Vanilla+

TALKING HEADS

Netcracker and Telenet discuss digital
transformation impacts on managing CSP
customer growth and service evolution

PLUS: Gartner identifies emerging AI trends in telecoms ■ Mobileum buys SIGOS ■ Cloud service provider
Blackbaud pays ransom ■ Computing: Intelligence at the Edge ■ ZTE enables FTTx and 5G resource sharing
■ Ireland's eir invests in service assurance ■ Network performance management evolving in a troubled world
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CONTENTS

IN THIS ISSUE

TALKING HEADS   10
Micha Berger, Telenet and
Mitat Kizilelma, Netcracker

DIGITAL TRANSFORMATION   16

20 CONTACT CENTRES

22 MARKET REPORT

26 INVESTMENT

EDGE COMPUTING 28

Netcracker

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Yes, this is a challenge! But help is always available

OK, no more mention from me of "new normals" – it's an annoying phrase for our global condition, and it hasn't improved with time. It's a statement of the flipping obvious that COVID-19 is presenting us all with enormous challenges, not just to make a profit but to enable the services we all deliver to our customers. That's why I have been encouraged to see – and to share with you in these pages – so much valuable advice that confronts the problems head on and offers solutions.

Jeremy Cowan, editorial director

The pandemic is not just a time for reflection in business, it may be the optimum time for radical transformation – digital transformation of your network. We've been advocating it for years – just type "transformation" into *VanillaPlus.com*'s Search engine to see the deep expertise of our contributors. It's never been more important to consider how, when and with whom you can adapt your business to your customers' evolving requirements. Take a look, for example, at the smart capital article by **Macquarie** on page 26, or **Gartner**'s analysis of artificial intelligence (AI) for telcos (p32). If you want to learn what's already been done, read how **Telenet** is managing customer growth and service evolution, backed by **Netcracker** (p10). The role of Edge intelligence in 5G services for enterprises is discussed in depth by **VoltDB** (p28).

We're not overlooking the here and now. One of many lessons this virus has taught us is the value of reliable, high quality communications networks, and Antony Savvas explores this in his Market Report on network performance management (p24). Of course, nobody said this would all be easy, which is why readers will find comfort in **Polystar**'s article by Gorka Esturo on obtaining a single, unified view of your network. Like I said, we can all benefit from advice, especially when it's as well-informed and up to the minute as this. Enjoy the magazine.

Jeremy Cowan
Editorial director, VanillaPlus
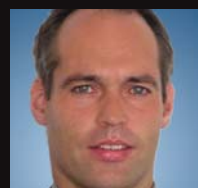
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Mobileum buys SIGOS to provide 5G and IoT end-to-end testing and analytics

Cupertino, California-based Mobileum Inc., a global provider of analytics-based roaming, network security, and risk management solutions, is acquiring SIGOS. This is the third acquisition that Mobileum has completed, following the purchase of WeDo Technologies in August 2019, and Evolved Intelligence in October 2018.

With global operations and offices in Silicon Valley (San Mateo, CA-USA), Ghent (Belgium), Nuremberg (Germany) and Singapore, SIGOS has been offering its customers active end-to-end domestic and roaming testing solutions to improve network security and service quality for mobile networks since 1989. The SIGOS portfolio includes the largest roaming and interconnection test system in the cloud, covering almost every country in the world. In addition to active testing, SIGOS provides mobile operators anti-fraud and revenue assurance managed service solutions. SIGOS was previously owned by Thoma Bravo, a private equity investment firm focused on the software and technology-enabled services sector.

"SIGOS is a leading company with over 500 network operators in 156 countries, including the top 100 mobile networks. The company has developed an impressive suite of technology and products that deliver great value to global telecom operators," says Bobby Srinivasan, CEO of Mobileum. "We are excited to partner with SIGOS and support them in the next phase of growth. As we continue to grow Mobileum, both organically and inorganically, the addition of SIGOS' strong product portfolio and unique testing infrastructure, as well as their great technical expertise and customer footprint will help us to expand the depth and breadth

of our offerings, and to further strengthen the value proposition for our customers."

"As a leading company for active end-to-end testing in service and network quality, including active fraud detection and billing verification, we are very excited to launch with Mobileum the essential next step for our journey in 5G. The combination of both companies' products and competencies will help create a tremendous value for mobile operators and enterprises, at a critical moment for them, as they rollout their 5G infrastructure and expand their portfolio of IoT services," comments Adil Kaya, CEO of SIGOS. "We believe we are uniquely positioned to support that journey, being able to provide active testing and to ensure a superior network quality, while simultaneously safeguarding our customers' network and protecting their revenue streams."

Mobileum has consistently grown its suite of analytics offerings in the years following its acquisition by Audax Private Equity in 2016. Building on 19 years of leadership in the sphere of roaming, Mobileum relied on its knowledge of mobile telecommunications to develop its 'Active Intelligence' platform that empowers real-time actionable insights across roaming, testing, fraud, and security domains. The combination of SIGOS' testing and monitoring solutions and its engineering team with Mobileum's advanced analytics platform is designed to create an innovative and robust framework for telecom network operators.

SIGOS complete testing portfolio, together with more than three decades of field expertise, will allow Mobileum to enhance its roaming, risk management and security solutions. ⊕

GTT appoints Ortega interim CEO as MacNeil joins as COO

GTT Communications, Inc. (NYSE: GTT), a global cloud networking provider to multinational clients, reports that GTT's chief revenue officer (CRO), Ernie Ortega has been named as the interim CEO while the Board continues its search for a new CEO.

Don MacNeil has also joined the GTT leadership team, as chief operating officer (COO). MacNeil will lead its network operations, service delivery, assurance and vendor management teams, as well as GTT's product organisation.

Ernie Ortega joined GTT in June 2019 as division president, Americas, and has extensive industry experience with a strong record of delivering revenue growth. Prior to joining GTT, he was CEO of Towerstream and previously held senior executive roles at Colt Technology Services, Cogent, and XO Communications, after beginning his career at MCI.

Prior to joining GTT, MacNeil was chief executive officer (CEO) at FiberLight, having served as COO, driving its business of designing, building and optimising fibre-optic networks. He has held several executive leadership roles over his career including COO, CMO and head of customer operations for managed network provider XO Communications. Don MacNeil also served as chief technology officer (CTO) for EdgeConneX, a global data centre solutions provider. ⊕

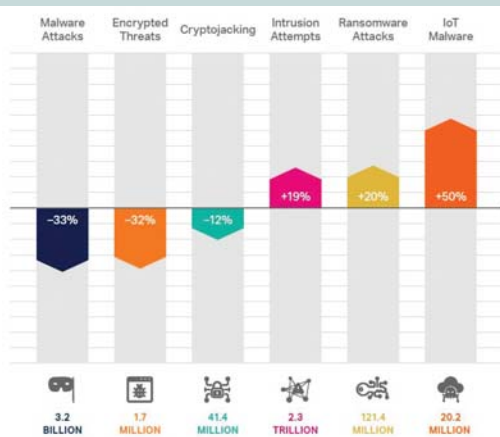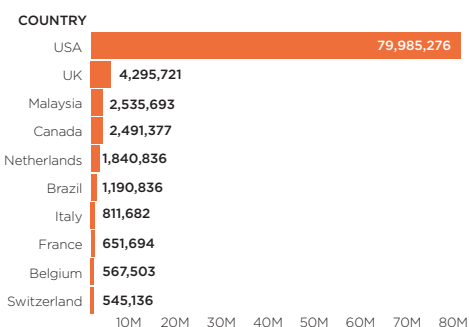**Ernie Ortega,** GTT Communications, Inc.

Ransomware is up globally

Meanwhile, California-based SonicWall Capture Labs threat research team has published its mid-year update to the 2020 SonicWall Cyber Threat Report. This highlights increases in ransomware, opportunistic use of COVID-19, systemic weaknesses and growing reliance on Microsoft Office files by cybercriminals.

During the first half of 2020, global malware attacks fell from 4.8 billion to 3.2 billion (-24%) over 2019's mid-year total. This drop is the continuation of a downward trend that began last November. Despite this decline, SonicWall's CEO Bill Conner said, "ransomware continues to be the most concerning threat to corporations and the preferred tool for cyber criminals, increasing a staggering 20% (121.4 million) globally in the first half of 2020.

Malware Attacks	Encrypted Threats	Cryptojacking	Intrusion Attempts	Ransomware Attacks	IoT Malware
–33%	–32%	–12%	+19%	+20%	+50%
3.2 BILLION	1.7 MILLION	41.4 MILLION	2.3 TRILLION	121.4 MILLION	20.2 MILLION

2020 Ransomware Volume / Top 10 Countries

COUNTRY

Country	Value
USA	79,985,276
UK	4,295,721
Malaysia	2,535,693
Canada	2,491,377
Netherlands	1,840,836
Brazil	1,190,836
Italy	811,682
France	651,694
Belgium	567,503
Switzerland	545,136

10M 20M 30M 40M 50M 60M 70M 80M

Cloud software provider Blackbaud pays ransom, hackers' increasingly favoured global attack vector

As our sister title, **The Evolving Enterprise** reported recently (https://bit.ly/2P6q24E) ransomware is behind 1 in 3 cyber security attacks on organisations, news was breaking of another major ransom attack. This time, reports Jeremy Cowan, it was **Blackbaud**, a third-party supplier of database services and customer relationship management (CRM) systems for enterprises, that paid hackers a ransom to unlock its own client data.

Blackbaud describes itself as "world's leading cloud software company powering social good." The clients in question reportedly include, homeless charity Crisis, the UK Universities of Aberystwyth and Aberdeen*, each of which has issued apologetic notices to its customers and partners. Other customers listed by the company include the American Diabetes Association, the Universities of London and Oxford, and YWCA Chicago.

In a statement (**https://www.black baud.com/securityincident**), Blackbaud said: "In May of 2020, we discovered and stopped a ransomware attack. In a ransomware attack, cybercriminals attempt to disrupt the business by locking companies out of their own data and servers. After discovering the attack, our Cyber Security team —

together with independent forensics experts and law enforcement – successfully prevented the cybercriminal from blocking our system access and fully encrypting files; and ultimately expelled them from our system. Prior to our locking the cybercriminal out, the cybercriminal removed a copy of a subset of data from our self-hosted environment. The cybercriminal did not access credit card information, bank account information, or social security numbers."

It went on, "Because protecting our customers' data is our top priority, we paid the cybercriminal's demand with confirmation that the copy they removed had been destroyed. Based on the nature of the incident, our research, and third party (including law enforcement) investigation, we have no reason to believe that any data went beyond the cybercriminal, was or will be misused; or will be disseminated or otherwise made available publicly. … We apologize that this happened and will continue to do our very best to supply help and support as we and our customers jointly navigate this cybercrime incident."

It is not clear what reassurance was given that the data would not be misused or shared in future, or how Blackbaud could trust the hacker's assertion it was destroyed. ⊕

Discovered in May, notified in July

In a message to its alumni, Rob Donelson, executive director of Advancement at Aberdeen University wrote: "On 16 July 2020, Blackbaud advised us that it had discovered a ransomware attack in May 2020. According to Blackbaud, the cybercriminal removed data from its backup server at some point between 7 February and 20 May 2020, and we have been informed that data related to our alumni was part of that. We understand that a significant number of organisations around the world have been affected."

One point of immediate concern to clients

was Blackbaud's delay in notifying them of the data breach. Aberdeen University said: "Blackbaud has advised that they did not notify us sooner because they needed to: defend against the attack; conduct the subsequent investigation; take measures to address the issue that led to the incident; and prepare resources for its customers."

If this can happen to an organisation whose raison d'etre is the storage and protection of mission-critical data readers may want to consider the preventative 5 steps outlined in a **NordLocker** article (**https://bit.ly/2P6q24E**). ⊕

IoT continues to serve threats

Work-from-home (WFH) employees or remote workforces can introduce new risks, including Internet of Things (IoT) devices like refrigerators, baby cameras, doorbells or gaming consoles. Researchers at SonicWall found a 50% increase in IoT malware attacks, mirroring the number of additional devices connected online. (**www.sonicwall.com/ThreatReport**) ⊕

Nokia can 'instantly migrate' 5mn legacy 4G radio units to 5G

A software-based upgrade that will enable Nokia's 4G/LTE radios to be migrated seamlessly to 5G/NR has been announced for the Finnish network equipment provider. These features will, says Nokia, have a high value to its customers as they provide immediate support for approximately one million radios, reaching 3.1 million by the end of this year and more than 5 million in 2021.

By upgrading existing radio elements via software, Nokia is helping to streamline the process of refarming 4G/LTE spectrum into 5G/NR. The move will also support existing customers and the installed base by offering a seamless and cost-effective upgrade path to 5G/NR.

Most of the 5G/NR deployments to date have been performed with TDD cmWave and TDD mmWave deployment but the next big wave of 5G/NR rollouts will be delivered by refarming existing FDD bands to 5G/NR.

TDD spectrum benefits from enlarged coverage and capacity when combined with already deployed FDD network infrastructure and spectrum bands via TDD/FDD Carrier Aggregation.

The ability to upgrade 4G/LTE radios via a software update will significantly smooth out the deployment of 5G/NR FDD, avoiding costly and disruptive site visits. Nokia has a vast customer base of 359 4G/LTE customers with deployed FDD RF units most of which are possible to upgrade. This will provide a new and smoother way for operators to build 5G/NR coverage in lower bands via spectrum refarming. Nokia's 4G/LTE radios are outperform all vendors according to independent testing.

Nokia also has Dynamic Spectrum Sharing (DSS) already in live networks covering 2G/GSM-3G/WCDMA-4G/LTE and recently introduced DSS for 4G/LTE-5G/NR. This capability completes a DSS solution,

covering all access technologies and making the radio frequency refarming to 5G/NR a simple and efficient process. In a typical case DSS will be introduced to one or few 4G/LTE bands which are then combined with carrier aggregation between other bands running pure 4G/LTE or 5G/NR. Nokia has the DSS solution covering all radio access technologies from 2G/GSM to 5G/NR.

Nokia estimates that this solution could save the telecommunications industry tens of billions of Euros in site engineering and re-visit costs as communication service providers are able to upgrade their networks to 5G/NR on FDD with software.

Chris Nicoll, principal analyst at ACG Research, comments: "While Open RAN promises software upgradability to ease transitions between 'Gs' and add new features, Nokia's Flexi and AirScale portfolio are providing a software upgrade to

Tommi Uitto, *Nokia*

transition over 5 million 4G radios to 5G. "Efficient FDD spectrum refarming is critical for fast, broad and deep 5G deployments. With Nokia supplying the majority of the world's 4G operators, supporting key advanced features such as DSS helps those operators lead with 5G."

Tommi Uitto, president of mobile networks at Nokia, adds: "We already provide LTE radios to hundreds of customers around the world. This is an important solution because it will help our customers, quickly and efficiently upgrade their existing LTE radios so that they are 5G-ready, saving them time and money." ⊕

ZTE launches Combo PON Plus solution to enable FTTx and 5G resource sharing

China-based ZTE Corporation, an international provider of telecommunications, enterprise and consumer technology solutions for the mobile internet, has unveiled its Combo PON Plus solution.

The solution features independent wavelengths to simultaneously provide GPON and 10G PON services while implementing 5G fronthaul over one port and one feeder fibre, thereby achieving rapid, cost-effective 5G deployments and full-service operations.

ZTE's Combo PON Plus solution has innovatively introduced

Combo PON Plus card to connect 5G macro cells through the OLT (Optical Line Terminal) platform. Different from traditional direct-fibre connection schemes, ZTE's Combo PON Plus solution can fully reuse the existing FTTx network infrastructure, such as access offices, fibres, ducts and outdoor cabinets, to reduce the rollout costs and shorten the service provisioning time.

The Combo PON Plus solution was introduced by ZTE in 2016 and has reportedly been widely deployed. As a global provider in the FTTx industry, ZTE had ranked second worldwide in terms of the FTTx market share in Q1 2020, according to a Dell'Oro Group report. ⊕

Ireland's eir selects EXFO service assurance for 3G, 4G and 5G networks

Dublin-based communications company, eir, and Canada's **EXFO Inc.,** the communications industry's test, monitoring and analytics experts, have set up a multi-year partnership. This is for the development and optimisation of eir's 3G and 4G mobile services, as well as the rollout of its 5G network, the largest in Ireland.

eir provides a range of advanced voice, data, broadband and ICT services to the residential, small business, enterprise and public sector markets. As part of the operator's ongoing investments in service quality for over one million subscribers, and following a competitive tender process, eir selected the following EXFO Nova service assurance solutions for end-to-end network performance analytics and troubleshooting:

- Nova Explorer provides deep end-to-end troubleshooting (from RAN to core), identification of root causes for customer complaints, and detection of quality degradations over multi-technology networks.

- Nova Analytics empowers informed and effective decisions based on network performance management analytics and business intelligence

- Nova Care was designed for customer service and technical support departments, providing on-demand subscriber-experience assessments for fast customer complaint analysis and diagnosis.

- These applications make the most of relevant data from EXFO passive agents as well as call traces and third-party probes.

These solutions are part of EXFO's recently launched Nova Adaptive Service Assurance (AISA), the first intelligent automation platform enabling mobile network operators to deliver ultra-reliable and high-quality service experience in 4G and 5G environments.

"eir is by far the largest investor in telecoms in Ireland and we are committed to keeping Ireland connected, including launching the country's first 4G network and the continued expansion of Ireland's largest 5G network," says Guillaume Duhaze, eir chief technology officer. "We chose EXFO as our partner because of the end-to-end capabilities of their service assurance solutions, as well as their shared focus on innovation to deliver fast, high-quality service to our over one million subscribers."

"We are delighted to partner with eir to assure best-in-class mobile experience for their subscribers, whether on 3G, 4G

Abdelkrim Benamar, EXFO

or 5G networks," comments Abdelkrim Benamar, EXFO vice president of Service Assurance, Systems and Services. "Network performance is now the key differentiator for mobile operators, and EXFO is committed to equipping them with the new breed of service assurance technologies required to cut through the complexity and reveal previously invisible problems."

eir is the largest provider of fixed line telecommunications services in Ireland, offering broadband, voice, TV and data services to residential, small business, enterprise and government segments. EXFO develops smart test, monitoring and analytics solutions for fixed and mobile network operators, webscale companies and equipment manufacturers in the global communications industry. ⊕

Nokia and U.S. Cellular to modernise 5G capabilities for enhanced CX

Nokia and **U.S. Cellular** have agreed to add 5G mmWave capabilities in the 24 GHz and 28 GHz spectrum bands. U.S. Cellular will deploy Nokia's AirScale portfolio, with Cloud RAN capabilities, to provide enhanced Mobile Broadband (eMBB) 5G mmWave.

The Nokia AirFrame open edge solution for Cloud RAN will also be included in the deployments, enabling a virtualised RAN that provides scalable benefits such as, significant Total Cost of Ownership (TCO) reduction through simplification automation and operation efficiency gains, as well as

through the support of open ecosystems.

To support U.S. Cellular's advanced Internet of Things (IoT) and enterprise customers, the company has also opted to include Nokia's Worldwide IoT Network Grid (WING) solution as a deployment component, which allows the scaling of 5G IoT services faster and more cost-effectively.

U.S. Cellular is beginning its multi-year deployment of 5G mmWave now, with commercial availability planned for 2021.

Mike Irizarry, CTO, U.S. Cellular says, "U.S. Cellular and Nokia

are taking bold steps forward together in the realm of 5G modernization and connectivity. With 5G mmWave technology from Nokia, we can provide our customers with the leading-edge capabilities of high performance, ultra-low latency 5G."

Ricky Corker, president of Customer Operations for Americas, Nokia, comments: "We are pleased to extend our relationship with U.S. Cellular with 5G mmWave technology and enable the company to deliver to its consumer and enterprise customers exciting new 5G services that require lightning performance with no

Ricky Corker, Nokia

discernable latency. This is a big leap forward in the provision of fast, secure and reliable networks in the Western, Mid-West and Mid-Atlantic regions." ⊕

Sunrise speeds time to market by 75% with hybrid cloud technologies

Switzerland's Sunrise Communications AG has worked with Red Hat, Inc., a provider of open source solutions, to build a hybrid cloud-ready platform and adopt an agile DevOps culture. The aim is to speed innovation and reduce time-to-market.

Sunrise has migrated several critical customer applications to its microservices architecture on Red Hat OpenShift, supported by Red Hat OpenShift Container Storage and Red Hat Runtimes, managed with Red Hat Ansible Automation Platform.

Sunrise is the largest non state-controlled telecommunications company in Switzerland, offering mobile and fixed line telephony and broadband, including a 5G network, as well as live and on-demand video streaming services. Sunrise is working to evolve its operations through infrastructure, product and service differentiation, and operational efficiency, with a focus on innovation and cross-pollination between its business units.

As part of this effort, the IT business within Sunrise initiated a digital and cultural transformation, migrating from legacy architectures to a microservices environment and moving to the Scaled Agile Framework (SAFe) methodology, where teams involved in developing and executing innovation collaborate more closely.

Already using Red Hat open source platform and middleware technologies, Sunrise looked to the vendor for a comprehensive enterprise Kubernetes platform and for support with the transition to a more agile culture. Red Hat Consulting provided a series of custom workshops and training sessions to help Sunrise to make full use of Red Hat's hybrid cloud technologies based on the needs of the business, which included development of a reusable blueprint for application development.

Sunrise is now running critical customer-facing applications on its Red Hat OpenShift-based platform, including Roaming Cockpit, which enables customers to configure roaming services and to purchase roaming packages for travelling abroad; My Sunrise, a customer

portal that enables subscribers to manage usage and add service bundles; and Sunrise Business Portal, an end-to-end user interface where business customers can activate new SIMs, manage employee devices and configure services according to every user's individual needs.

Darrell Jordan Smith, Red Hat's vice president, Global Industries says, "Sunrise is passionate about its transition to a more agile culture and cloud-native architecture and is using Red Hat OpenShift in a forward-thinking way that elevates it to a

powerful position to execute on its strategies for 5G, cloud edge computing, Internet of Things (IoT) and new vertical industry opportunities as these elements come together."

Elmar Grasser, chief technology officer, Sunrise Communications AG adds, "We wanted to go all-in on containers, and we were convinced by Red Hat OpenShift as a powerful platform that would enable us to leap into the future. Now OpenShift is a central part of our business IT, and it has given us the opportunity to be more flexible and responsive." ⊕

Elmar Grasser, Sunrise CTO: "We wanted to go all-in on containers."

China Mobile builds a 5G network with high-end routers

The Jilin branch of China Mobile has been helped by ZTE Corporation to build a 5G core network, using ZTE's high-end router, the ZXR10 M6000-18S. ZTE is an international provider of telecoms, enterprise and consumer technology solutions for the mobile internet.

ZXR10 M6000-18S works as the Unified Power Format (UPF CE) of the 5G core network. This is the ingress of the network cloud, to connect with the switching equipment on the UPF core layer, while forwarding and maintaining the routing information outside the UPF, and thus connecting with the external equipment at high speed. In this way, the device connects with equipment inside and outside the 5G core network at the same time.

Based on ZTE's patented ROSng routing operating system, ZXR10 M6000-18S features SR, EVPN, SRv6, and BIER while supporting the evolution of the IP network towards a simplified and intelligent architecture.

By virtue of the single-slot 800G capability powered by in-house NP chipsets, ZXR10 M6000-18S is recognised as one of the industry' good routers, in terms of forwarding performance, energy saving and SDN capability.

In China Mobile's centralised procurement of router products in 2019, ZTE's ZXR10 M6000-S series routers reportedly ranked first in the high-end router 2T segment with a share of 50% while ranking second in the high-end router 400G segment with a share of 30%. ⊕

Digital transformation: managing CSP customer growth and service evolution

As a leading provider of quad-play telco services in Belgium, Telenet – which serves more than 2.5 million customers in Flanders and Brussels – is progressing well in its digital transformation program, which it undertook to better serve its customers, anticipate customers' needs and innovate towards future services.

Part of this multi-phased program involves upgrading its IT landscape, including Business Support Systems (BSS) and Customer Support Systems, and integrating all customers onto a single platform. To make matters more challenging, **Telenet** wanted to migrate the customers it gained through its acquisition of mobile provider **BASE** in 2015. With so many moving parts and business goals, Telenet needed a partner that it could learn from and rely on for such a critical endeavour.

Ultimately, Telenet selected **Netcracker** to work side by side on this long-term program. We talked to Micha Berger, CTO of Telenet, and Mitat Kizilelma, vice president of Strategic Accounts at Netcracker, on the scope of Telenet's digital transformation, what challenges they faced, how Netcracker has helped the operator become ready for network and service enhancements – among them 5G, new products and digital offers – and how the coronavirus pandemic has impacted their business and customer relationships.

VanillaPlus: Can you tell us about your acquisition of BASE, which added mobile services to your portfolio as well as customers?

Micha Berger, Telenet: Telenet had previously operated as an MVNO (mobile virtual network operator), and we had more than a million customers,
but understanding that data consumption is only growing, we had the ambition to become a full mobile operator. We even bought spectrum at some point, but we never really built out a full mobile radio network. So, after we reached the tipping point of a million mobile customers, we thought it made sense to 'buy instead of rent.' We wanted to become more aggressive in terms of bundles we could offer and have the ability to scale, and to reach those goals it made more sense for us to go all in and become a mobile operator ourselves.

After the BASE acquisition, and as part of our plan, we clearly understood that our IT platforms were mainly designed for either fixed or mobile offers and were unable to expand to support this huge influx of new mobile and fixed customer and their connectivity demand. We needed to invest more in IT to support converged services, which led to a dilemma: Do we develop on our legacy fixed platform or our legacy mobile platform, or do we build something new from scratch to support fixed-mobile convergence and future proof ourselves and support our customers in a more digital way?

After doing the math and looking at our company ambitions, it made much more sense to start from scratch, but of course that was easier said than done.

What were the challenges involved in this ▶

Micha Berger
CTO
Telenet

Mitat Kizilelma
vice president of Strategic Accounts
Netcracker

program to upgrade your IT systems, and what were the key areas you focused on?

Berger: After the BASE acquisition, we had multiple IT stacks: the BASE mobile stack, Telenet's converged stack and a B2B (business-to-business) stack. The idea was to combine all functionality together into a single stack. It didn't make financial sense to keep old stacks active due to support costs and the effort involved in maintaining them. Instead, we wanted to create further synergy by building a single stack.

We planned to decommission a key part of our IT stacks and build one IT stack to support residential and business customers with fixed and mobile product combinations. We also aspired to offer value-added services such as security, SDN-related products, OTT (over the top) services and much more.

To do this, we planned for a converged stack from Netcracker that included a real-time charging platform, full stack BSS, flexible and powerful digital layers, which are all supported and linked to each other by a set of APIs (application program interfaces).

Can you tell us about Netcracker's relationship with Telenet and how it's changed over the years as Telenet's business has grown and evolved?

Mitat Kizilelma, Netcracker: In many ways, Telenet is a great example of one of our customers in terms of our close working relationship, evolution of the products and services we are delivering to them and the overall strategy to support their digital transformation. When we started working with Telenet in 2017, they were a cable broadband operator similar to other customers we've worked with over the past 30 years or so. They had been offering cable and fixed voice services to residential customers since the mid-1990s, but over the years gained assets through acquisition and buildout – including the 2015 acquisition of BASE – to become a dominant quad-play provider in Europe.

We quickly saw Telenet's ambition to grow, and with those changes to their offerings and increase in subscribers – both residential and business – it required a very close, trusted relationship to ensure Telenet's IT infrastructure was up to the task.

As part of Telenet's major transformation program, how did you prioritise critical functions to guarantee uninterrupted service?

Berger: This was actually a full-stack transformation for Telenet but with a focus on the BSS and Customer ▶

> We planned to decommission a key part of our IT stacks and build one IT stack to support residential and business customers with fixed and mobile product combinations.
> **Micha Berger**
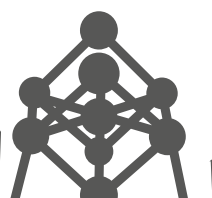
Support System, including a real-time online charging system (OCS) and a single product catalogue that can be easily accessed from other systems. This also involved building a set of APIs that can access BSS processes from external systems.

Replacing the IT stack was challenging but necessary to simplify our processes, which had previously grown very naturally into different directions. This transformation project was a way for us to revisit our legacy systems processes and determine if our business flows were efficient and still valid. We tried very hard not to reinvent the wheel and instead put existing knowledge to work along with out-of-the-box processes coming from the Netcracker platform.

Once we made the decision to do a full-stack swap and combine both fixed and mobile residential and B2B customers, we had to decide how to begin the migration. We wanted to first migrate postpaid mobile-only customers to the new stack since that was going to be easiest and would benefit the business most. The former BASE customers were migrated to the new platform about 9 months ago. We can say that both the migration and the operational experience of being live for 9 months has gone quite smoothly without major incidents. We are proud of the teamwork involved and the outcome of this phase.

Now that we're comfortable with the results, our next phase involves migrating prepaid mobile customers. Then we'll move to our SOHO and fleet mobile customers, and within 12-18 months we'll migrate our quad-play customers. We're doing this in phases to ensure minimal disruption to our business.

When Telenet gained new mobile customers through its acquisition of BASE, what did that mean to their existing BSS deployment, and what was Netcracker's involvement in their transformation program?

Mitat Kizilelma: Telenet went from being an MVNO to running their own mobile network. This does not happen overnight and requires major changes on the BSS side.

I believe Netcracker has played an integral role in Telenet's evolution to becoming a quad-play provider and the BSS transformation those changes ▶

Micha Berger
CTO
Telenet

necessitated. Our new Netcracker 2020 portfolio is really geared for operators like Telenet that are offering a wide range of technologies and products and services over a variety of network infrastructure. Due to Telenet's rapid growth, both organically and through acquisition, and their evolution towards 5G and other next-generation technologies, they wanted to consolidate their various IT stacks onto a single platform and selected us for this project.

Our cloud-native Digital BSS platform encompasses everything Telenet needs for its different lines of business and for both residential and business customers and current and future business models. This includes our Customer Engagement layer, which helps deliver a digital-first experience to customers across all channels. It's an incredibly robust solution that allows operators to deliver a consistent customer experience, increase revenue through targeted upsell and cross-sell opportunities and automates customer interaction.

To meet Telenet's program requirements, we delivered a number of our solutions from the Netcracker 2020 portfolio, such as Customer and Revenue Management, which included Customer Information and Order Management, Customer Care & Problem Management, Retention and Loyalty Management, Contract & SLA Management, Call Center Desktop, Product Management and Lead Management.

On the billing side, Netcracker provided an Online Charging System (OCS) to handle real-time transaction management of both prepaid and postpaid customers, Converged Billing, Customer Billing Management, Collections Management and Voucher Management. The BSS solutions include embedded analytics, which will help Telenet shorten time-to-market for new products and services, increase revenue from converged and third-party services, generate new revenue across both digital and physical channels and improve customer retention and loyalty.

Given Telenet's focus on delivering converged and third-party services, what have been the key elements you've put in place to gain the most business benefits, such as shorten time-to-market for these services, boost revenue and improve customer retention and loyalty?

Berger: Without a doubt, the single product catalogue and out-of-the-box solutions have given us the greatest business benefits. We've been able to shorten time-to-market since we are not dealing with complex customisations. The single product catalogue allows our business to easily configure new

products in one system and then get those definitions propagated to the complete landscape. This includes order intake, billing and even our online marketing and sales journeys. Our business recently launched a new mobile product and was able to do this with a smaller team and shorter time-to-market than was possible with our legacy systems. I'm confident this will further improve when we get to know the platform even better.

Another area that provided us with tangible results is the OCS. We are in fact using OCS for real-time transaction management of our postpaid customers. Customers get access to accurate real-time balance management and experience extremely low latency and zero provisioning delays when requesting new services or changing service plans via multiple channels in real time.

In addition, we have shifted to Agile ways of working and Agile at scale, which has resulted in improved time-to-market as well as optimised internal processes that allow us to make decisions quickly and become much more flexible. Also, without the new IT landscape, our complicated legacy solutions would slow down the Agile teams to the extent that many of the benefits would be drastically limited.

How has the partnership with Netcracker helped Telenet to deliver a comprehensive and innovative product offering for your customers?

Berger: When we chose Netcracker, it was due to their very deep experience with operators similar to us. We wanted to learn from that experience and make sure we were not duplicating efforts or reinventing the wheel. Netcracker challenged us when we were thinking we should deviate from using out-of-the-box solutions but were equally supportive when we really had to deviate due to local legislation, for example. We were also using their Blueprint methodology to create an optimal environment for our customers and to reach our business goals.

I'll admit there was a bit of a learning curve on both sides, but we had a vision and were looking for a partner that shared this vision but also who would share the risk with us and take a leap of faith. Once we started the transformation program, we could see we would be able to tackle any challenges due to having the right expertise on both sides. ▶

> **Our cloud-native Digital BSS platform encompasses everything Telenet needs for its different lines of business and for both residential and business customers and current and future business models.**
> Mitat Kizilelma

> **This future-proof architecture will support 5G services as well as other IT services such as security, B2B services and services we haven't even thought of yet.**
> Micha Berger

In the end, it was a win-win situation for everyone. We learned a lot from Netcracker, and Netcracker took the knowledge from our project to other customers. We are fortunate to have a positive atmosphere and relationship where everyone grows and learns.

What do you see as the critical use cases for 5G, and how are you preparing your IT infrastructure to support an upgraded network and new services?

Berger: The IT stack we are building is not just to support our existing product offerings; rather it is more to support and allow innovation for services we do not have today and what would serve our business in the future. This was key in our selection of Netcracker, because we were looking for an IT partner with the expertise and capabilities to support us in our vision.

This future-proof architecture will support 5G services as well as other IT services such as security, B2B services and services we haven't even thought of yet. We'll be able to develop new services and port them to the IT stack quickly and get them digitally to our customers without delay.

We're making a very big investment in 5G to enable Telenet to build new products for the future based on this new technology. This could be mobile broadband solutions that offer gigabits per second of speed; it could be IoT offers for businesses or verticals like manufacturing; or it could be VPN, network slicing and gaming services to name just a few. Essentially anything that will require low latency and guaranteed speeds are areas we are looking at very seriously.

During these recent uncertain times, how has the impact of COVID-19 changed your business processes and impacted your relationship with your customers? And what are you doing to ensure uninterrupted service and being able to address the questions and concerns from customers in this difficult period?

Berger: We as an industry have proven that we are a critical lifeline element for our customers, especially during these challenging times. Connectivity is always important, but when you are locked down in your house connectivity is deemed to be one of the most critical services to maintain your quality of life and allow you to be entertained, work and study. We knew this before the pandemic, but now we understand even

better this responsibility we carry on our shoulders.

Our network was built for exactly this type of extreme situation and includes redundancy, increased capacity and the ability to scale and deliver more bandwidth to customers as needed.

And now during this pandemic, we are supporting our customers in ways we had not before. For example, we are taking our social responsibility very seriously by being more flexible with customers who may be experiencing financial difficulties and are having trouble paying their bills.

In addition to being more flexible in terms of payments and delaying disconnections, we are also adding connectivity for students who require access to online schooling. We've opened up 1.5 million Wi-Fi hotspots across Belgium to students and have donated laptops to those that need devices after schools shut down.

We are also offering digital remote customer support to reduce the number of on-site tech visits and reduce contamination risks.

As the Netcracker and Telenet teams have had to work remotely the past several months and can't be face-to-face onsite, what steps have you put in place to ensure Telenet receives the support it needs?

Kizilelma: This current period of uncertainty and massive disruption is being felt all around the world and within all industries, including telecommunications. As offices shut down and global travel was severely curtailed, we were naturally concerned that supporting operations in Belgium would present an unsurmountable challenge. However, we were very pleasantly surprised at our quick transition to a remote delivery model, which included some employees shifting their work hours to be aligned with the customer's sites.

In fact, during the pandemic we helped Telenet migrate former BASE residential customers to our BSS solution, including OCS. The complex solution has remained stable and is achieving high call success rates. With the initial phase complete, we are beginning the next delivery phase, which includes prepaid, SOHO and fleet customers. The virtual delivery program was a success due to close collaboration and open communication across the product, delivery and operations teams. ▶
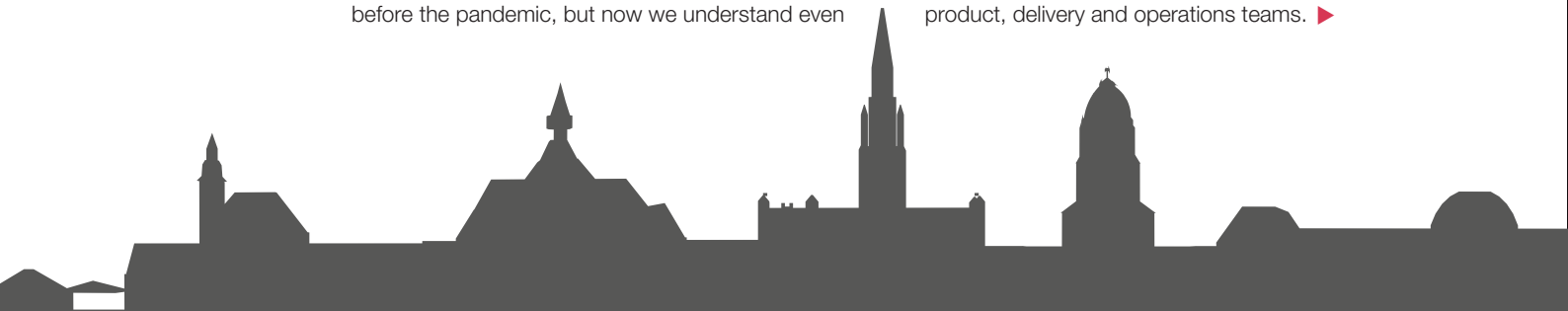
What has it been like having your teams work remotely due to the current pandemic, and has it affected your transformation program?

Berger: I've been pleasantly surprised that it has not affected the program at all. We have a large team working on this program, and most individuals have been working remotely all along. Between Netcracker and Telenet, we have teams of people in different countries, speaking different languages and coming from different vendors and partners, but once the COVID-19 pandemic shut down most face-to-face interactions, we were concerned that the program would be impacted.

We were forced to change our overall culture, so virtual meetings instead of morning standup meetings and other adjustments, but nothing has been delayed due to the pandemic. We've been able to do migrations, upgrades and patches remotely. We are monitoring processes remotely and are able to do real-time testing as needed. I'm very proud of how we were able to pivot quickly and continue moving forward even in very difficult times.

Mitat Kizilelma
vice president of Strategic Accounts
Netcracker

The outlook for SD-WAN in a post-COVID landscape

SD-WAN has unquestionably been one of the most important developments in enterprise connectivity in the past several years. But given the impact of the COVID-19 pandemic what lies ahead for this market, asks Guy Matthews, editor at NetReporter @ NetEvents.

Network managers and CIOs everywhere are keen to embrace a working environment that is connected digitally, rather than physically, driven by the power of cutting-edge software not legacy hardware. That is why the last few years have seen pressure for the kind of flexibility, scalability, efficiency and security that SD-WAN can enable.

It has been a dynamic market for start-ups and veteran networking vendors alike. We've seen the acquisition of hot new players by established names, with **CloudGenix**, **VeloCloud**, **Viptela** and **Nuage Networks** acquired by **Palo Alto Networks**, **VMware**, **Cisco** and **Nokia** respectively. **HPE** has just made a move for **Silver Peak**.

As well as acquisitions, the SD-WAN market has also seen some interesting collaborations and partnerships. **Netcracker**, part of **NEC**, has for example joined up with **Versa Networks** to deliver a complete, scalable managed SD-WAN solution based around Netcracker's network-as-a-service (NaaS) offer. Key players such as **Fortinet** and **Aryaka** are also currently thriving.

So what's next for a market currently experiencing a pandemic-related slowdown? Is the outlook healthy?

Scott Raynovich, chief technology analyst with analyst firm **Futuriom** believes the inherent qualities of SD-WAN will see its popularity sustain: "We've gone through several generations of networking, starting with client server and followed by the explosion of the Internet," he points out. "The next stage was the data

Scott Raynovich
chief technology analyst
Futuriom

centre and then cloud, with each stage leaving remnants of the previous generation. What SD-WAN does is arbitrate between these bits and pieces, and find the best way to get you where you need to go."

COVID-19, he believes, will end up simply emphasising the value of SD-WAN as the glue that pulls everything together, a sort of a built-in VPN overlay, essential at branch sites and for the many people now working at home. "There are so many different applications and use cases for SD-WAN," he points out. "At Futuriom we try to nail down why people are buying SD-WAN and what they see as the benefits. This year people see SD-WAN increasingly as a security tool." ▶

What would you expect to be the primary benefit of SD_WAN software or services for your networking operations?
(multiple responses allowed)
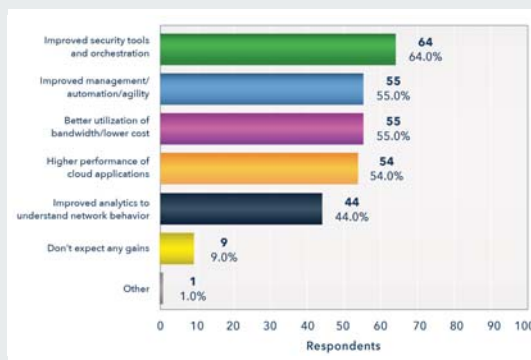
"If you look at a timeline of what's happening in the SD-WAN carrier managed services market, we saw triple digit growth in 2019 - a very healthy and robust market."

"We found that 64% of people we asked said the main benefit was to improve security tools and orchestration of security," observes Raynovich. "SD-WAN is also often seen as a way to compliment MPLS circuits or other private circuits and give you a cheaper way to leverage broadband or internet in a secure fashion and lower the cost of your bandwidth."
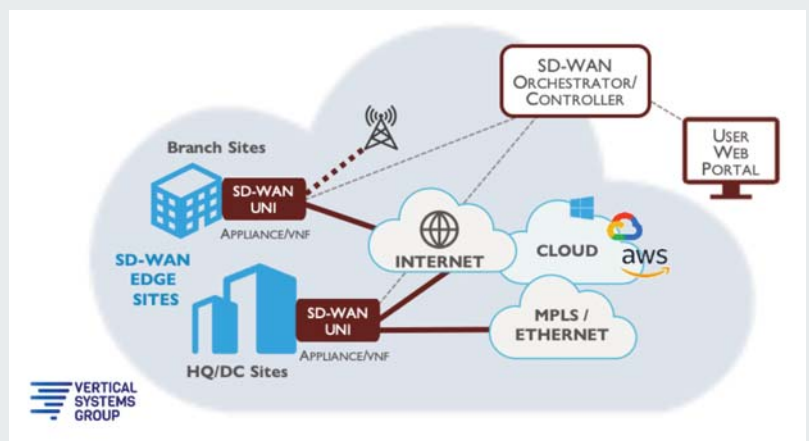
Erin Dunne, director of research services with analyst firm **Vertical Systems Group**, views the market through a slightly different lens: "We are focused on carrier-managed SD-WAN services," she explains. "We define that as a carrier-grade offering for business customers that's managed by a network operator, meaning you are paying a bill to a network services operator on a monthly basis."

"If you look at a timeline of what's happening in the SD-WAN carrier managed services market, we saw triple digit growth in 2019 - a very healthy and robust market," she says. "We saw that continue into January and February of this year. In March, we start to see the demand side stifle due to the pandemic. Installations couldn't get into the building, enterprise customers all went home, implementations are starting to either be deferred or cancelled. The hope that later in the year we'll start to see revenue kick back up and pipelines start to recover."

Shin Umeda, vice president and analyst, **Dell'Oro Group**, agrees that there has definitely been a major impact from COVID-19 on the market.

"If you look at it from the point of view of the access router market, the big branch office devices that form wide area networks, that has traditionally been dominated by a single vendor – Cisco," he says. "Now what we're seeing is SD-WAN and a more software-centric approach with many new vendors. Enterprises are really focusing in on the benefits of using a centralised software centric model - gaining more control of their network and really attacking the way the traffic patterns have changed. SD-WAN is not something that just emerged out of thin air, but it's an alternative to technologies that existed in the past." ▶

Carrier Managed SD-WAN Definition

SD-WAN Market Performance

SD-WAN Market 1Q20
- Double-digit Y/Y growth, but lower than recent history
- First of sequential revenue decline
- Results affected by supply chain disruptions caused by COVID-19 pandemic
- Revenue buoyed by subscriptions

2020 Outlook
- SD-WAN growth rate in 20-30% range, down from 64% in 2019
- Ongoing supply chain disruptions, scarce deployment resources, and delayed trials
- Reduced IT spending due to macroeconomic uncertainty
- Increased consolidation activity

SD-WAN Vendor Landscape

Cisco
Silver Peak
VMware
Versa
Fortinet
Aryaka
Huawei
Nokia

Market size and vendor revenue share based on trailing four quarters: 2Q19 to 1Q20

Flattening the Curve
How Tech Builds Business Resiliency and Enables Agility

SD-WAN Investment Plans:
Almost half expert no change, or accelerated investments

Q. How has COVID-19 impacted your organization's planning for major networking investments in WAN, including SD-WAN?

Source: Future-Proofing the Enterprise Network: COVID-19 Pandemic Impact Survey IDC, June, 2020

Shin Umeda
vice president
and analyst
Dell'Oro Group

Brandon Butler
senior research analyst,
Enterprise Networks
IDC
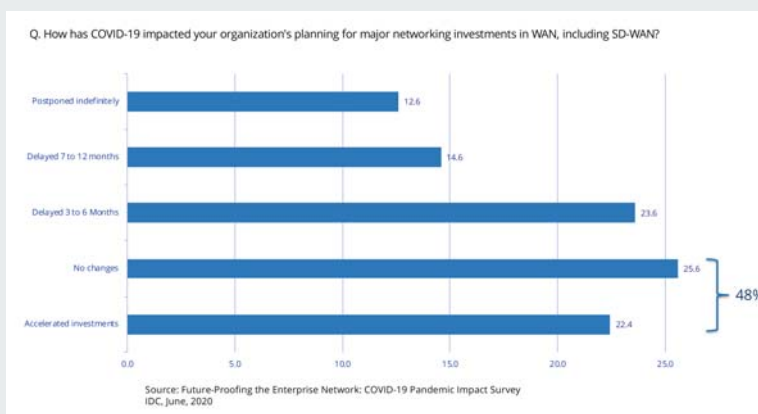
Brandon Butler, senior research analyst, Enterprise Networks, **IDC** believes that looking at the economic situation, the macro environment that enterprises are in right now is a journey from crisis mode into slowdown, through to recession and then somewhat of a return to growth and a new normal.

"The initial phase of the journey was around business continuity and cost optimisation," he says. "Now we're getting into the era of business resiliency."

"There are targeted investments that are going to be made for important technologies, and one of those is going to be around SD-WAN," predicts Butler. "We looked at investment plans for wide area networking, including SD-WAN, and how they have been impacted by the COVID situation. And the big takeaway for me from this is that SD-WAN is a relatively resilient market. Almost half of respondents are actually going to be accelerating their investments. We believe that SD-WAN could be one of those areas that could see targeted investment. We expect increased investment in cloud services. And in turn, we expect enterprises to increasingly invest in SD-WAN to be able to enable those connections to the cloud and to the data centre."

Scott Raynovich, chief technology analyst, Futuriom feels certain that the SD-WAN market, even with a major post-COVID bounce, is likely to see some major consolidation over the next few years: "You hear people saying there are 50 plus SD-WAN vendors out there, but it's really 10 to 12 of them controlling most of the revenue," he observes. "How are these other vendors going to survive?" he wonders. ▶

"If there are 40 companies trying to be bought out or have an exit and there's one happening per year it will take 40 years, so no doubt some will fail."

Erin Dunne
director of research services
Vertical Systems Group

Shin Umeda, vice president and analyst, Dell'Oro Group, notes that the market is a complex mix of companies: "Some are just software based, some are analytics based and moving into SD-WAN," he says. "It's hard sometimes to decipher exactly what companies are doing. It's difficult for smaller players to gain momentum and to gain the installed base to be able to sustain the business. That's perhaps why we are starting to see consolidation around a relatively small number. We're four or five years into SD-WAN as a market and not every company is going to be able to keep developing products unless they start to see some returns on their investment."

Brandon Butler, senior research analyst, Enterprise Networks, **IDC** points to some important merger and acquisition activity that the market has already seen, such as the recent acquisition of CloudGenix by Palo Alto Networks: "We expect that to continue with this long tail of smaller SD-WAN vendors," he forecasts. "We also expect to see other vendors move into this market, for example HP Aruba which is talking about building integrations between the enterprise campus and Wi Fi environments out to the branch."

Scott Raynovich, chief technology analyst, Futuriom also expects to see consolidation speed up: "If there are 40 companies trying to be bought out or have an exit and there's one happening per year it will take 40 years, so no doubt some will fail."

But is the COVID crisis ultimately good or bad timing for SD-WAN? Will the people who invested in it before the crisis hit be the first to emerge? Or is it unlucky timing that just as the market lifts off, it gets squeezed.

Brandon Butler, senior research analyst, Enterprise Networks, IDC is an optimist: "I'd say the glass is half full," he reassures. "This has been one of the fastest growing markets within the enterprise networking market that we've been tracking at IDC over the last couple of years. And while 2020 will dampen the market because of COVID, we believe that growth will return towards the end of this year. And then back to a fairly robust growth next year. I think some of the drivers that we see in terms of how businesses are responding in COVID times, relying more on cloud-based applications, for example, will also help to drive SD-WAN adoption into the future. Some businesses are actually going to be accelerating their investments with SD-WAN, because maybe they want to ensure those connections to cloud-based applications. Others are delaying or maybe postponing their investments as well. Compare it to something like the enterprise wireless LAN market, for example, which we expect to be hit harder this year."

So what of the nearly 30% of Futuriom's respondents who have not as yet made an SD-WAN move? Given all the advantages described by experts and analysts, what is holding them back?

"It's probably money," concludes Scott Raynovich, chief technology analyst, Futuriom. "Most technology investment cycles are driven by upgrades. Most of the people I've talked to, who are implementing SD-WAN are evaluating branch office routers. Do they buy a new router or buy SD-WAN, which does routing and a bunch of other stuff too. The people that are stuck are probably looking for budget to go through this upgrade cycle."

Brandon Butler, senior research analyst, Enterprise Networks, IDC believes there is also the power of inertia: "Some enterprises have a fat MPLS connection between their branch office and their data centre, and they're not heavily using cloud services," he points out. "They don't have a huge need for additional cloud services. We have similar survey data in single digits of those not interested in SD-WAN. And that's sort of why think of the profile. There's a certain class of the market that's just not willing to move on to a cloud-based management of their enterprise networking technology."

Building the remote contact centre of the future:
The new norm post-COVID means redefining home working

Although working from home was originally intended to be a stop-gap for many businesses during the pandemic, employers and employees alike are seeing the benefits. As Anne-Meine Gramsma, chief commercial officer at ContactCenter4ALL reports, Gartner predicts over 40% of all employees will continue remote working post-COVID and many businesses are seriously considering shifting suitable operations to 24x7 remote working, ushering in a new long-term way of working that surpasses 'traditional' office-based work and what we traditionally refer to as home working.

Remote working used to mean staff worked from home using standard office applications – often on personal devices and leaving employees lacking dedicated remote working solutions that ensure staff and customer communication and collaboration remain unaffected.

Home working redefined
During lockdown, businesses became more aware of the need for Unified Communications platforms to advance remote working and provide the enhanced technology that could offer these dedicated remote collaboration and communication features. Witness the boom in popularity for Microsoft Teams – the platform has seen 75-plus million users per day since lockdowns were established worldwide. This upward trend is not set to disappear post-pandemic.

Remote working – the new norm for happy employees
The new norm post-COVID is likely to encourage employees to work from a remote location. The objective is to embrace a strategy that is more efficient and effective for everybody – and that includes the customer. Yes, commute times and expenses are significantly reduced, and pre-pandemic research indicates employees who work from home are significantly more productive, but businesses must ensure they put in place effective, long-term remote working strategies that ensure customer service levels are not affected, but rather enhanced.

Redefining remote working means delivering uninterrupted first-class customer experiences
All that is typically required for contact centre agents to work effectively from home is access to modern contact centre software, a headset and a pair of monitors. But it takes more than this to deliver uninterrupted services to customers at the speed and level expected by today's consumers.

I've already mentioned the dramatic growth in usage of Microsoft Teams during this lockdown period. When a proven collaboration platform such as Teams is integrated with dedicated contact centre software, then businesses can stay fully accessible to customers, integrating collaborative platforms and capabilities for all remote agents to maintain the same high level of agility and flexibility.

Remote workers must be able to communicate with customers, using their channel of choice
Solutions must be able to handle omnichannel communications, in which remote workers can provide support on the customer's channel of choice depending on regional popularity. Integrating these communication channels into a single client unlocks further features to help deliver an excellent customer experience, such as warm transfers, enhanced call routing and colleague availability alerts.

Intelligent call routing a priority for remote working
Disparate customer service teams can pose challenges in delivering a consistent customer experience. Customer calls are often at risk of being routed to the first available agent instead of the most suitable agent for a specific query – increasing resolution times and customer frustration.

Features such as intelligent, skill-based routing help tackle this by ensuring customers receive first-time problem solving from the best available expert, ▶

The author is **Anne-Meine Gramsma**, chief commercial officer at **ContactCenter4ALL**

During lockdown, businesses became more aware of the need for Unified Communications platforms to advance remote working and provide the enhanced technology that could offer these dedicated remote collaboration and communication features

without compromising on answer times. All incoming customer calls, regardless of channel, can be routed through the same engine and assigned based on query type.

Remote working must not mean poor accountability

Another challenge to overcome with remote teams is ensuring employees are fully accountable and operating as effectively as their office-based counterparts. Here contact centre solutions can incorporate extra functionalities for real-time reporting, to ensure agents are operational and delivering a consistently high level of customer service.

For supervisors this means access to granular reporting dashboards, with performance metrics and data visualised through tools such as Power BI. This goes far beyond capturing standard details such as customer solve rates. Supervisors are provided with

heats maps of activity to identify particularly busy periods of demand on a daily and weekly basis, and can track average call-back times and queue times to identify and address potential bottlenecks where more agents are required.

The time is ripe to embrace the remote contact centre

Remote operations based on a platform such as Microsoft Teams and enhanced with dedicated contact centre software will ensure agents can effectively collaborate to provide the right service and skillset to the customer's channel of choice. Businesses without dedicated remote working solutions can today make the transition to large-scale remote working within weeks. Shifting to a fully remote contact centre offers benefits for businesses, employees and importantly customers alike – if a remote strategy is thoroughly evaluated, tailored to requirements and deployed effectively to ensure customer service levels remain high.

Disparate customer service teams can pose challenges in delivering a consistent customer experience

www.contactcenter4all.com

Network performance management evolving in a troubled world

With the ongoing pandemic and the continuing demand to upgrade networks to accommodate new technologies around 5th Generation mobile communications (5G), the Internet of Things (IoT) and artificial intelligence (AI), for instance, network performance management has never been more important.

The author is freelance technology journalist, **Antony Savvas**.

Antony Savvas considers how network operators can square the demands of performance, profitability and subscribers' quality of experience (QoE) as more of them work remotely during the coronavirus.

According to **Global Market Insights (GMI) research**, the worldwide network monitoring market will be worth US$5 billion by 2026, growing at 10% per year. In 2018, analyst house Gartner said the market was worth $2.1 billion and was growing at a compound annual growth rate (CAGR) of 16%. The extensive penetration of smartphones, cloud services and other connected devices is helping to drive the very steady growth, said GMI.

Key players in the network performance market include **Cisco**, **Polystar**, **Arm**, **Infovista, Ericsson**, **Global Wireless Solutions, Ribbon**, **NTT Data**, **Accedian**, **AppNeta**, **Broadcom**, **NETSCOUT**, **Colasoft**, **ExtraHop**, **Flowmon**, **Kentik**, **LiveAction**, **LogicMonitor**, **Netcracker**, **Nyansa**, **Paessler**, **Plixer**, **VIAVI** and **Riverbed**, among others.

Changing demand
Paul Carter, CEO of mobile network benchmarking firm Global Wireless Solutions, says of the situation: "The pandemic has made people more reliant on their smartphones and networks more than ever before. Lockdown measures and ongoing social distancing have meant that voice and video calling have all but replaced face-to-face conversations in most aspects of our work and social lives during the past six months."

> **"The pandemic has made people more reliant on their smartphones and networks more than ever before."**

He adds: "As we continue to adapt and change our connectivity habits, so too will the demands and challenges placed on operators. They must continue to be diligent and focused on maintaining their networks to ensure they are meeting demand and delivering on customer expectations."

Evolving problems
Sameh Yamany, CTO of network test, measurement and assurance technology vendor VIAVI Solutions, comments: "As more people work and study from home, remote connectivity is more critical than ever. Yet, service providers are challenged to shift resources, maintain connectivity and manage bandwidth as networks are strained to breaking point.

"This situation is creating both performance and security challenges, ranging from VPN over-subscription, unstructured and dynamic network demand, bandwidth limitations and remote application performance, to security vulnerabilities such as phishing attacks and ransomware. If not addressed, these challenges will significantly impact network performance and QoE (quality of experience)."

The pandemic is having a direct effect on how operators can maintain their networks too, says Yamany. "The ongoing pandemic requires network operators to take precautions to keep employees and customers safe. Remote connectivity, workflow automation and virtualised network testing and optimisation are key to enabling service providers to install, upgrade and troubleshoot subscriber services. This, while being socially responsible and allowing ▶

front-line technicians to optimise QoE and limiting their time in the field."

Yamany adds it is "critically important" for service providers to continue to optimise performance of networks to maintain remote connectivity and sustain dynamically changing traffic patterns, while simultaneously deploying tomorrow's 5G networks to enable greater speed and capacity. But the demands were further complicated by the trend to disaggregate network architectures, he says.

As a result, service providers require test and measurement tools and processes that speed and simplify deployment and activation – such as fibre monitoring, virtual activation, test process automation and remote instrument access – to allow technicians to not only spend less time in the field, but efficiently execute and troubleshoot a myriad of tasks and protocols while reducing the underlying complexity.

Yamany says: "Mobile network technology is progressing toward a fully virtualised 5G standalone (SA) architecture. Therefore, the entire ecosystem supporting the network must evolve accordingly, replacing hardware-based solutions with containerised virtual machines which can respond dynamically as the network shifts.

"As operators embrace 5G SA architecture, new virtualised assurance and optimisation technologies will be needed to enable seamless visibility across the entire network."

Mapping out network needs
Analyst house, Gartner recently published its *Market Guide for Network Performance Monitoring and Diagnostics*. Gartner confirms how new dynamic network architectures are impacting network monitoring solutions, as edge migration to the cloud and microservice / container architectures affect the efficiency of traditional monitoring stacks.

It says hybrid environments make it crucial for monitoring solutions to address an increasingly complex IT infrastructure, and noted the aims of network operations are aligning with security operations, which have to work together to ensure that a business network is performing securely and efficiently.

Gartner asserts that half (50%) of network operations teams will be required to "re-architect" their network monitoring stack due to the impact of hybrid networking by 2024. As a result, the analyst says network operators must future-proof their network monitoring solutions by investing in systems that provide visibility across edge and cloud connectivity, including cloud-native architectures.

Addressing CSP needs
The evolving cloud, edge, 5G, IoT and AI automation and connectivity needs of communication service providers to address market demands, means network performance management vendors have to tailor their product offerings accordingly.

In the case of Polystar, a provider of monitoring and analytics platforms to more than 100 CSPs worldwide, it recently merged operations with Elisa Automate – a specialist in network automation solutions – which became a new business unit within Polystar.

According to consultancy firm **EY**, automation, backed by artificial intelligence and pervasive analytics, has emerged as a "key driver" for the digital transformation of operator networks for the cloud-native and 5G eras. The adoption of these emerging techniques and technologies, says EY, is "critical" to securing the benefits of transformation programmes and enhancing agility, so that operators can optimise customer experience and accelerate business efficiencies.

Insights and data
Mikael Grill, CEO of Polystar, says of the merger, "Our joint offers are already delivering new customer benefits, by combining network analytics insights and data with process automation to ensure more effective operations."

With 5G, **Samsung Electronics** has literally taken automation to another level, with its new drone-based antenna configuration measurement solution for networks. The solution offers operators a simplified way to more efficiently manage cell sites, improve employee safety and ultimately optimise network performance.

With the system, an engineer on the ground uses a smartphone with a remote control application to fly a camera-equipped drone that captures photos of the antennas installed on a building's rooftop, instead of having to climb up there with equipment in a process that can take hours. The drone view and data is accessed via the engineer's smartphone and then transmitted to a cloud server within seconds.

The deep learning-based AI solution instantly verifies the rotation and tilt of antennas, so that engineers can determine if they are installed correctly at predefined optimal angles. Samsung says the whole process can be accomplished within 15 minutes, starting from flying the drone to the delivery of measurement results to the smartphone and cloud for analysis.

So while the current situation the communications industry finds itself in is complicated, the challenges are clearly defined and there are solutions out there to help it overcome them for the benefit of customers.

Mikael Grill
CEO
Polystar

Paul Carter
CEO
Global Wireless Solutions

Sameh Yamany
CTO
VIAVI Solutions

Making your network problem-free: Simple in theory, demanding in practice

Gorka Esturo, CTO Office member at Polystar tells VanillaPlus why a single, unified view of your network is the key to unlocking effective network performance management.

> **The network should be a problem-free asset that allows customers to enjoy and experience your services**

VanillaPlus: Why is network performance management so important for the telecoms industry?

Gorka Esturo, Polystar: The network should be a problem-free asset that allows customers to enjoy and experience your services. They should not notice any issue or degradation. Since the network is the most important asset, it's essential that it delivers. To achieve this, you need a comprehensive Network Performance Management (NPM) framework that spans all use cases and domains, providing both macro and micro views of your estate.

So, when we talk about NPM, we mean a focus on the capability of network systems to deliver according to expectations. When you acquire equipment, you do so based on certain requirements and assumptions – measuring performance validates that the solution does do what it should, according to specifications and agreed parameters. Systems in telecoms network must deliver – not just operationally, but also for customers.

VanillaPlus: What steps do operators need to take to optimise performance management?

GE: Put simply, you need to know what you are talking about! You need the capability to see what's happening in the network through continuous observations, so that you can make an accurate diagnosis – and then consider the best way to ensure that the right corrective measures can be taken.

VanillaPlus: Why is this different from other approaches?

GE: The information that fuels NPM comes from the network. This is important, because it doesn't require active campaigns or data capture programmes – such as drive tests – which, in turn, require resources and incur costs. Such actions only create snapshots, capturing data at a certain time.

NPM, gives you a single view, 24x7, across the whole network – and ensures vendor independence. All network systems, irrespective of the supplier, have reporting and monitoring interfaces that provide key data. We collect, aggregate and process this data, generating a complete view of network operational performance, regardless of the origin of the solutions in your network.

VanillaPlus: How do you know that what you are collecting is accurate?

GE: It's a question of trust. It is true that ▶

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Gorka Esturo
CTO Office member
Polystar

sometimes you may obtain incorrect or invalid data. Real NPM means that you must be able to spot such errors and identify them – deviations from the norm must be filtered. Validating data quality is essential – and anything that doesn't offer this capability will provide false reports. Data reliability can never be entirely guaranteed – but our solutions have the intelligence to flag errors, ensure they are eliminated, while delivering consistent performance.

VanillaPlus: How does this lead to a macro view of network status that you mentioned?

GE: You have a ubiquitous eye – everywhere, all the time. This means that, through time, you can map trends and see how the network evolves. This can be combined with other sources of data to build the foundational overview you need. As a result, you gain a comprehensive picture, that also evolves with the real situation.

VanillaPlus: What else can you do with this data?

GE: We feed the clean data to systems that can take remedial and corrective actions, such as those from our automation products delivered by Elisa Automate. This creates the opportunity to introduce operational and assurance automation to all domains in the network – going into the core, transport, IMS and beyond. Elisa handles the automation, while we provide the data to drive decision-making.

And, it's not just classical OSS (operations support system) data. We capture data from any relevant source. Fault management information, alarms from other systems, and so on. A key advantage we bring is that we can easily and quickly spin-up new interfaces and resource adapters to collect

new data and integrate this with the overall view – enriching it and increasing the value of the network overview / picture.

VanillaPlus: Looking to the future, what will be the impact of virtualisation, transformation to the telco cloud and 5G?

GE: We're kind of agnostic to virtual resources – so long as we have a source of data, we can work with it! There's no challenge for us here as such, so it's easy for us to support an operator through its virtualisation journey.

The problem with 5G is that it will increase the volume of data exponentially – consider the density of radio cells that's required for 5G coverage, for example. Not only will we have the main services, there may be new dynamic services enabled by slices. And, there will be new connected devices, so how do you tackle this?

This demands hugely efficient storage and processing capabilities – the ability to choose the right indicators from the data streams available is essential here. You can follow the standards to a certain extent, but in the end you must also have the expertise to make appropriate judgements – and that's hard. You can't acquire this overnight – but our deep experience enables us to adapt easily to the new dynamic world enabled by 5G.

VanillaPlus: Can you share some examples from your experience in working with operators?

GE: Well, all operators are different. They want to see different things – so creating the right dashboards for each operator is essential. They need to see what they need to and be able to take the right action. Moreover, the trends for each will be different, so you need to be able to make predictions based on different data sets tuned to each case.

The capability to raise alarms based on trends and weighting criteria – which can be dynamic, based on what happens – is essential. These alarms must be then sent to the right place, which will differ from operator to operator. So, the problems are the same, but the environment is different in almost every case.

VanillaPlus: What key benefits will operators obtain?

GE: The capability to measure independently, continuously and automatically the status of the network and its performance – dynamically and across the entire network and service footprint. It's quite simple really – but in practice very demanding!

NPM is well-established, but it changes all the time. It's essential not to overlook the data you already have, because it provides invaluable insights to protect your reputation and assets – and support your growth and evolution.

> **"In the end you must also have the expertise to make appropriate judgements – and that's hard. You can't acquire this overnight – but our deep experience enables us to adapt easily to the new dynamic world enabled by 5G."**

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Smart capital: Keeping telecom network operators ahead of the connectivity curve

COVID-19 has supercharged the demand for connectivity and increased the financial challenges for the telecom providers and technology partners who need to supply it. With a growing number of people set to continue working remotely, better connectivity for homes is now essential, says Amy Wettenhall, associate director of the Technology, Media & Telecoms (TMT) team of Macquarie Specialised Asset Finance.

Countries also need to move quickly to fully exploit the benefits of 5G and the Internet of Things (IoT), as this technology could increasingly drive gross domestic product (GDP) and greatly improve profitability and efficiency for individual businesses and larger enterprises alike.

For organisations able to utilise this technology through more advanced connectivity, operational cost is reduced, efficiency improved, data analytics may be scaled in a real time agile way and customer centricity will be enabled like never before. For instance, by employing IoT, instead of having to wait for a piece of equipment to fail and then have it repaired, that equipment can itself warn about imminent problems and arrange for the necessary overhaul. ▶

The author, Amy Wettenhall, is associate director of the Technology, Media & Telecoms (TMT) team of Macquarie Specialised Asset Finance based in London. A TMT industry expert, Amy turned her passion for technology & commercial management into delivering smart capital products; to support the TMT sector delivering the technology of tomorrow faster, and more efficiently. Prior to this Amy held executive positions as commercial director of Ericsson's Market Area in Europe and Latin America and as head of Commercial at the BBC — with more than 15 years' experience in the Media, Telecommunications and Transport sectors.

There is a growing recognition that the only way to deliver the widespread connectivity required, is with cross-industry co-operation, competition in the market, and an end-to-end vision shared by industry and government alike. The various elements of digital infrastructure simply do not work in isolation – their combined capability is not only contingent on one another, but essential to create the network itself.

Finding the investment

However, in addition to the necessity of this industry-wide coordination and shared mindset, firms are struggling to find the necessary investment. Operators are constrained with their existing capital commitments and mounting pressure on their balance sheets. Conversely suppliers are saddled with legacy research and development costs, making the ability to offer new 'CAPEX light' business models problematic.

As well as selling their services to consumers at home for entertainment and, increasingly for business use, they are also having to meet rapidly growing demand from enterprises. Most consumers of technology are used to paying for products and services on a subscription, or OPEX basis only.

Across all sectors, there is a discrepancy between new technology becoming available, the demand for it, and the time it takes to achieve a return on the investment required to offer it. For instance, providers need to offer 1Gb bandwidth for domestic customers, but then rely on monthly subscriptions to pay for the large initial capital outlay – thus putting their balance sheet under considerable pressure.

In many cases technology suppliers have been forced to offer significant discounts, simply to get to an acceptable price point for their customers. This is where smart capital can help.

To roll out 5G, operators need a substantial volume of capital and technology partners need to be paid within a reasonable time frame – almost certainly less than the time it takes for operators to recoup their investment from monthly payment plans.

Quicker route to healthy balance sheets

Moreover, the operators need these funds allocated as efficiently as possible, in other words employing a smart capital solution. This allows faster access to the latest technology for the operators and a quicker route to maintain healthy balance sheets.

The result could be commercial success for them – and more competitive, advanced, and agile economies globally.

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In many cases technology suppliers have been forced to offer significant discounts, simply to get to an acceptable price point for their customers

Intelligence at the Edge

5G has been steadily bringing the benefits of speed and scale to the forefront, and is clearly going to change the world of communication in ways never before realised. But who is going to benefit from all these investments? When one reads about 5G in mainstream media, it is often misleading, says Dheeraj Remella, chief product officer at VoltDB. There is a lot of talk about 5G and how it provides blazingly fast internet on mobile devices. At times, as with many new technologies, facts give way to hype and sensationalism. To help clear that up, let's start by clarifying a few things about what 5G is.

5G has many components that will be different from 4G including the radio, network core and the various bands. Within the context of this paper, we will address the bands of 5G.

5G operates across three bands: low band (< 1GHz), mid-band (3 GHz to 24 GHz) and high band (> 24 GHz, also known as mmWave).

- While the low band provides higher coverage, the speeds are less than expected from LTE (Long Term Evolution to 4G).
- The mid-band is where most operators are operating today, between 3.3 GHz and 3.8 GHz. More frequencies are getting opened to the 5G usage in the mid-band. The term mmWave refers to the spectrum above 24 GHz, which opens up much higher speeds and lower latencies.
- The higher frequencies have an inherent constraint

on the distance the signal can travel and are susceptible to interference. These constraints restrict the applicability of the technology across vast areas.

Enterprises are the primary beneficiaries

When you put together the facts that mmWave offers - the fastest connectivity at the lowest latency, and the 5G objectives of low latency, connection density, and support for machine-type communications, it's evident that enterprises will be the primary beneficiaries of 5G advancements.

Connection latency of 1 millisecond, while supporting a connection density of 1 million devices per km2, is necessary to accelerate business process digitalisation in many industries. 4G connectivity of 2000 devices/km2 is not going to be sufficient to achieve this objective. ▶

Business process transformation

Let's take a more in-depth look into what it takes to accomplish business process transformation. A high-level process overview could look like this:

- Create digital twins of the physical assets. The initial stage of creating digital twins is to create a state machine that stores the state changes of an asset.
- Use this state change information to analyze and predict future changes.
- Determine what actions can address these predictions, i.e., prescriptions.
- Apply the predictions rules and prescriptions rules to the state change events to decide the best action.
- Refine these predictions and prescriptions with updated information on an on-going basis.

These steps map the evolution of the usage of data as well. First came databases to store data for querying. Then came big data for analytics: predictive and prescriptive. Today's demands for speed and volume require a data platform that makes decisions — leveraging the state database and intelligence from big data - to drive actions.

Predictions can be mainly of two types:

1. Capitalisation opportunities
2. Threat prevention opportunities

Prescriptions can range from presenting the best offer to a customer, to picking the right next step in an industrial automation setting or even preventing a
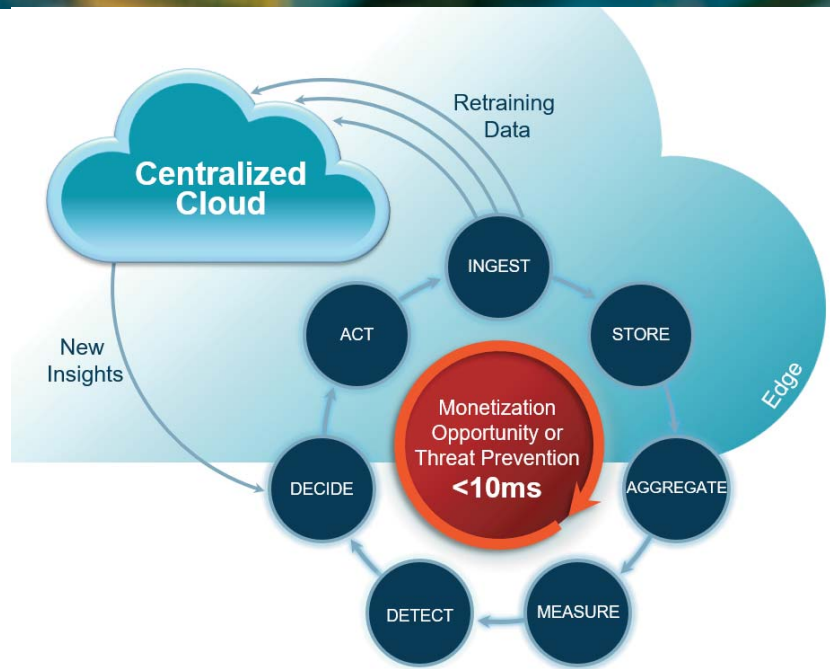
network intrusion. There is real differentiating value in implementing these prescriptions within milliseconds of detecting the prediction.

5G connectivity has ushered in a redefinition of real-time and data-value. Real-time is now in milliseconds. But, more importantly, the value of data has moved from just state recording and analytics to in-event decision making. This shift in the data-value definition requires a data platform that addresses the value extraction process's entirety. ▶

"The goal remains the same; to deliver the lowest latency journey from an event to a responding action."

To fully utilise data, there are two cycles of processing:

1. The maintenance of state and decision-making processes together
2. Big data analytics for predictive and prescriptive insight generation

As the diagram shows, the fast cycle feeds the slow cycle with new retraining data, and in turn, the slow cycle feeds the decision-making process with new insights. This separation of the slow cycle and the fast cycle brings us to this paper's main point. Why does one need to move intelligent decision-making to the

edge? Simple: To deliver the lowest latency journey from an event - single or complex - to a responding action.

Decisions close the source

A system's decisions need to be close to the source of the events. This proximity enables the system to complete the round trip required to create a meaningful interaction. Decisions in the cloud are too far away from the source and actors. The round trip to the data centre, alone, will make the decision moot. On the other hand, the decision cannot be made inside devices such as gateways since this makes the decision contextually too narrow and will render it inconsequential.

There are many examples of the monetary value hidden in the first few milliseconds from an event taking place. For example:

- A credit card company was able to reduce fraud by 83% by applying 1,500+ rules on every transaction within 30 milliseconds.
- A telecom operator increased their offer acceptance rate by 253% by presenting the best offer at the moment of engagement - deciding what to show and then showing it in under 10 milliseconds.

But in the end, the benefits depend on the application and the organisation's data usage maturity. An Internet Service Provider (ISP) can detect and thwart 100% of the distributed denial of service (DDoS) attacks on their customers' sites. An AdTech security company can identify bot publishers in less than 10 ms and prevent them from stealing campaign funds by not bidding on their real estate.

Early forms of transformation

These examples are some of the early forms of digital transformation. Several industries are still misperceiving digital transformation as just translating existing processes into their digital versions. These are the cases where, although the original intent was to make it a little better, one ends up with a far worse situation (Look up Verschlimmbesserung - It is one of these German words that captures a complex scenario in a single word). Effective digital transformation requires a rethinking of the existing business processes to do the right thing in the right way instead of a business-as-usual approach.

Industry 4.0, with its reimagined business processes due to better connectivity and fast communication, is a seemingly obvious recipient of 5G benefits. But a low latency communication is not that beneficial when the service that is sitting in the middle of this communication round-trip is situated far away or ▶

The author is **Dheeraj Remella**, chief product officer, VoltDB

takes too long to make decisions. Multi-access edge computing (MEC) is a ripe space to address the real-time needs for business process transformation and exploit the connectivity improvements.

Multi-access edge computing

Historically, organisations used MEC for data thinning and aggregation but not much for process automation. It is becoming apparent now that with modern hardware, next-generation MEC can drive automation onsite or at least at the network edge. Edge computing is going through the same transformation as physical computing went through to cloud computing. In telecom, Advanced Telephony Computing Architecture (ATCA) gave way to Virtualised Network Functions (VNFs), which in turn gave way to Containerised Network Functions (CNFs).

Intelligence is moving from firmware within devices to software for commodity hardware. The need for agility and an ever-increasing pressure to shrink the time to market for new solutions is driving this shift to software-enabled everything.

Next-generation MEC brings the scalability of distributed computing and low latency of gateway-less communication over private 5G. The software transformation brings the agility of applications (or microservices) and data running in containers. But there is a caveat here. There are conflicting forces in action. Microservices' dictum is to separate business logic and data. Teams that take that message verbatim end up with applications that depend on pure data storage technologies. But for this combination of applications and storage technologies to work together, data needs to be moved to the processing layer, i.e., the application microservices. This need to transfer data to a separate processing layer is in direct contrast to one of container-based architecture's constraints: low network bandwidth allowance.

To address this misaligned architecture, one needs to rethink the bifurcation point away from orthodox business logic and data standpoint.

The data is of two types:
1. Business-related data
2. Application state-related data

Similarly, the business logic is of two types:
1. Application state control logic
2. Data-driven decision-making logic

Once these second-level details come in place, it becomes clear that to utilise the network bandwidth optimally, one will need to process data within the data storage platform. This finer-grained separation of concerns will eliminate expensive failure handling and resilience management in catastrophic failure, sub-optimal network usage.

VOLTDB

Conclusion

In conclusion, moving intelligence closer to the event source will become the de facto pattern of fast data solution building. But done naively, the efforts will result in a Verschlimmbesserung situation! The definition of the edge itself will, of course, vary from application to application. Communication service providers are actively involved in the network edge by colocating their data centres with public cloud vendors' edge data centres; think of Verizon's partnership with AWS Wavelength or AT&T's collaboration with Azure Edge Zones. In industrial automation, the edge is at a plant level while in autonomous cars, it is in the vehicle.

Regardless of the edge definition, though, the goal remains the same; to deliver the lowest latency journey from an event to a responding action and, in doing so, reap the tangible business benefits of intelligent decision-making at the edge.

VoltDB empowers global organisations to leverage emerging 5G latency standards to power new revenue opportunities, transform their business and operational support systems, or develop strategic integrations for their enterprise customers. The platform instantly derives value from anomalous events captured across multiple streams of fast data, directly influencing in-the-moment monetization, preventing digital fraud, and supporting digital transformation initiatives. VoltDB is purpose-built to address application-specific scale and latency challenges and augment previous big data and messaging investments to enable businesses to evolve from big data analytics to fast data decisions. For more information, please visit **voltdb.com/**.

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Gartner identifies emerging artificial intelligence trends in the telecom industry

The distance between how far artificial intelligence (AI) techniques and technologies are from development to mainstream adoption is a key reference point for planning upcoming product portfolios and roadmaps in the telecoms industry. Peter Liu, research vice president at Gartner says, product and services leaders must have a solid understanding of not only the realistic adoption times and a strong prediction on the subsequent impact of AI technologies on the industry.

In the latest Gartner analysis on AI and its impact on the telecom industry, we have identified the latest overarching themes and trends in the space.

Conversational AI takes hold

Understanding the interests of the customer and delivering an above and beyond customer experience is paramount to the telecoms industry. Telecoms businesses need to improve the methods in which they deal with customers on a day-to-day basis, with the aim of enhancing experience, improving care quality and overall creating a much deeper level of customer understanding.

Successful customer management includes not only caring for existing customers, but predicting retention rates, forecasting future buyers and estimating when they might buy, who they might choose and what they may be willing to pay. Using this information, the most successful businesses will then offer existing and future customers, what they want, when they want it.

Implementing technology to do this can be complex, when you take into account the volume of data and context required to enable businesses to arrive at actionable conclusions. We believe that conversational AI technologies such as chatbots and virtual assistants are driving forward this new way of interacting with customers.

Chatbots and virtual assistants are able to continuously translate customer interactions into actionable insights through machine learning (ML), augmented analytics and natural language processing (NLP).

Intelligence augmentation to empower decision-making

Augmented intelligence, which can provide executives with sophisticated models as a basis for short and long-term decision making, is starting to gain traction in the telecoms industry. Where real life experts may have made company decisions alone in the past, new AI technology is trying to replicate the knowledge and reasoning methods of these experts. The AI can then offer assessment and recommendations for any given problem.

This is especially interesting in the telecoms industry where speed and accurate decision-making is so often vital.

AI for operational efficiency

The second trend is leveraging AI to achieve operational efficiency and automation in the telecoms industry. As new technologies and services like 5G and various network slicing software are deployed, communications service providers (CSPs) networks have become more complex.

To address this complexity, CSPs need to increase the intelligence of short and long-term network operations and planning. Relying on traditional human intervention here is not enough – intelligent and real-time closed-loop automation can have a hugely positive impact.

AI can monitor patterns by analysing large volumes of network data in real-time and detect/predict events/act on them automatically. This not only ensures a robust and automatic network operation but also runs on lower operational costs and minimises the risk of human error. ▶
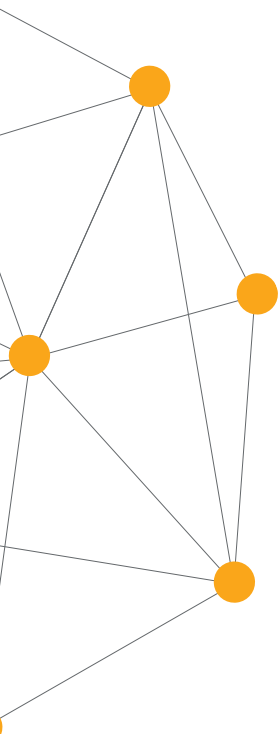
The author is **Peter Liu**, research vice president, **Gartner**

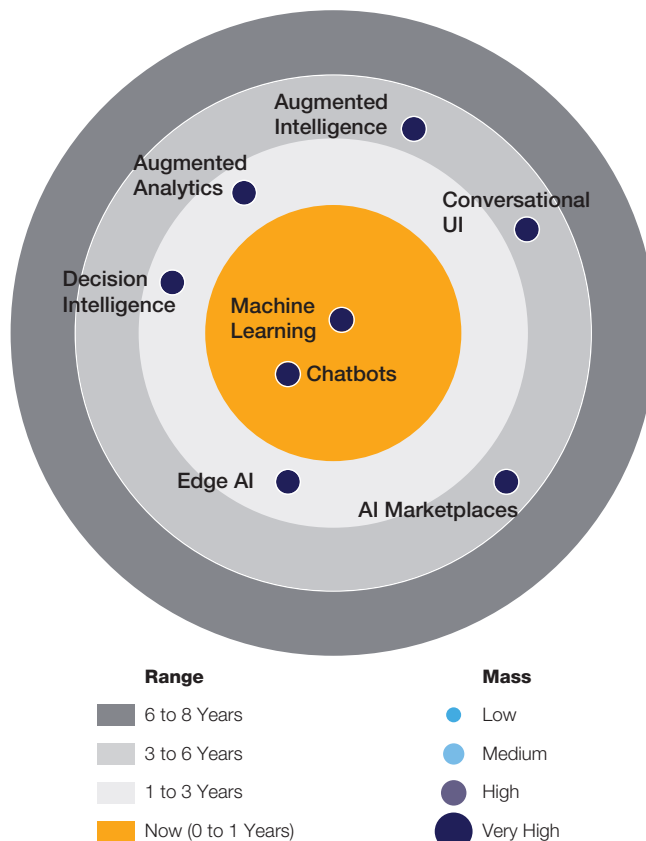## Edge AI is encroaching on the cloud

Finally, the last trend is around edge AI. The velocity, variety and volume of data captured by endpoint devices are facilitating a rapid expansion in demand for advanced AI within various 'edges'. The increasing use of edge devices to aggregate sensor data is spurring the growth of niche edge AI vendors who are focused on improving the management of on-site data, and the insights gleaned from this.

Edge AI also offers immediate financial impact such as reducing cloud, network transport and storage costs. In response, we have noticed that cloud service providers are extending their reach into customer premises and private clouds.

We expect other providers such as communications platform-as-a-service (CPaas) and content delivery network (CDN) vendors also entering the market to provide their version of near-and far-edge value.

Product and services leaders need to structure AI solution proposals by viewing CSPs' digital transformation through the following lenses: improving customer experience, operational excellence and sales/marketing activity. In addition, decide where to use various types of AI in network operation and management segments and identify how human skills and AI can work together.

Emerging Technology and Trends Impact Radar
Artificial Intelligence in Telecom Industry

Augmented Intelligence
Augmented Analytics
Conversational UI
Decision Intelligence
Machine Learning
Chatbots
Edge AI
AI Marketplaces

Range
- 6 to 8 Years
- 3 to 6 Years
- 1 to 3 Years
- Now (0 to 1 Years)

Mass
- Low
- Medium
- High
- Very High

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WHERE IS IoT NOW?

UPCOMING EVENTS

MVNOs World Congress Virtual Event
15 – 17 September
https://tmt.knect365.com/mvnos-world-congress/

BIG 5G Event 2020 Virtual Event
22-24 September
https://tmt.knect365.com/big-5g-event/

FutureNet World Virtual Event
22-23 September
https://www.futurenetworld.net/

UC EXPO Virtual Event
30 September – 1 October
https://www.ucexpo.co.uk/ucexpo/en/page/ucexpo-home

Global Carrier Billing Summit 2020 Virtual Event
6 – 7 October
https://tmt.knect365.com/global-carrier-billing-summit/

Digital Transformation World Series Virtual Event
October 7 – November
https://dtw.tmforum.org/

Telecoms World Middle East Virtual Event
13-14 October
https://www.terrapinn.com/conference/telecoms-world-middle-east/index.stm

Broadband World Forum Virtual Event
13-15 October
https://tmt.knect365.com/bbwf/

IoT Tech Expo North America Virtual Event
4-5 November
https://www.iottechexpo.com/northamerica/

5G Briefing Frankfurt, Germany
4-5 November
http://www.5gbriefing.com/

IoT Tech Expo Europe Amsterdam, Netherlands
24-25 November
https://www.iottechexpo.com/europe/

NGON & DCI World Barcelona, Spain
1-3 December
https://tmt.knect365.com/next-generation-optical-networking/

How successful was your IoT project?

Fully Successful	**12%**
Mostly Successful	**30%**
Mostly Unsuccessful	**40%**
Not Successful	**18%**
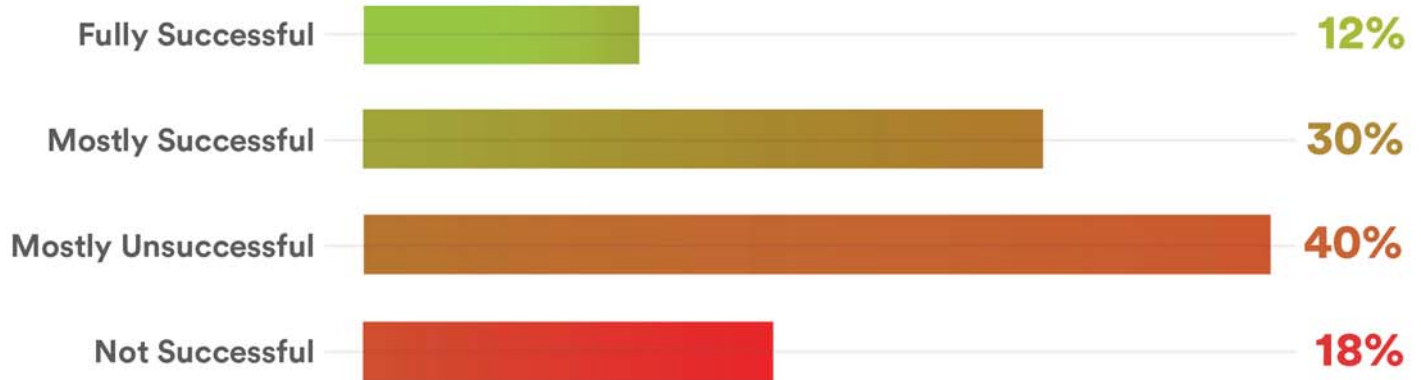
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