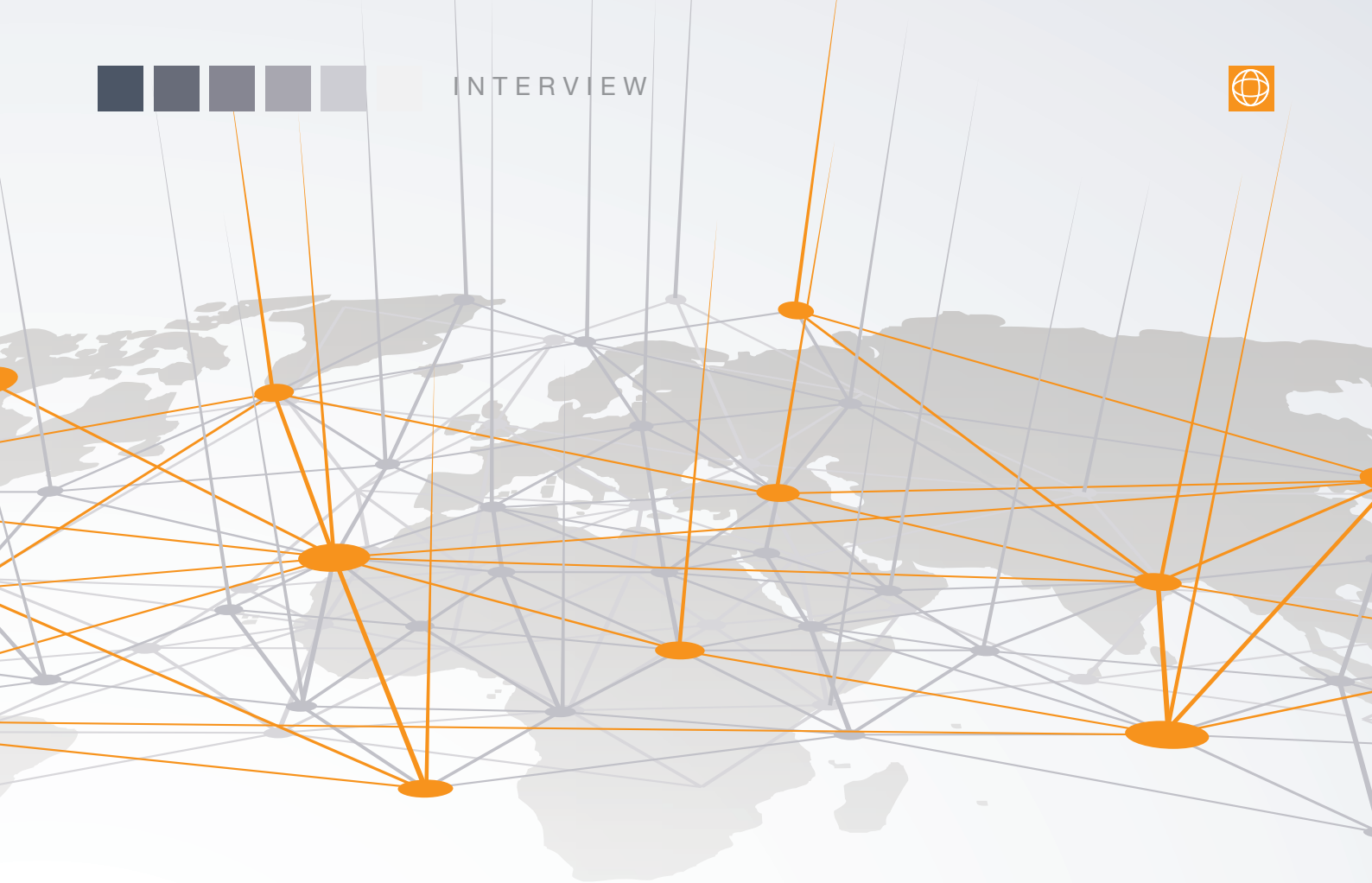
These factors - the need for more investment, the need to precisely document network assets, as well as the need to be able to value them accurately and manage their efficient operation – are combining to create a perfect storm for a solution originally designed with an entirely different operational purpose in mind.

In the US, a move to standardise network equipment terminology arose from a Federal Communications Commission (FCC) mandate on customer service assurance. Adopting a universal language was a good way to ensure that networks could always successfully interconnect. To further smooth the way, **iconectiv** developed its Common Language solution – now adopted by all the major US carriers – which not only helped eliminate ambiguity of terminology and enable efficient network interconnections, it also served other operational and business needs.

The Common Language solution works by providing a series of unique codes from iconectiv that identify and describe various elements of the network and also support interworking between different networks. The codes cover the equipment itself, the location where it is installed, and operational information about connections and the ordering of services on the network. The iconectiv Common Language codes associated with the equipment and its location can be particularly valuable for efficient and accurate asset management.

In addition, the codes are vendor agnostic and so they give service providers a universal means of determining what the equipment is, where it is, the function it performs, an accurate idea of its net worth and when it is likely to need to be replaced. And it can do this on a global basis.

The Common Language solution is market proven and tested. In the US, it has successfully supported operator interworking and driven common reporting standards for more than 30 years. During that time the Common Language solution has continuously evolved to meet the changing demands of the telecommunications industry – smoothly anticipating and adapting to a world where hardware assets are constantly ▶



changing. The Common Language approach can also be applied in network functions virtualisation (NFV) and software defined network (SDN) environments, as well as within traditional fixed and mobile networks.

A new application

Now the Common Language solution can serve an important new purpose. With Common Language, both the operational and finance teams within the service provider business can have a completely accurate picture of the network's assets – and their value. Given the nature of a CSP's business, this information tends to be effectively siloed within each operational department making it harder to grasp an overall picture of business and network health. But it doesn't have to be that way.

All networks require continual operational and developmental investment

By combining Common Language with data from the finance inventory, it becomes possible to much more accurately amortise the cost of network equipment – right down to a single line card within a server or network switch. To know when that card was installed, exactly what cabinet it sits in and at what location, and when it needs to be replaced is not only invaluable from a network maintenance perspective, it also enables much more accurate financial planning and valuation of network assets.

The application of Common Language coding can also help Group operators track spending on network equipment and aid efficient network maintenance – for example: reducing the overall spares inventory by identifying compatible equipment, or reducing network downtime by tracking recall notices to enable equipment with known faults to be replaces before it fails.

Network finance and operations in sync

The Common Language solution was developed to help ensure that networks could always interconnect and deliver quality of service assurance for the subscribers. Today the solution can still deliver against that basic, and vital, goal; but it can also help in so many more ways that are equally vital to the operator's business.

When judging the need for network investment, and assessing the return on previous activity, data from the Common Language solution will be able to be combined with other management data in order to give a much clearer picture of business performance. As well as helping to prove the efficient financial management of past network investment, the Common Language data will also be able to provide a more accurate valuation of current network assets than has ever been possible before.

All networks require continual operational and developmental investment. iconectiv Common Language is a simple, seamless and secure way for service providers to accurately track, record, manage and report on that investment.

When a business can share vital information, reliably and accurately, right across its value chain and supply chain, partners and business units are able to work together and deliver improved business decision-making. Collaboration means more accurate forecasting, better trend analysis, better inventory management, and better product or parts availability. It bolsters profitability, supports investment and builds better businesses. The Common Language solution underpins and supports all those goals. ■

www.iconectiv.com

Three ways decision-making AI is transforming CSP operations

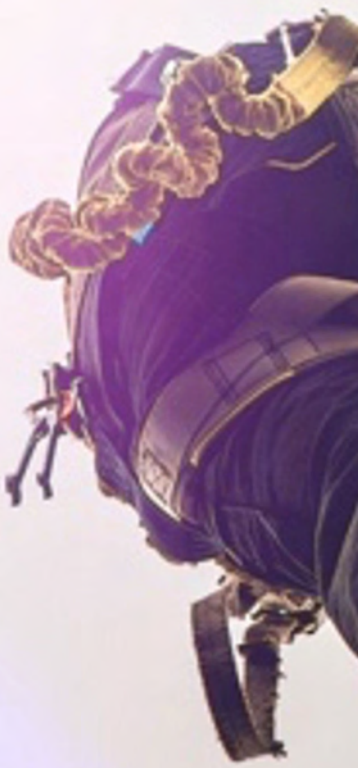
As a telecoms leader, you face extremely complex challenges. It's your responsibility to lead your organisation to optimal profitability, performance and reliability, while minimising risk and maximising scalability. However, you must achieve this amid global change, supply chain disruptions, regulatory restrictions and complex interdependencies, writes Manuel Rassi, the telecom account director at Gurobi Optimization

Manuel Rassi
Gurobi Optimization

When faced with such complex, mission-critical challenges, how can you make confident, unbiased decisions? Many organisations look to their data analytics for answers. Your data can reveal what's happened in the past, why and what's likely to happen next. But data analytics relies on historical data – so it falls short when your present no longer looks like your past.

To make unbiased decisions for achieving your optimal business outcomes, you need to be able to take all of the complexity into consideration – every objective, every constraint. And that requires an artificial intelligence (AI) capability that can explore all of those factors and all of the possible solutions and help you identify the best way forward.

Let's take a look at how decision-making AI – and, specifically, mathematical optimisation – can address several major challenges facing telecoms leaders today.



Optimise 5G network planning

To remain competitive in the age of 5G, you need to bring your networks to maximum capacity – optimising coverage and service levels. That requires making complex decisions around deployment site selection, infrastructure availability in terms of fibre, installation costs and mast adaptation and/or construction. This becomes even more difficult when you add in variables such as various technology options per spectrum band, and their location and business case dependencies.

You need to identify the best course of action – a solution that's explainable, justifiable and sustainable. And you need to be able to repeat this process continually, so you can make optimal decisions at the speed of change.

With mathematical optimisation's decision-making AI capabilities, you can let the AI do the complex calculations for you. You let it know your objectives – such as maximising coverage, minimising costs and maximising revenue – as well as your constraints, and let the ▶

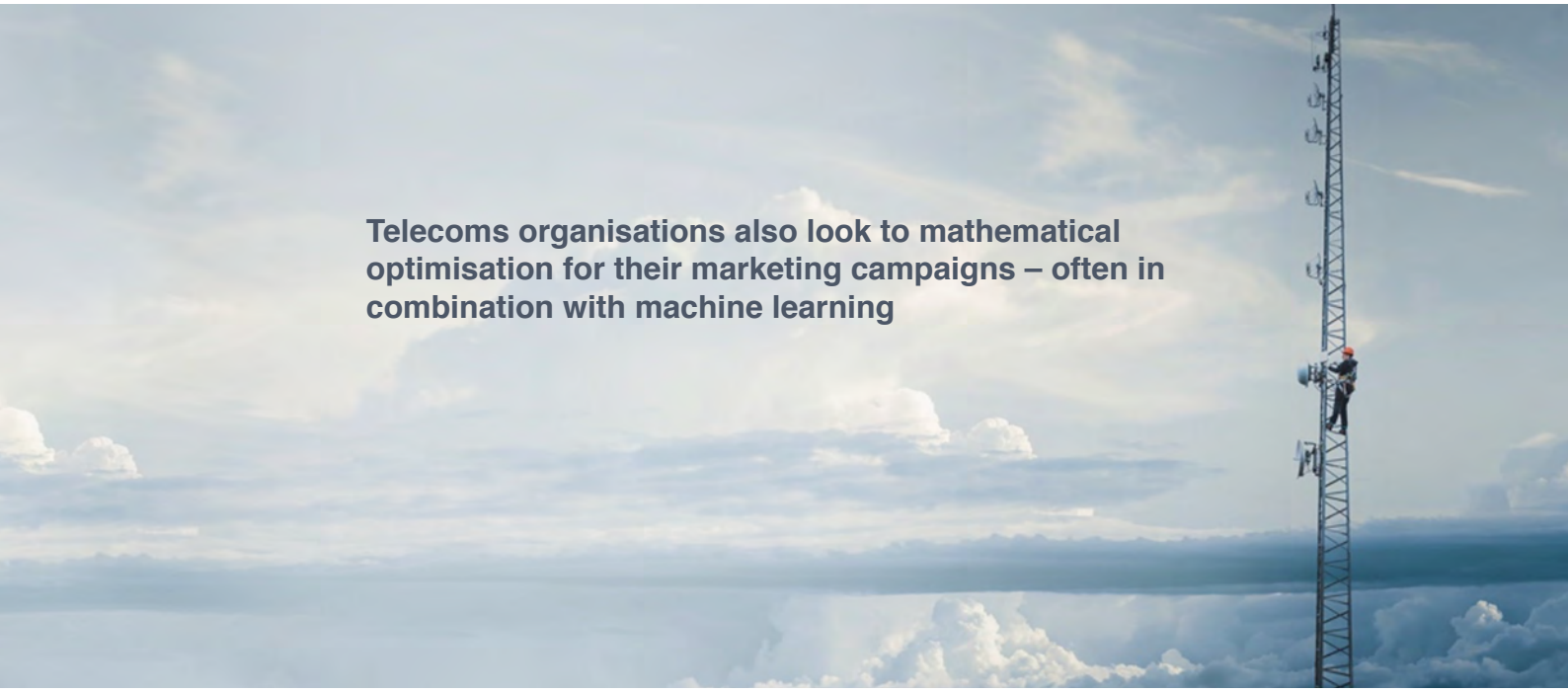
AI consider all of the possible ways you can achieve those objectives. Often in seconds, it can identify your best course of action. As soon as factors change, you can update your inputs and run it again.

Telecoms leaders use mathematical optimisation for everything from fibre optic network and facility location planning to coverage, frequency and radio planning. You can model entire scenarios for 5G deployment, including your parameters and constraints, and obtain the optimal solution.

Optimise CSP retail and supply chains

The supply chain is the backbone of a great customer experience. You want to help your customers buy what they need, when they need it and in the way they prefer – whether that's in store or online. But with the pandemic upending supply chains everywhere, you need a better way to keep your products flowing. ▶

To remain competitive in the age of 5G, you need to bring your networks to maximum capacity – optimising coverage and service levels



Telecoms organisations also look to mathematical optimisation for their marketing campaigns – often in combination with machine learning

If you're like many telecoms organisations, you operate on a relatively rigid, fixed system that doesn't give you the flexibility or insight to quickly respond to customers or global events. As a result, you may have too much or too little stock on hand at different stores – and regularly pay high rates for expedited shipping at crunch time.

But with mathematical optimisation, you can re-imagine your retail and supply chain operations. You can automate your decision-making and replenish stores with the right products at the right times, while minimising retail inventory and meeting your out-of-stock targets.

And because mathematical optimisation decision-making is model based, you simply need to update your model whenever your variables change – or whenever you want to explore new possibilities. Often in seconds, you can identify your best, unbiased decision.

Optimise telco marketing campaigns

Telecoms organisations also look to mathematical optimisation for their marketing campaigns – often in combination with machine learning. They use machine learning and other advanced analytics tools to target customers and prospects with their 5G solutions. Tools like these are highly effective because they predict elements such as expected response rate and lifetime value.

What machine learning can't do, however, is incorporate your company's unique business objectives and constraints into your targeting decisions. These tools also fail to deliver when your company is faced with new challenges, and you find yourself having to redo the whole process from scratch.

Mathematical optimisation provides an opportunity to utilise machine learning to make the best possible targeting decisions, with the flexibility to adapt to any new constraint or parameter of your business. By combining machine learning and mathematical optimisation, you can efficiently target the right person, with the right offer, through the right channel, at the right time and ultimately drive increased sales and ROI with your marketing campaigns. For example:

- **Sales and marketing campaigns:** Optimally shape your 5G marketing campaigns and sales packages and automatically determine which packages of products and services to offer to which customers, when and at what price.
- **Customer acquisition and management:** Use the power of advanced analytics to manage risk in customer acquisition.

Transform your decision-making

Gurobi helps leading telecoms organisations – from the US Federal Communications Commission **(FCC)** to **A1 Telekom**, **AT&T** and others – address their toughest decision-making challenges.

Vodafone is one such example. Having applied Gurobi mathematical optimisation in each of the ways described above, the CSP has been able to maximise ROI by optimising its fibre network design. With Gurobi, Vodafone configured its retail shop network to optimise its support of sales, given a variety of constraints – and it was able to strategically open as many shops as possible after pandemic lockdowns, as safely as possible.

How can Gurobi transform your CSP operations? Reach out to me and we can talk about it. Drop me an email at **rassi@gurobi.com**. ■

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Network disaggregation drives innovation, flexibility, and the potential to optimise operations

As communications service providers (CSPs) introduce open radio access networks (RAN) and prepare for new 5G network use cases, the vendor landscape is transforming to offer greater choice and meet their specific needs. However, this is not without complexity and the expanded ecosystem must consider both new and legacy networks as well as breed confidence that systems will work. At the heart of this new era are service management and orchestration (SMO) frameworks and RAN intelligent controllers (RICs) that enable control, communication, and optimisation of disaggregated and Open RAN projects.

Here, Per Kangru, a technologist in the VIAVI Corporate Strategy Office, and Chris Murphy, the regional chief technology officer at VIAVI, tell VanillaPlus managing editor, George Malim, how the company is helping to support and develop solutions that power the new networking ecosystem

George Malim: Why are the SMO framework and RICs so important for the success of the disaggregated and Open RAN projects?

Per Kangru: The key here is to understand these are components that allow the disaggregated network to function in a structured and ordered manner. By doing so, we're able to create an ecosystem where not everyone needs to provide a complete solution, but they can focus on their specialties.

From a market perspective, focusing only on Open RAN gives you a tiny portion of the addressable global market initially, but optimisation of all the functions on all the macro networks is an ongoing activity. As CSPs build-out capacity and make additions to existing networks, a vendor that can only touch things based upon an Open RAN architecture is limited to a small percentage of the global market. As a result, we are seeing some vendors of SMO frameworks – and CSPs – providing an infrastructure to target not only Open RAN but also legacy networks, which are sometimes called purpose-built networks. An architecture like an SMO means you can deliver services not only against Open RAN architectures, but against all legacy environments, and you can create and foster that ecosystem on a much wider engagement level.

Chris Murphy: I think what this all focuses on is the desire for 5G to be as flexible as possible and to support many use cases in as wide a range of deployment scenarios as possible – including those we've not actually thought of yet. That need for flexibility is reflected in the way that Open RAN is progressing. We want to be able to place networks in factories with different form factors at the radios, and to address the site acquisition pressures that face public networks. Having form factors for different environments to support everything from commercial smartphones to fixed wireless access using this technology is critical in this case. But it is unreasonable to expect that a vendor of a purpose-built network can address all these options for deployment scenarios and use cases. That's why the Open RAN vision is needed.

Network slicing means that the different network functions must adapt in new ways to deliver services with the right mix of key performance indicators (KPIs). In this way, CSPs can ensure customer satisfaction for different network slices and meet service level agreements (SLAs), all on the same infrastructure. Maximum flexibility is vital because it breaks down the network into components and allows different players to compete in different spaces within it.

GM: Is Open RAN increasing opportunities for vendors to compete because CSP customers want more choice and the ability to choose the vendors they want?

PK: There are two aspects of this. One is a desire for multiple ecosystem players to foster and increase the velocity of innovation. This is, for example, what the Telecom Infrastructure Project (TIP) wants to achieve by enabling CSPs to be ▶

Per Kangru,
VIAVI Solutions

much swifter in delivery of new technologies and new networks and services at home. The other aspect boils down to large portions of the CSP ecosystem being located in a world where there are vendor selection limitations.

Practically speaking, due to various political situations, some CSPs are unable to include the Chinese vendors in their network equipment sourcing. From a legacy perspective, that leaves CSPs only two vendors from which to choose. No one in the procurement process of buying network equipment thinks that's enough for effective price negotiations. This limitation then presents a whole discussion on what is needed to add a new horse to the race. Fostering a completely new, non-Chinese vendor that can provide a purpose-built RAN type of solution is unrealistic at this point. Therefore, openness becomes a way to create a new supply ecosystem if it can execute.

It doesn't matter which of the traditional vendors are selected. They all have an extremely diligent process for integrating their RAN nodes, optimising them, and making sure they're delivering excellent performance. In their lab environment, they have made considerable investments in facilities, people and test automation. The question here is whether the Open RAN vendors or integrators will be able to provide a sufficient solution, at least one that is as good as what the traditional vendors provide.

The Open RAN ecosystem cannot realistically outspend the traditional vendors on their RAN integration expertise. However, their approach could be via a different path, such as using artificial intelligence (AI) and machine learning in the RIC and SMO, delivering solutions on par with the traditional vendors. There is a precedent for this approach, similar to how hyperscale providers have been able to outsmart the legacy datacentre industry.

CM: CSPs have been trying to regain power back from the vendors for a very long time, and now they're seeing that their wish is within reach. We shouldn't expect that suddenly the purpose-built network vendors will be able to optimise their systems for every possible scenario. When a CSP has selected its mix of components and vendors for the different network functions, radio units, the RIC, and the applications on the RIC and SMO, they may be the only one to have selected that particular blend of components and vendors. The CSP needs to be confident that these will be functional in their network and consequently, that their network will operate optimally. To mitigate against some possible risks of fragmentation, TIP is advocating for specific blueprints to be validated and tested.

GM: What key technologies are required to build a viable solution?

PK: This is really where you need the perfect mix of platform, RIC and/or the SMO provided by various companies across the industry. The platform needs to speak to the apps that communicate and control the various parts of the infrastructure. Some platforms support not only the Open RAN interfaces but legacy purpose-built networks as well, thus enabling expanded use cases. ▶

The Open RAN ecosystem cannot realistically outspend the traditional vendors on their RAN integration expertise

Chris Murphy,
VIAVI Solutions

CSPs will select components in the Open RAN area and, on the RIC and SMO side, they will choose a platform to meet their needs

The platform becomes the first element that a CSP must have in place, and inside that platform is where they can start building different use cases from components with various capabilities.

Analysing the various use cases, one can clearly see that many of them will rely on a set of capabilities – foundational capabilities, that can be used by multiple use cases inside the platform. One example of this is our NITRO Mobility geolocation capability which enables CSPs to receive trace information from the infrastructure and identify where the subscriber is located, what performance they receive, on what service type, on what device and with beam-based 5G, at what elevation, at that point in time. Taken at an aggregated and anonymised level, the data can be very valuable for a multitude of use cases. Moreover, this generates overall subscriber-based performance understanding in the whole network, broken down as granularly as needed depending upon the use case. The granularity relates to physical spaces and is not tied to specific cells. This rich subscriber-centric and performance-based data can be used precisely to inform the rest of the applications within the platform about performance and service usage, which in turn allows them to perform the proper setup or optimisation, taking into account all of the relevant parameters such as location, the coverage and capacity layers, and the specific application usage.

CM: The term I like to use is foundational capabilities because you're trying to deliver use cases or capabilities on the RIC, to achieve certain objectives. Foundational capabilities include geolocation, which tells you where your subscribers are, and where there's demand on the network for which services, along with how well the network is delivering these. It can also include identifying changing patterns or new behaviours which are anomalous, for example. This may trigger responses or certain use cases to be carried out to make sure that the performance is maintained despite the anomaly. This in-depth visibility can extend to instances of intensive utilisation of applications or network slices, where the foundational capabilities enable the platform to detect, troubleshoot, diagnose, and then mitigate them. This will be an important capability that extends to responding to impairments in the network infrastructure itself.

GM: How is VIAVI engaging with the industry on RIC/SMO at the moment?

PK: CSPs will select components in the Open RAN area and, on the RIC and SMO side, they will choose a platform to meet their needs. We see that many CSPs are making platform selections without necessarily selecting the applications to run within it at the same time, so they're making two separate decisions: one for the platform and another for the applications.

Our geolocation capability is already used today by a large footprint of CSPs around the world for purpose-built networks where we support automated site verification and optimisation use cases, troubleshooting, analytics or use cases where we feed external third party applications. We know that we must adapt to the environment of the ▶

customer and ensure that our platform and capabilities can effectively operate in any possible compute or hosting environment.

Regarding our geolocation capability, we can't work with only one platform vendor in this space, we must work with the vendors selected by the CSPs. This means we're engaging with the relevant parties out there in a model where we basically embed our capability into that platform. We make sure that it works effectively and that it can be delivered to meet the needs of CSPs.

We've ensured that our capabilities can run within the available frameworks established by the CSPs, and that we can deliver value to them regardless of their choices. Furthermore, we have further nurtured our traditional customer partnerships, but we are also collaborating in a very agile manner with some smaller players in the Open RAN ecosystem.

We've been involved in a TIP project with **British Telecom** and **Accelleran**. This engagement has expanded and recently attracted funding from the UK government. There have been other activities announced at the TIP Forum. We are engaged with different vendors today, and we are anticipating there will be many more in the near future.

We are also working on the standardisation side and closely support the **O-RAN Alliance**'s Open Software Community (OSC). Across the board, we have tried to work with companies that are ready for the market inflection. We don't necessarily have an opinion about who is likely to win or not, or what one should prefer. It's likely that this ecosystem will continue to shape itself over the next couple of years, and we want to clarify that we are a strong partner within it. There will be many players in the race, and we are happy to partner with them.

CM: We're working on selected projects which will expand the number of delivered use cases. This isn't only for the RIC, but also for network emulation for use cases which aren't yet supported in the infrastructure that we're using. We're also working with **Ericsson** on its SMO framework, Intelligent Automation Platform, to deliver some of the foundational capabilities that we've been doing with TIP. What we are doing in the Open RAN space also applies to the more traditional, purpose-built networks.

We're contributing to a wide range of O-RAN Alliance working groups including those where the non-real-time and near-real-time RICs are defined, to make sure that the data for these foundational and optimisation capabilities are exposed to the appropriate interfaces, and that they are available on the right timescales to support the required optimisations. We are also members of the minimum viable products (MVP) committee, to work on prioritising the efforts made across the working groups, and to demonstrate our use cases.

PK: We are truly focused on helping this ecosystem to materialise from the standardisation side, and through development, validation and sourcing, as well as in the operational stages, with the right apps. CSPs can then drive great operational performance both on a real-time basis and in terms of how they can optimise their operations in the future. ■

We've ensured that our capabilities can run within the available frameworks established by the CSPs, and that we can deliver value to them regardless of their choices

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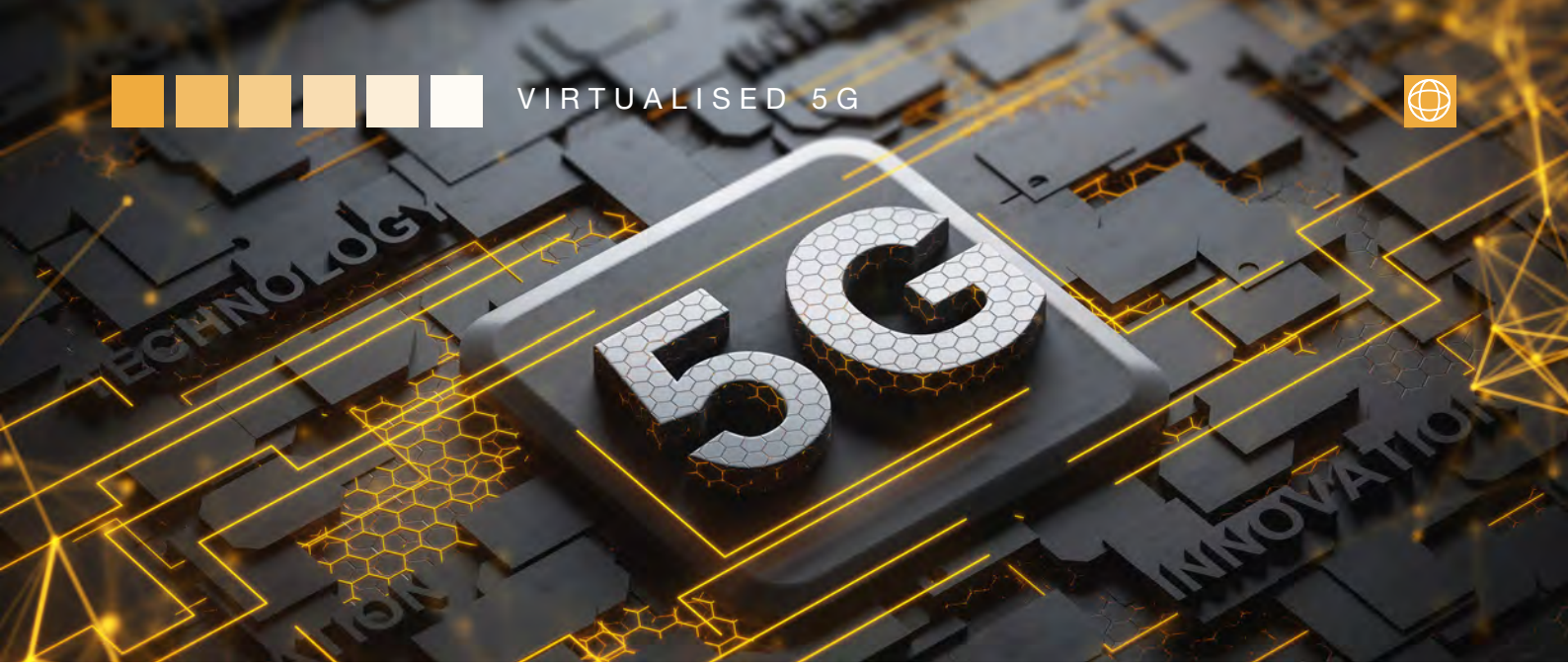

How to make open and virtualised 5G pay

Running Open RAN (O-RAN) cloud-native workloads on a virtualised environment, rather than relying on bare metal, can help CSPs expand services and potentially speed 5G monetisation. It's an area that will be addressed at MWC22 and Antony Savvas looks at developments in the market in advance of the event

"CSPs are changing how they build and deploy open networks, so they can develop innovative services that capture the edge opportunity"

Generally speaking, bare metal requires separate resources dedicated to separate functions, often meaning excess processing and memory capacity is being under-utilised at off-peak times. Virtualisation is designed to achieve maximum asset efficiency by allowing you to share a pool of resources, easily scaling up and down – distributing workloads and cost-efficiently planning for peak traffic times.

VMware says bare metal is a static, short-term solution in the telecoms industry, and maintains virtualisation increases efficiency, flexibility, security and, ultimately, delivers capex and opex savings. "Virtualisation is the better decision for today and tomorrow, yet there still remains some uncertainty about its immediate and long-term benefits," says Lakshmi Mandyam, the vice president of service provider product management and partner ecosystem at VMware. "RAN workload performance is the same on hypervisors as on bare metal. Performance is king, and resistance to virtualisation often rests on the misconception that running Open RAN workloads on a hypervisor increases latency and hinders performance. This is simply not the case. Industry-standard cyclic tests and operating system latency (OSlat) performance tests show no performance penalty when using a VMware ESXi hypervisor, and VMware vSphere 7 Update 3 is easily within RAN workload latency requirements."

Open telecoms

Dell Technologies has just unveiled a suite of telecoms systems and services to bolster the open telecoms ecosystem, and help communications service providers (CSPs) to "affordably" ramp up their transformation to open, cloud-native networks, it says.

"CSPs are changing how they build and deploy open networks, so they can develop innovative services that capture the edge opportunity," says Dennis Hoffman, the senior vice president and general manager for the Dell Technologies Telecom Systems Business. "Our expanded telecoms solutions portfolio gives network operators the speed and simplicity they need to quickly modernise their networks and monetise new services."

New approach

Robin.io sees the need for a "new approach" in managing software applications, services and physical resources. Today, it says, 5G operators, cloud platform providers and over-the-top service providers require new solutions that provision capacity and automate multiple levels of infrastructure, hardware, software, cloud platforms and appliances. This, while simultaneously consolidating virtual machine (VM) and container-based services, reducing operations and resource silos. ▶

Dennis Hoffman, Dell Technologies

Lakshmi Mandyam, VMware

"At Robin, we have seen a lot of success with our cloud platform, automation and lifecycle management feature set," says W. Brooke Frischemeier, the head of product management at Robin.io. "But, it's not just about a rich feature set, it's how you do it that counts. Interfaces are easier to use, requiring far less expertise and training. Furthermore, automation should be policy-based, with no hunting and hard-coding throughout the entire lifecycle. Everything can be completely automated in a way that significantly reduces time to outcome."

For its part, Dell has taken the wraps off its Dell Telecom Multi-Cloud Foundation, Dell Open RAN Accelerator and other new solutions
The Dell Telecom Multi-Cloud Foundation is a turnkey, end-to-end, modern network infrastructure solution that helps CSPs build and deploy open, cloud-native networks faster with "lower cost and complexity". It includes Dell hardware, Dell Bare Metal Orchestrator management software and the CSPs' choice of integrated telecoms cloud software platforms, including from **Red Hat**, VMware and **Wind River**.

Once implemented, CSPs will have a scalable cloud foundation spanning core, edge and RAN for their open hardware and software environments, with the flexibility to design and deploy open network functions and differentiated edge services.

Opex savings

ACG Research estimates "up to 39% opex savings" for CSPs deploying the Telecom Multi-Cloud Foundation in their networks. The firm also found CSPs save time on server provisioning, software upgrades and cloud stack integration and testing when using the technology.

Dell and **Marvell** are also collaborating on new hardware to accelerate Open RAN. Existing virtualised and Open RAN systems have previously lacked the performance of established networks, says Dell, "hindering" the ability for CSPs to implement cloud-native 5G.

The Dell Open RAN Accelerator Card is an inline 5G Layer 1 processing card for vRAN and Open RAN. Designed for Dell PowerEdge and other x86-based servers, the PCIe card is said to bring the same Marvell baseband silicon technology and performance of today's leading 5G radio networks to the Open RAN ecosystem.

"We're pleased to see Dell Technologies and Marvell come together to innovate and create technologies that will enhance Open RAN platform capability and vendor diversity for operators," says Andy Dunkin, the Open RAN RF and digital platform development manager at **Vodafone**. "The promise of virtualised Open RAN platforms will be enhanced with the accelerator card, offering network operators like us a less costly and more efficient path to Open RAN."

Containerisation

Robin enables its vision with three products that are deployed at one of the world's first fully containerised, end-to-end 5G networks, at **Rakuten Mobile**, where flexibility, ease of use and real-time scale are being demonstrated. The product line includes bare metal to services lifecycle manager, Multi-Data Center Automation Platform (MDCAP), the Cloud Native Platform (CNP), offering service performance and ease of use, and the application Cloud Network Storage (CNS) system.

Robin's offering, says Frischemeier, improves integration, deployment and lifecycle management performance, and eliminates operations and resource silos with "harmonised container and virtual machine lifecycle operations". The solution includes automated and resilient full-stack lifecycle management of the bare metal hardware platform, software platform, cloud platform, third party appliances, and cloud and virtual network function (CNF/VNF) services chains.

VMware's Mandyam adds that virtualisation saves "incredible amounts" of hardware, processing power, cooling resources and physical space. "Hardware optimisation has become increasingly important for cell sites where space is limited and innovative apps are being developed. The need to use hardware resources wisely is especially acute amidst a global chip shortage. Virtualisation allows you to mix and match workloads on the same server and conserve resources, as well as offering significant capex and opex savings."

CSPs save time on server provisioning, software upgrades and cloud stack integration and testing when using the technology

CSPs look to virtualise the benefits of 5G without the costly metal

Communications service providers (CSPs) are looking to run their 5G workloads in an efficient and scalable way to help them achieve 5G monetisation as quickly as possible. Antony Savvas talks to Lakshmi Mandyam, the vice president of service provider product management and partner ecosystem at VMware, to explore a potential way forward

Antony Savvas: How important is the telecoms business to VMware?

Lakshmi Mandyam: VMware has been rooted in the world of hardware disaggregation and cloud-based operations in nearly every industry since our inception. Bringing cloud agility to CSPs is a priority for VMware because CSPs are the glue that holds all other industries together.

AS: Are you embedded in the CSP market in terms of how CSPs are moving to 5G and the provisioning of edge services?

LM: For years, VMware has been enabling cloud and virtualisation capabilities in CSP data centres and core networks. Recently, as CSPs have continued to reap the benefits of a more agile core, they've asked us to extend those benefits to the radio access network (RAN) and edge. Moving to 5G will require CSPs to embrace open methodologies and cloud native approaches. As part of that, our Telco Cloud Platform will allow service providers to unify their siloed environments, to automate service delivery across a highly distributed and multi-cloud network, and to deliver customisable services with end-to-end visibility and ▶

SPONSORED INTERVIEW

Lakshmi Mandyam,
VMware

managed quality of service. It will also simplify network operations and decrease costs.

AS: VMware works with the cloud hyperscalers in provisioning multi-cloud services generally, but is in competition with them when it comes to the provisioning of next-generation services and edge deployments in the telecoms market, how is VMware doing here?

LM: As the communications industry has continued to transform, a few things have become clear:

1. No single vendor can or should do it all
2. Disaggregation has blurred the lines between technologies
3. CSP business models are going to require much higher levels of operational efficiency

This is why the philosophy we have adopted aligns perfectly with CSPs – we are all-in when it comes to the multi-vendor, multi-cloud approach. While we compete in some ways with many of our partners, we feel this is the future of the industry – best learn to cooperate and co-innovate quickly. For the hyperscalers specifically, they offer incredible value to CSPs, and it's important to us that we enable our customers to access that value.

This is our sweet spot, we provide them access and flexibility without losing control. VMware will continue to cooperate with our hyperscaler partners, whether they're being used for core functions, RAN functions or to enable edge use.

AS: What do you see as the hot areas in the CSP space, in terms of software development to address CSP needs?

LM: There are a few areas in which we're seeing a lot of development for service provider transformation:

Next-Generation Performance – CSPs are looking to virtualisation to provide the flexibility they will need to enable customisable services. Over the last ▶

There is so much happening in the RAN and it's all about disaggregation and programmability

few years, a lot of work has been done to virtualisation to provide carrier grade performance. In fact, RAN workload performance on VMware ESXi hypervisors versus bare metal is the same – there is no performance or latency penalty. Industry-standard cyclic tests and operating system latency (OSlat) performance tests prove this. So now, you get all the decreased footprint, simplified operation and improved security of virtualisation, without taking a hit to performance.

RAN – There is so much happening in the RAN and it's all about disaggregation and programmability. The journey has started for many by virtualising the RAN, but several are on their way to Open RAN. Our Telco Cloud Platform RAN offers a path through virtualisation and Open RAN. One of the most exciting parts of the RAN transformation is what's happening in the RAN intelligent controller (RIC). The RIC is responsible for the control and management functions of the disaggregated Open RAN. Our vendor neutral approach, combined with our RIC's programmability, promotes a best-of-breed RAN architecture, creating a rich and vibrant xApp and rApp ecosystem through the VMware RIC software developer kits (SDKs). While the SDKs elevate the activities of app developers, they also empower CSPs to develop their own xApps and rApps to match their specific business and technology priorities.

The CSP ecosystem will be ever-evolving. In addition to the shifting we're seeing in the existing vendor space, we're also seeing a huge amount of growth from new companies

Edge – The network is becoming distributed. We're moving resources to where data is produced and consumed. To manage this, we need a balance between centralised and de-centralised architectures. We are providing consistent developer experiences to help build, run and manage applications at the edge, and our multi-cloud approach makes sure the edge isn't built as another silo. We've also been doing a lot of work with the Open Grid Alliance (OGA), a collaboration organisation that produces vendor-neutral strategies to re-architect the internet with grid technologies. Globally distributed, the grid weaves together a public and private fabric of compute, data and intelligence, to enable contextually aware, immersive applications at the edge, on demand.

AS: Open RAN and the disaggregation of the radio access network has been talked about for some years now, with analysts saying there has so far been low take-up across the CSP market. VMware seems to be betting big on it, when the sales activity doesn't seem to be there, why is that?

LM: Based on the requests we manage on a daily basis, from CSPs large and small around the globe, Open RAN is absolutely a priority for most. The transformation is still relatively new, and a transformation of this significance doesn't happen overnight. We're already seeing early deployments of Open RAN, but we are certainly still on the path to mass adoption.

Many CSPs are still evaluating the readiness of Open RAN, which is why some of these early trials, like **Vodafone**'s RIC trial and deployments like those at NTT, are all helping the industry better understand how to continue down the path. We have conducted extensive testing of RAN workloads to help illustrate how disaggregation, programmability, security and openness of the RAN are production-ready.

AS: How does VMware see the CSP ecosystem? Is it good enough to address the needs of service providers and their customers, or do standards and regulatory bodies have to do more to make sure development matches user needs?

LM: The CSP ecosystem will be ever-evolving. In addition to the shifting we're seeing in the existing vendor space, we're also seeing a huge amount of growth from new companies. Just within the RAN, we're working with nearly ten start-ups who have created incredible opportunities for CSPs in the RAN for spectrum efficiencies, device location, assurance, intelligence, and more. While we will continue to see more innovation as the deployments proliferate, I think we've made incredible progress as an industry in spotlighting the value of a multi-vendor approach.

AS: Lastly, what predictions does VMware have for the telecoms industry over the next five years?

LM: Monetisation will be the name of the game over the next five years. As 5G deployments increase and CSPs begin to enable the edge for enterprises, we'll start to see many new revenue generating services popping up. Among those, I believe two of the front-runners will be network slicing and private 5G – two of the leading business cases to enable customisable services for digitally-advanced enterprises.

Beyond monetisation of services however, we do anticipate that our customers will make a concerted effort to take seriously the impact their businesses can have on the environment. At VMware, this has been among our top priorities from the beginning. Arguably, our entire company exists to help businesses reduce energy consumption and waste. That is, after all, one of the main drivers of virtualisation – the ability to grow your business while using less IT hardware. And that applies to CSPs along with everybody else.

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How CSPs will drive customer experience excellence in 2022

Communication service providers (CSPs) have helped get countries through the pandemic. Their networks and services ensured children could continue learning during lockdowns and have kept people connected, able to work from home and entertained via a boom in streaming services, writes Vladimir Mitrasinovic, regional vice president at Amdocs

Yet nearly two years since the Covid era began, it's still ecommerce leaders who are setting the standard for digital customer experience (CX). These brands do well in customer satisfaction league tables run by the **Institute for Customer Service** (ICS) and others because of how slick and holistic the online experience is.

CSPs know the inherent value of omnichannel and digital in retaining and winning customers in a competitive market. Notwithstanding obstacles and diversions on the way, they have made and will make great strides in their journey towards improved CX. And as telecoms looks to raise its game and compete with ecommerce and other sectors, the good news for CSPs and their customers is that CX is currently a key focus for the sector.

Indeed, a recent survey by **Mobileum** found that 56% of telecoms operators ranked enhancing CX as their top priority for 2022, followed by ensuring a well-performing and reliable network (19%), mitigating security and risk threats (13%) and cutting costs (13%).

So how should CSPs go about taking CX to the next level in 2022? For me, there are two routes that should be followed.

Vladimir Mitrasinovic, Amdocs

Firstly, embrace greater automation and artificial intelligence (AI) throughout the customer's digital journey. While there will always be a need for the human touch in customer service and CX, there's evidence that digital-savvy consumers enjoy using online self-service tools and chatbots seeing them as a hassle-free way of getting things done quickly. This is where a CSP can play to its strengths in how it understands and exploits customer usage patterns to deliver improved experiences.

AI, of course, isn't purely about self-service rather it can take the human-assisted experience to the next level. It can also be used to do the hard work of analysing overwhelmingly huge data sets and then creating insights that can be used proactively to offer personalised assistance or services at scale. CSPs can become even more service centric and begin to reap the benefits of these data insights to create new digital processes to enhance customer experiences rather than simply digitise existing processes and service models.

Secondly, when it comes to being more agile and customer centric, legacy systems get blamed for holding back change. Some commentators like **McKinsey** call for a total reset and a complete migration to a greenfield setting for network and infrastructure. More appropriately for CSPs, a cloud migration strategy can help transform performance. Many CSPs are on this path already. Some have done the lift and shift of existing systems into the cloud but in 2022 we will see many more reinventing applications, systems and processes entirely for the cloud.

In this respect, the cloud can be a hub where a CSP can behave most like one of those customer-centric digital native businesses. A truly cloud-native environment enables a CSP to work flexibly and efficiently with partners on future innovations, from collaborative development and testing to shared deployment and analytics. In this way, the burden of raising a CSP's CX game is shared, accessing an ecosystem of technologies and technology talent that shares how modern software and infrastructure is built using open application programme interfaces (APIs) and microservices among other techniques.

CX is going to be a key battleground for CSPs in 2022 and beyond. The CSPs who thrive will be those who focus on how they deliver great digital customer journeys and service outcomes through ambitious programmes around AI and cloud native migration.

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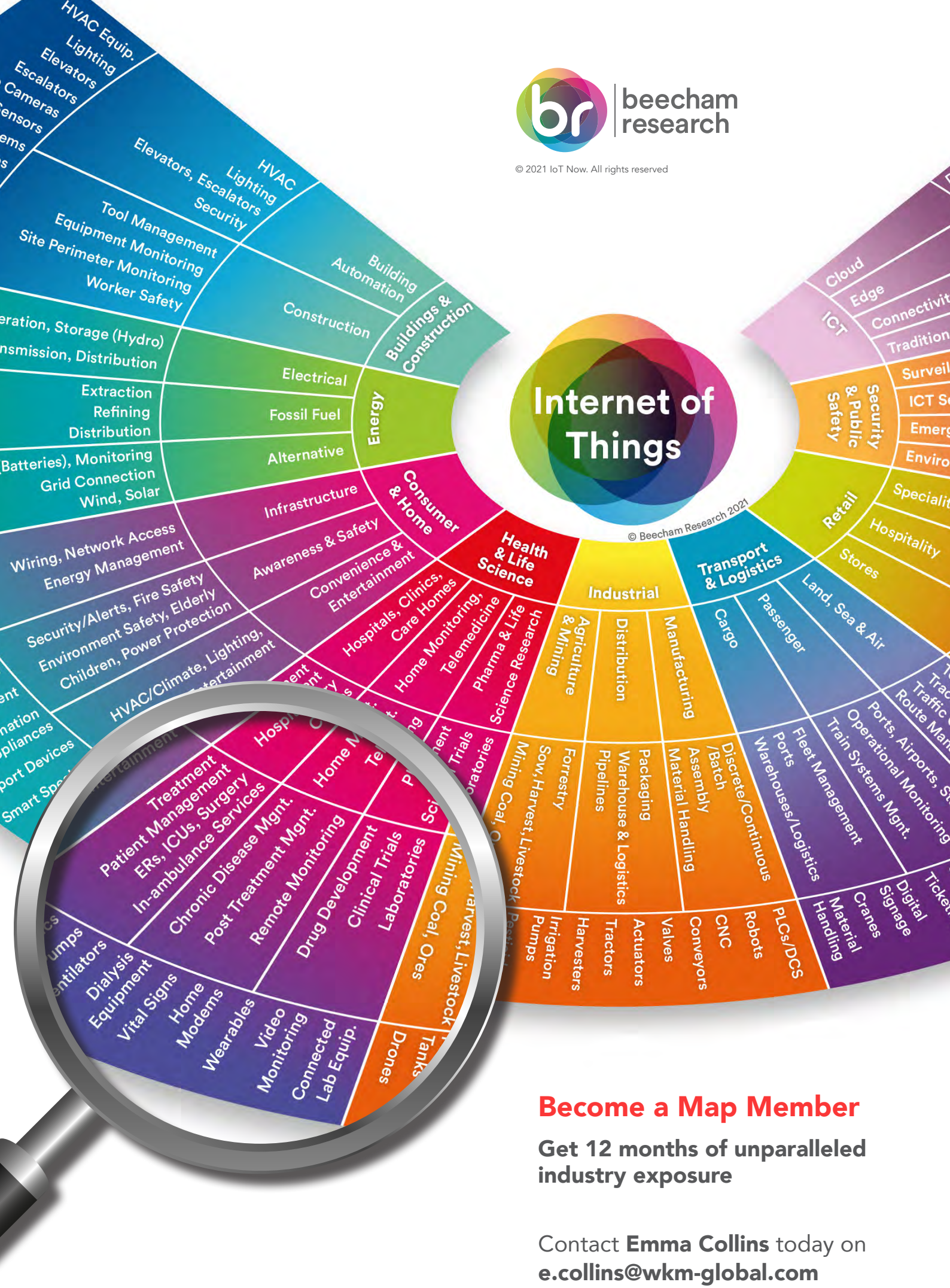

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MWC Barcelona 2022
28 February – 3 March 2022
Barcelona, Spain
https://www.mwcbarcelona.com/

The Edge Event
15-16 June 2022
London, UK
https://tmt.knect365.com/the-edge-event/

Big Data & AI World
2-3 March 2022
London, UK
https://www.bigdataworld.com/

5G Expo 2022
21-24 June 2022
Fort Lauderdale, Florida, USA
https://www.5gexpo.com/east/

ICT Maghreb
14-16 March 2022
Algiers, Algeria
https://www.ictmaghreb.com/en/

IoT Evolution Expo 2022
21-24 June 2022
Fort Lauderdale, Florida, USA
https://www.iotevolutionexpo.com/east/

Privacy-Enhancing Technology Summit Europe
4-6 April 2022
Zurich, Switzerland
https://www.kisacoresearch.com/events/privacy-enhancing-technology-summit-europe

DevOps As A Service Summit
11 October 2022
Virtual Event
https://techforge.pub/events/devops-as-a-service-summit-3/

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- **81% expect edge to improve operations by 2025**

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