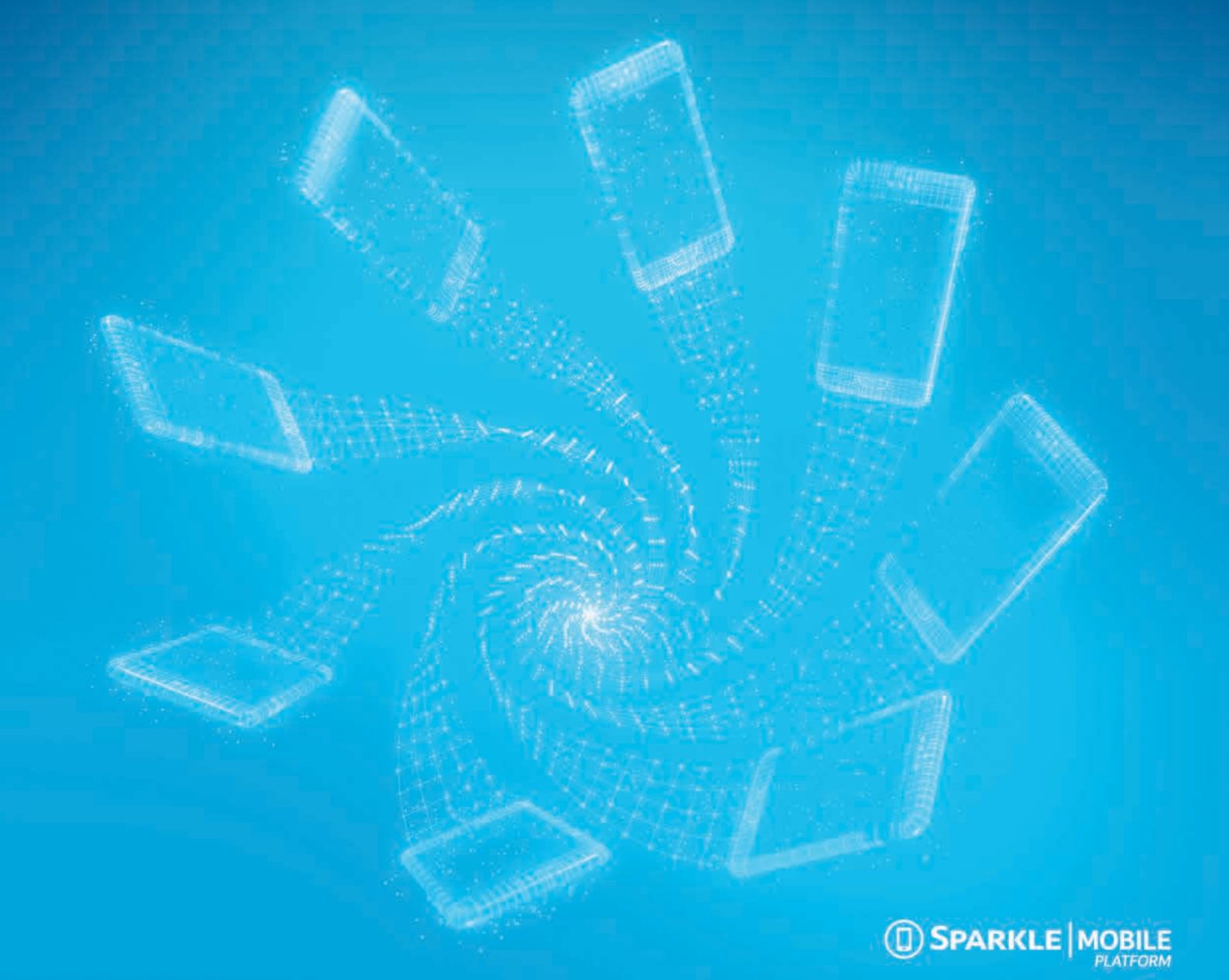
Q3 2017
Volume 10
Number 3

south asian wireless COMMUNICATIONS

For wireless comms professionals in the Southern Asian region

- How to profit from remote and rural networks
- Connecting the region's education sector
- Developing architecture for the web-scale era



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May 2017: Movicel Angola selects Sparkle SMS Booster to protect its network and generate new revenues.

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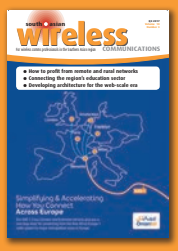

Q3 2017
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Omantel Wholesale is Oman's leading integrated telecommunications services provider. It specialises in delivering ultra-low latency networking that enables its partners to connect and grow their businesses around the world.

Oman is one of the most connected places on earth and this gives Omantel's partners a unique hub at the nexus of North, South, East and West.

Omantel finds the simplest and easiest way for its partners to access some of the most challenging and high-growth markets in the world. Its business is about being open and easy to work with so that its partners can take full advantage of its global infrastructure and unique geographic position.

It has investments in 20+ submarine cable systems and offers direct and rapid access to the developed markets of Europe, Asia and North America as well as unique destinations like Iran, Pakistan and Yemen.

When partners choose Omantel, they gain simple, trusted and high-performance connectivity.

For more on Omantel, turn to page 12

For more information, please visit: www.omantel.om/wholesale

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Omantel

KADIUM

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Digitata Networks expands existing offering to enable a subscriber-centric view of mobile networks

Digitata Networks offers a range of software products developed to control, monitor and automate all major mobile technologies (2G, 3G, 4G and WiFi) across the different domains within a telecommunications network (Subscriber, RAN, Core and TX). These vendor-agnostic products include Configuration Management, Performance and Revenue Monitoring and Asset Tracking. With the recent acquisition of NetTrax from RanWorx Solutions (rebranded to NetCE), Digitata Networks is able to also offer Mobile Network Operators a subscriber-centric view of their network performance.

"The synergies between the newly-acquired NetCE and Digitata Networks' existing solutions ensure a combined offering that will be of great benefit to our current and future customers. The addition of NetCE gives Digitata Networks the subscriber component that the Digitata group is proud to support in all of its product streams."

Philip Korf, **CEO: Digitata Networks**

About NetCE

Customer Experience App
NetCE is a Customer Experience app residing on subscriber handsets. It monitors the customer's experience of the network and reports back to a centralised server for further analysis by network engineers.

Passive Monitoring
For subscribers, the app runs in passive monitoring mode. It collects data about call quality, call drops etc, in the background without the subscriber doing anything. This data is then sent to a centralised server.

Online Analysis
Data collected from subscribers can be viewed and analysed by an engineer on an online portal. This includes reports on the different events in tabular, graphical and geographical formats.

Crowd Sourcing
If many subscribers install the app, the operator essentially has a team of network quality testers. If multiple people in the same area experience similar problems, engineers can react quicker to fix the issues.

Drive Tests / Active Monitoring
Engineers can use the app in active monitoring mode for drive tests. Data is collected along the route and uploaded to the centralised server for analysis of problem areas.

Customer Complaints
Customers can also log specific complaints directly on the app, and receive feedback on these complaints too.

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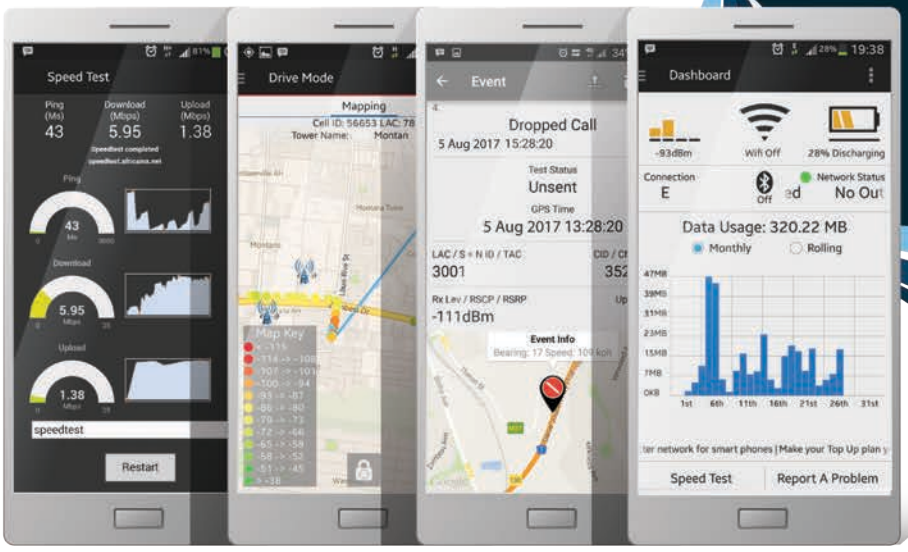


Contact us at
info@digitata.com

NetCE

Regional operators showcase telecoms tech with Chinese help

ZTE has been spearheading various telecoms innovations across South Asia with several milestone achievements announced over the last few months.

In early August, Singtel said it will deploy Massive MIMO technology on its LTE-A network to enhance mobile data speeds by up to 200 per cent at special events.

Working with Ericsson, Huawei and ZTE, it installed a 2.6GHz Pre5G Massive MIMO network in the Marina Bay area where more than 150,000 people were expected to gather and generate high data traffic during Singapore National Day on 9 August. Other deployments are planned for the Singapore F1 night race and the New Year countdown event.

ZTE said Pre5G Massive MIMO is ideal for guaranteeing service quality in high-density scenarios. Following the site commissioning at Marina Bay, the company said: "The Pre5G Massive MIMO cell witnessed a sharp increase in throughput, shared the traffic volume of super-busy macro-station cells, and significantly improved the network speed on user terminals as well as the user experience, thereby increasing the overall service throughput in the region."

ZTE believes Massive MIMO is arguably the "most important" 5G technology. Although the 5G standard has yet to be set, by using core 5G technologies that have met commercial conditions on 4G networks, the firm claims its solution helps operators achieve smooth evolution from LTE networks, continuous improvement of network performance and user experience, and innovations in business models and services.

Singtel plans to deploy Massive MIMO technology on its LTE-A network at special events such as the New Year celebrations.

The company added that by the end of 2016, Pre5G-related products and solutions had been deployed on more than 60 networks in more than 40 countries. As well as Singapore, other South Asian countries that are leveraging Pre5G technologies include Malaysia, Thailand and Indonesia.

The latter country has also seen its first FDD-LTE Massive MIMO field trial. In mid-July, ZTE said that it had carried out the successful tests with Telkomsel in Eastern Indonesia.

It claimed that compared to existing 2x2 MIMO FDD LTE networks, the field trial achieved an almost four-fold increase in data throughput to 468Mbps. The partners used commercially-available TM9 handsets and MiFi units in a simultaneous four handset/MiFi configuration with 20MHz bandwidth. They said the test demonstrated the capabilities FDD-LTE Massive MIMO to enhance the performance of LTE networks without a change in user terminals.

For the next phase of trials, ZTE and Telkomsel will verify other technical aspects such as coverage, mobility, and interference.

Earlier in July, Ncell Axiata announced that it had evolved its traditional Advanced Telecom Computing Architecture (ATCA) into virtualised architecture. Using ZTE's virtualisation technology, the operator has developed a virtual subscriber data management (vSDM) platform that is said to feature advanced distributed architecture, hierarchical storage and multi-level protection, as well as cloud.

According to ZTE, the new platform enables Ncell Axiata to: increase cost savings on hardware investment and operations; establish a more intelligent and flexible telecoms network with high stability; helps accelerate new task deployment; and enhances user experience.

Meanwhile, across the border in Bangladesh, Banglalink claimed it had successfully commercialised the world's largest vSDM platform. At the end of May, ZTE said 60 million subscribers had been migrated to the new platform which features "advanced" virtualisation technology to achieve hardware and software decoupling, and a large-capacity database to integrate multiple network elements.

The firm added that the platform uses generic COTS hardware to achieve "flexible and elastic" on-demand deployment, saving investment and O&M costs for Banglalink. As a result, ZTE said the operator will be able to meet continuous network evolution and service needs such as 5G and IoT.

In Thailand, ZTE won the bid for three networks in True's beyond-100G backbone WDM project. The backbone networks will provide valuable functions to the operator such as ultra-large capacity OTN cross-connection, intelligent scheduling of optical networks, and ultra-long-distance transmission. ZTE reckons this will "greatly improve" True's network capacity and effectively promote its service growth in 3G/4G, fixed network, broadband and other fields.

The deployment features the 100G WASON (WDM automatic switch optical network) solution, PM-QPSK/PM-16QAM and coherent reception technology, and third-generation SD-FEC (soft decision forward error correction). ZTE says all this achieves transmission without electronic relays in the entire network, thereby greatly reducing costs.

The company adds that SDON (software-defined optical networking) technology makes optical network transmission more intelligent, effectively shortens the service deployment time, and significantly improves the efficiency of network scheduling.

Southeast Asia's first commercial NB-IoT network goes live

Singapore's M1 says it has launched Southeast Asia's first commercial nationwide NarrowBand-IoT network.

M1 now joins a select group of operators globally who have commercially launched NB-IoT networks. According to an update from the GSA (Global mobile Supplier's Association) issued in July, they include Telus Canada, T-Mobile, Telia Norway, Vodafone Spain, Deutsche Telekom and Vodacom South Africa.

In Singapore, M1 says solution providers and businesses can now develop and deploy new IoT-enabled solutions such as smart energy management for buildings, environmental monitoring, asset tracking and fleet management, to name but a few.

The company cites local utility firm Keppel Electric as an example. As part of a collaboration, Keppel is piloting the NB-IoT *Energy Management Meter* which is expected to enable it to deploy power and water meters to its customers' premises faster and more cost-effectively.

Keppel Electric GM Janice Bong says: "With the full liberalisation of the electricity market expected in 2018, the launch of M1's NB-IoT network is a timely development for us and our customers, who will get to enjoy easy access to useful real-time consumption data at a lower cost. We also see the potential of such implementations helping consumers to manage their electricity use more prudently."

Telkom 1 no longer in service following anomaly

On 25 August, state-owned PT-Telkom Indonesia announced an "anomaly" on its *Telkom 1* satellite. It said the glitch caused a shift in the direction of the satellite's antenna and consequently disrupted all transponder services.

As a precautionary measure, Telkom began recovering services by transferring a number of customers to *Telkom 2*, *Telkom 3S* and other third-party satellites. Working with *Telkom 1*'s manufacturer, Lockheed Martin, the operator suggested that it had expected to complete this sooner rather than later. But by the afternoon of the following day, the recovery process was still ongoing.

Telkom then setup a 24/7 crisis centre staffed by more than 1,000 technicians from across the group. The company's president director, Alex J. Sinaga, said the whole operational team needed to focus on accelerating the customer migration process, both in terms of preparing the replacement transponders and repointing the ground segment antennas.

But in a press statement issued on its website at the end of August, the operator said that following an intensive investigation carried out with Lockheed Martin, *Telkom 1* will no longer be in operation. It said: "Based on in-depth analysis, the satellite was not functioning as normal. Lockheed Martin recommended to shut down the operation to prevent interference with other satellites."

Telkom established a 24/7 crisis centre that was personally supervised by the company's directors, including president director Alex J. Sinaga (centre).

By 10 September, Telkom announced that it had successfully completed recovery for all of *Telkom 1*'s 63 subscribers, eight of which are VSAT providers with 12,030 sites, bringing the total ground segment to 15,091 sites.

Some reports have suggested that *Telkom 1* may actually have broken up. ExoAnalytic Solutions is a US-based firm that runs a global network of 165 telescopes to provide real-time tracking and monitoring of objects in geostationary orbit. According to arstechnica.co.uk, one of ExoAnalytic's telescopes in Eastern Australia seemed to have captured images showing the satellite in fragments.

In mid-September, a Lockheed Martin spokesperson said: "At this time we cannot verify the accuracy of recent news reports speculating about potential debris. We are working diligently to understand the facts and support PT-Telkom's recovery efforts. We will provide updates as they are available."

The spokesperson added that engineers from the two companies were in contact with *Telkom 1* and reviewing data about its operational status to understand the nature of the anomaly and determine the next steps. "The satellite is functioning and responding to commands, although the anomaly has affected its operational status."

When it was launched to 108°E in August 1999, *Telkom 1* was expected to have a 15-year life, but recent assessments showed that it was in good condition and had enough power to carry on operating until at least 2019. However, Telkom had already been planning to replace the orbiter in mid-2018 with *Telkom 4*. This will feature 60 C-band transponders and offer greater capacity than *Telkom 1* which carried 24 C-band and 12 extended C-band transponders.

TCCA has BIG idea to support broadband

The TCCA (TETRA and Critical Communications Association) has formed a new working group to encourage broadband vendor cooperation in the development of common global critical communications solutions.

The Broadband Industry Group (BIG) will drive market adoption of standardised critical communications LTE and subsequent 5G technologies for the benefit of critical communications users and organisations. It also aims to promote an evolutionary approach towards future solutions.

Ericsson's Jason Johur (pictured left) says BIG will focus on ensuring 3GPP-compliant products and services to meet the evolving needs of all critical comm users. Also pictured is the group's chair, Philippe Agard. PHOTO: ERILLISVERKOT

The TCCA says this work will build on its achievements of driving and supporting open standards and interoperability, and ongoing research into professional users' requirements to protect customer investments for the long term.

"With the formation of the BIG, TCCA has provided industry a home to advance critical service based on broadband, including migration to 3GPP LTE and 5G standard technologies," says TCCA chief executive Tony Gray. "In parallel, we will continue to recognise the importance of narrowband PMR, and model our broadband activities on the success of those technologies in supporting professional users worldwide. This success will be further strengthened by the evolution of interworking between critical narrowband and broadband technologies."

Philippe Agard, Nokia's global public safety and defence segment leader, will chair the new BIG. He will be supported by Jason Johur, Ericsson's market development director for mission-critical communications, as vice-chair.

According to Nokia, organisations across key vertical markets have been expressing the need for an evolution from narrowband PMR towards broadband. It says that as the first networks are rolled out, BIG will help open up a broader worldwide ecosystem."

The *Dual Band Dot* is designed to enable multi-band deployments and carrier aggregation, which is important in 5G readiness, according to Ericsson.

Ericsson Dots in Thailand and VNPT's BSS upgrade

Vietnamese telco VNPT has awarded Ericsson a contract for a new online charging system. And in a separate deal, True will deploy the Swedish vendor's radios to improve indoor connectivity in Thailand.

State-owned VNPT (Vietnam Posts and Telecommunications) will use the *Ericsson Charging System* to help reduce opex and lay the foundation for its transformation to a digital enterprise.

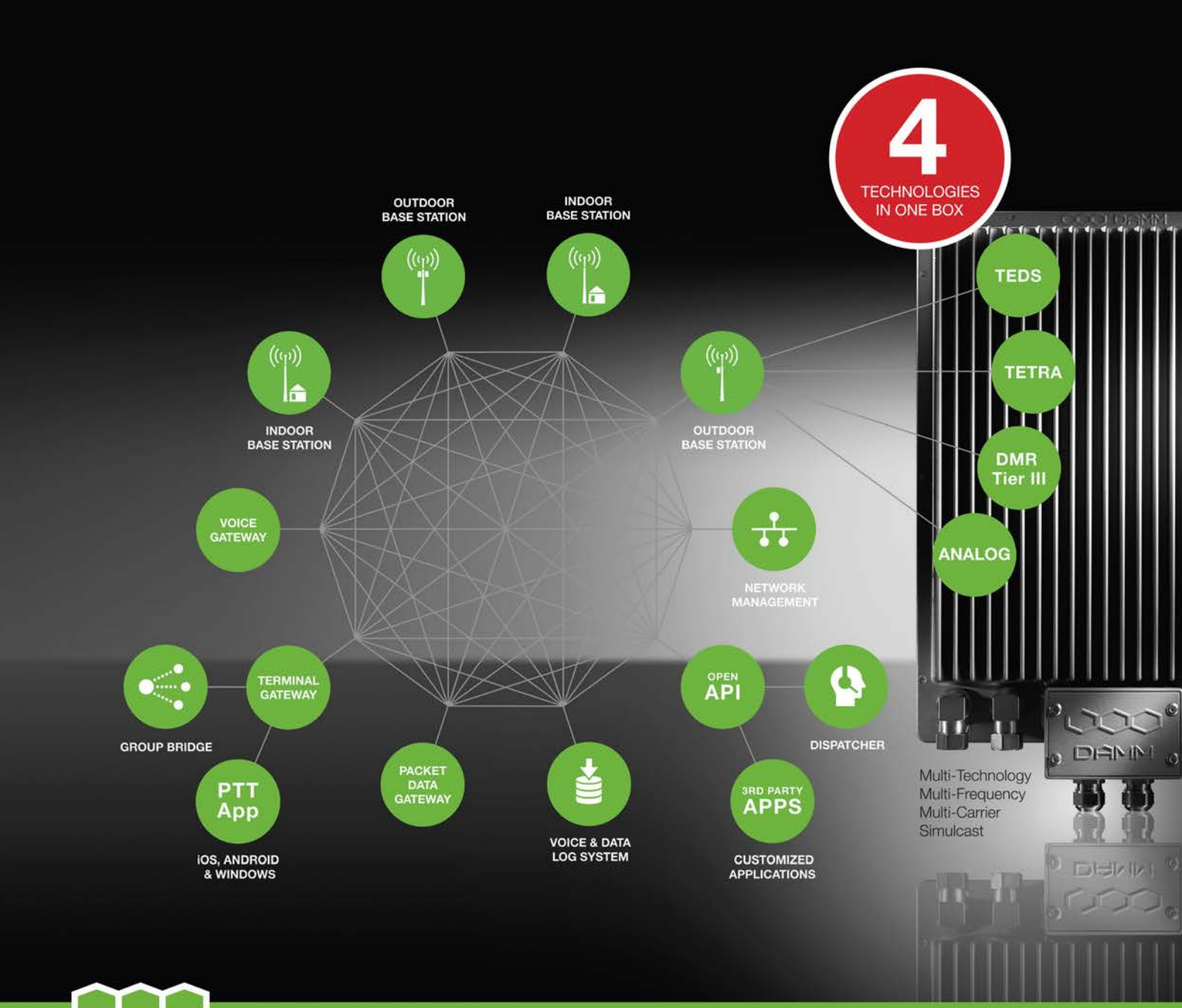
The new system will replace VNPT's legacy infrastructure. It will enable the operator's 40 million subscribers to request and update account information in real-time and automatically get notifications on costs, balances, and bonuses. Ericsson says its platform will also give VNPT a better understanding of customer behaviour, and make it possible to rapidly create personalised offers.

The contract includes a backend IT peripheral system that is expected to speed up the deployment and migration to the new platform which will be put in service by VNPT during the 4Q17. The operator will then launch 4G services on the new platform.

In Thailand, True will use Ericsson's *Dual Band Dot* system to provide cost effective and high-performing indoor networks, with multiband deployments and carrier aggregation.

According to the vendor, the *Dual Band Dot* combines two frequency bands in one device to reduce cabling costs and leverage available spectrum. It is part of the firm's *Radio Dot System* and is said to enable a simple deployment that is fully integrated with the outdoor macro network.

True began installing the *Dots* in May 2017, focusing on the northern, southern, and central regions of Thailand. The first deployments covered hospitals, shopping malls and hotels.



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App drives financial inclusion

Malaysian MVNO Tune Talk is developing a smartphone app to help financially excluded pre-paid subscribers gain access to advanced credit services.

Created by US company Juvo and powered by its *Identity Scoring* system *(see News, Q316 issue)*, *Pay Later* is a digitised service that provides pre-paid users with access to progressive levels of financial services, starting with airtime loans. By using Juvo's proprietary data science and game mechanics technology, subscribers graduate to higher levels of credit based on top-up and repayment history, account information, and every day interaction.

Since launching in 2009, Tune Talk now has more than 1.5 million active subscribers and is said to be the country's largest mobile pre-paid MVNO service. It is using Juvo's technology to create an app that provides a single destination for shopping, notifications, merchandising, credit extensions and account management.

The company hopes that the solution will drive higher levels of engagement, increase retention, and help it to develop an identity-based relationship with customers. Tune Talk head of product Stewart Kumar claims the company has "worked hard" to deliver a differentiated offering that meets its customers' unique needs. He says: "Juvo is in a unique position to help us transform our customer engagement, increase ARPU and support financial inclusion by creating our first lending and shopping applications."

According to Juvo founder and CEO Steve Polsky, making credit extensions and personalised financial services available to all customers is one of the best ways to increase engagement with pre-paid users and drive financial inclusion.

He adds: "Juvo's Identity Scoring technology not only helps limit zero balance days – the times when subscribers can't afford to top-up and are therefore without service – but it also significantly reduces churn while increasing consumption."

Teltronic to provide TETRA for Philippines' metro line

Teltronic has been selected to provide a complete TETRA communications system for a metro rail line in Manila.

The Metro Rail Transit line 7 (MRT-7) project in the Philippines' capital is being developed by SMC Mass Rail Transit 7.

Connecting 14 stations, the 22.8km line will run northeast from an interchange with MRT-3 at North Avenue, serving Quezon City, Caloocan City and San Jose del Monte in Bulacan province. MRT-7 is set to serve around 350,000 passengers a day when operations begin in August 2019, potentially increasing to 800,000 per day upon completion of a series of planned upgrades.

Teltronic – which is now a part of Hytera Communications – was awarded the contract by rolling stock manufacturer and E&M turnkey provider Hyundai Rotem.

Under the agreement, Teltronic will provide its *NEBULA* TETRA infrastructure, *RTP-603* on-board equipment, *STP9000* hand-portable and *SRG3900* fixed radios, and a *CeCo-TRANS* control centre. The onboard equipment will be fully integrated with both the train control and management system, allowing remote vehicle monitoring from the control centre. It will also be integrated with the public address and intercom systems, providing communication between passengers and control in emergency situations.

"By leveraging the power of TETRA technology, this end-to-end solution will enable SMC to communicate in a mission-critical way with the personnel involved with the operation of the MRT-7," says Josep Jonch, Teltronic's APAC business development manager. "It will also allow real-time monitoring of vehicle and the location of the train among other functionalities, making a vital contribution to the safe transportation of thousands of passengers each day."

MRT-7 could serve around 800,000 passengers a day after it begins operations in 2019.

Maritime broadband boost for Indonesia

Patrakom is strengthening its broadband maritime services using satellite capacity to provide seamless, high-speed connectivity to passenger vessels and oil barges traversing domestic routes in Indonesia.

As part of a multi-year, multi-transponder deal, Patrakom will lease capacity of about 28MHz to provide connectivity for more than 80 vessels via *SES-9* which orbits at 108.2°E. SES says this is its largest satellite for Asia-Pacific, and claims that it features a "powerful" mobility beam to provide coverage for vessels sailing across the East Indian Ocean.

Endi Fitri, the company's director of business development, says: "At Patrakom, we provide daily connectivity to hundreds of vessels sailing across Indonesian waters. Today, many of these vessels are limited by the level of connectivity due to the high entry barriers to get access to satellite communications."

Fitri adds that *SES-9*'s high-power mobility beam offers reliable coverage over high-traffic domestic routes, enabling a cost-effective usage of bandwidth for the Patrakom's maritime customers.

Based in the province of Jawa Barat, Patrakom is a subsidiary of Telkom and specialises in telecoms and network solutions for the broadband maritime market.

Wireless relief after rats' high fibre feast

InfiNet Wireless has helped Airports of Thailand (AOT) to deliver improve connectivity and enhanced safety in four of its airports.

Four of AOT's busiest airports – Suvarnabhumi, Don Mueang, Ubon Ratchathani and Phuket – began suffering major downtime due to heavy rainfall and rodents damaging the installed fibre infrastructure on many occasions. This led to various operational issues, including difficulties transferring the most basic of data streams, and regular loss of voice and CCTV traffic.

AOT approached local InfiNet Wireless partner Easy Networks to replace the cable network and provide a high-capacity wireless system that could transfer real-time data. The solution that was deployed consisted of point-to-point (PTP) links from the *InfiLINK 2x2* product family which, according to InfiNet, delivers throughputs of up to 280Mbps over distances of 80km or more.

Thailand's six international airports handled an average of 109 million passengers last year.

The company adds that all the PTP backhauls were fitted with standard E1 converter modules, delivering up to 2Mbps for the "seamless" transfer of existing analogue video, voice and passenger data between different sections of each airport.

Warach Watanakulchai, MD at Easy Networks, says: "AOT can now monitor and manage in real-time all aspects of passenger movement with greater confidence, while at the same time enhancing security and safety in all its airports."

Rapid rollout of LTE in Nepal

At the start of September, Ncell announced that its 4G network had now reached the cities of Kohalpur in Banke and Birendranagar in the Surkhet district of mid-western Nepal. Since launching services earlier this year, the operator has now connected 19 cities across the country.

The operator first launched 4G services in Nagarkot, Banepa and Dhulikhel in the Kathmandu Valley on 1 June. This was followed by 12 other cities including Pokhara, Damak, Hetauda, Birjung, Butwal and Nepalgunj, amongst others.

Ncell corporate services director Pranay Acharya says: "As a part of our vision to contribute to the goals of National Broadband Policy and Digital Nepal, we will continue to expand 4G/LTE in other parts of the country as well so that more cities have access to new technology and people are able to reap its benefits."

The firm is also planning and testing LTE in other cities with a target of connecting 40 by 2018. It adds that 15 per cent of the population will be able to access its 4G network by the end of 2017. Work is also under way to double 3G coverage to 60 per cent of the population by 2018, with the focus on rural and remote areas.

As part of its National Broadband Policy, Nepal's government wants to make broadband connections available to 45 per cent of households within 2018, and make all village development committees connected with broadband by 2020.

Nepal's first 100G network – News, p11.

AIS introduces innovative 1Gbps network in Thailand

AIS (Advanced Info Service) is claiming a regional first with the launch of a 1Gbps network in Thailand.

The operator says its new *NEXT G* network features 'Multipath TCP' technology to help overcome obstacles presented by existing mobile frequencies. It uses AIS' LTE network, which is said to offer the largest 4G footprint in Thailand with 49,000 sites, and the company's *SUPER WiFi* high-speed internet network that covers more than 80,000 spots nationwide.

Developed in collaboration with South Korea Telecom, AIS says its Multipath TCP system combines the capacities offered by its wireless networks, allowing customers to benefit from internet access speeds of up to 1Gbps where its *4G ADVANCED* and *SUPER WiFi* are both available in the same area.

AIS has created a "Digital Gallery" where customers can experience products that are displayed like art.

At present, the only handsets compatible with the network are selected models from Samsung. AIS says it worked closely with the manufacturer in developing firmware to enable the use of *NEXT G* on its smartphones.

In a separate development, AIS is hoping to showcase its technological innovations at its revamped store in Central World, Bangkok. Following an investment of more than THB40m (USD1.2m), the company says its store has now become a "Digital Gallery" where customers can explore a variety of products that are displayed in a similar way to precious art.

In addition, AIS has trained shop staff as "Digital Gurus" able to advise and assist customers professionally as well as develop new service innovations.

The operator currently has 140 shops across Thailand and is considering plans to renovate further outlets in line with its Digital Gallery concept.

Globe Telecom gains "360" customer view

Globe Telecom is using machine learning to deliver targeted and optimised products and services to its 60 million customers, while maintaining compliance with the latest industry data regulations.

The Philippines' telco says its mobile data traffic has grown from 151PB in 2016 to 280PB this year. The company is looking to manage this increased volume of data with technologies like the IoT to glean real-time insights of consumer behaviour.

"Our ability to strategically manage and monetise information about our customers will enable us to deliver value-added products and further differentiate ourselves in today's competitive business landscape," says Gil Genio, CTIO, Globe Telecom.

As a result, the company has deployed the cloud-optimised machine learning and analytics platform from US-based software firm Cloudera. With this at the core of Globe's data management architecture, it's claimed the company can extract its increasing volumes of data from different sources and channels, and then ingest them into a centralised hub that is made securely available to all employees across the organisation.

According to Cloudera, its scalable platform delivers machine learning and advanced analytics techniques to become data and insight driven. Mark Micallef, the company's APAC and Japan VP, adds: "Globe Telecom can now use data to gain valuable insights, make accurate business decisions faster, and deliver targeted marketing campaigns and offers to enhance their customer's experience."

■ In July, Globe announced that it had begun introducing Massive MIMO at 2600MHz to enhance mobile internet connectivity in high-density areas. This followed testing in the Makati financial district earlier this year which found that the technology improves capacity up to six times when compared to a regular site. The initial rollout covers 150 wireless broadband sites, mostly in Southern and Northern Luzon.

IOX plans cable to connect Africa and Asia

IOX Cable has announced that it will build the first open cable system to connect Mauritius and Rodrigues island to South Africa and India.

IOX will work with Alcatel Submarine Networks (ASN) to build a fibre network that will stretch more than 8,850km to connect the east coast of South Africa, Mauritius, Rodrigues and then on to India's east coast.

The company says its cable will provide Mauritius with route diversity and claims this will reinforce the country as a communication hub in sub-Sahara Africa. It will also connect Rodrigues to a submarine cable for the first time, enhancing ultra high-speed broadband services.

Providing an ultimate design capacity of more than 13Tbps per fibre pair, the system will integrate ASN's *1620 SOFTNODE* and ROADM branching unit which is claimed to offer dynamic features for enhanced system resilience. It will also use the vendor's submarine repeaters as well as its end-to-end submarine network management system.

This latest news follows IOX Cable's plans announced earlier this year to extend its regional subsea systems in the Indian Ocean.

IOX says its system will allow easy connectivity to current and future undersea cables on Africa's east and west coasts.

TOT partners with dtac

Telenor's Thai subsidiary dtac has been selected as the preferred partner for 4G services on TOT's 2300 MHz spectrum. State-owned TOT holds 60MHz in the 2300MHz frequency band until 2025. Under the partnership proposal, dtac will build a network based on this spectrum and have the right to utilise up to 60 per cent of the capacity for a fixed annual fee of THB4.5bn. The two operators will sign a final agreement during Q417.

Jazz secures spectrum

Pakistan's leading cellco, Jazz (formerly Mobinil), has acquired additional LTE spectrum. It won the auction held earlier this year and was awarded 10MHz paired spectrum in the 1800MHz band for a net sum of USD295m. Jazz has more than 53 million subscribers, and is a subsidiary of VEON and Global Telecom Holding. *(Jazz offloads its tower business in Pakistan –Wireless Business, p13.)*

Towers get reprieve

An Indian state order to remove all cell towers from within 500 meters of jails across Rajasthan has been stayed by the country's Supreme Court. In 2012, Rajasthan's high court ordered the removal of all towers from the vicinity of schools, colleges, hospitals and playgrounds because of fears about radiation. Earlier this year, it extended the edict to jails, which would have resulted in the removal of 400 towers and 2,500 base station sites. Following a successful challenge by the Cellular Operators' Association of India, the ruling has now been overturned.

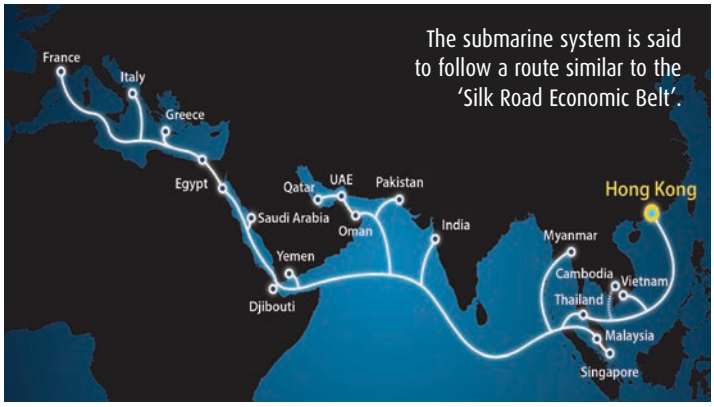
AAE-1 ready for service

What's been described as the largest subsea cable system to launch in almost 15 years has now gone live.

Asia-Africa-Europe 1 (*AAE-1*) stretches 25,000km and is the first high-capacity cable system to link all of the major Southeast Asian nations to Africa and Europe via the Middle East. It connects Hong Kong, Vietnam, Cambodia, Thailand with Malaysia and Singapore, then onwards to Myanmar, India, Pakistan, Oman, UAE, Qatar, Yemen, Djibouti, Saudi Arabia, Egypt, Greece, Italy and France.

The system is said to deploy "state-of-the-art" 100Gbps transmission technology, with a minimum design capacity of 40Tbps.

Whilst *AAE-1* terminates at two POPs in Singapore, one unique feature is that it also continues further into Asia via diverse terrestrial routes across Thailand, connecting Vietnam, Cambodia and Hong Kong. As a result of transiting through these countries and avoiding the heavily congested Malacca Straits, it's claimed this routing enables the cable to have one of the lowest latencies between Hong Kong, India, the Middle East and Europe.



By connecting major carrier-neutral POPs in Hong Kong, Singapore and Marseilles, the consortium behind *AAE-1* says members can choose their preferred backhaul providers available in these POPs or in landing stations in Asia, the Middle East, Africa or Europe.

Members of the cable consortium include China Unicom, CIL, Djibouti Telecom, Etisalat, GT5L, Mobily, Omantel, Ooredoo, OTEG, PCCW Global, PTCL, Reliance Jio, Retelit, Telecom Egypt, TeleYemen, TOT, Viettel, VNPT and VTC.

Bharti and SKT partner on next-gen tech

Bharti Airtel is aiming to build what it describes as India's "most advanced telecom network" with the help of South Korea.

Following the signing of a strategic partnership agreement in September, the company will use SK Telecom's expertise across several areas. These include developing bespoke software to dramatically improve network experience, leveraging advanced digital tools such as machine learning and Big Data, and building customised tools to improve network planning based on every customer's device experience. According to Airtel, the capacity to identify, monitor and deliver improvements to the network experience on an individual device basis will be a first in India.

The two operators will also collaborate on an ongoing basis to evolve standards for 5G, NFV, SDN and IoT. They plan to jointly work towards building an enabling ecosystem for the introduction of these technologies in India.

Airtel chairman Sunil Bharti Mittal reckons the partnership will bring a "dramatically improved" experience to Airtel customers in India by leveraging the expertise of a company that has built one of the world's "best" mobile broadband networks.

"With SK Telecom's clear and undisputed leadership in technology, this is one partnership that will decisively change the game in India and put the country at par with the most advanced broadband nations in the world," claims Mittal.

Cambodia's first 4.5G network launched

Smart Axiata has commercially launch Cambodia's first LTE-A Pro network.

Using 256QAM, 4x4 MIMO and multi-carrier aggregation, the operator says its 4.5G network can now achieve peak speeds of up to 600Mbps in selected areas.

Smart currently operates 2,300 2G and 3G sites, and more than 1,800 LTE sites across Cambodia. Working with Huawei, the mobile operator says it was the first in the country to offer LTE after launching the technology in 2014. In what's claimed to be another first, it has since rolled out 4G to all of Cambodia's 25 provinces. Earlier this year, Smart also debuted 4G+ with VoLTE (HD Voice).

Smart Axiata CEO Thomas Hundt added that 5G is not "far away".

The operator says it is investing in the growth of its network infrastructure in support of the government's objectives of 100 and 70 per cent mobile broadband coverage in urban and rural areas respectively, by 2020.

Speaking at the *4.5G Evolution: Road to 5G* press event in August, Smart Axiata CEO Thomas Hundt said: "We invested USD75m in 2016 and another USD80m this year, largely for network expansions and upgrades to provide top-notch mobile internet with lifestyle enhancing value-added services."

He added that 5G is not "far away". Smart Axiata says it is already studying key 5G technologies such as Massive MIMO to ensure that it is prepared as soon as the relevant standards are defined and the technologies become commercially available.

WorldLink builds Nepal's first 100G optical network

Fixed broadband operator WorldLink is upgrading its 650km-long backbone network in Nepal.

It will use DWDM technology and Nokia's *1830 PSS (Photonic Service Switch)* as part of an intercity network that stretches from Kathmandu to Bhairahawa and Birgunj, and provides international connectivity between Nepal and other countries, including India.

WorldLink is said to be Nepal's largest fixed broadband operator and has 120,000 residential subscribers and 5,000 enterprise users. It's claimed that the company is now connecting 10,000 FTTH service subscribers every month, and is therefore facing continual increasing demand for network capacity.

Nokia says the *1830 PSS* will enable WorldLink to flexibly increase its network capacity, reach and density. It reckons this is possible because its optical technology is powered by the industry's "most programmable" chipset, the *Photonic Service Engine-2* with super coherent technology.

The deployment represents Nepal's first 100G transport network. Nokia claims its "highly scalable" optical platform will ensure low latency and high resiliency, and allow WorldLink to cost-effectively increase network capacity as needed.

Nokia says its *1830 Photonic Service Switch* enables WorldLink to flexibly increase its network capacity, reach and density.

WorldLink CTO Samit Jana adds: "This is our largest project to date, and it will allow us to provide ultra-fast broadband services for our mobile and fixed network subscribers in cities as well as rural areas across the country."

RCOM launches enterprise grade 4G VPN

Reliance Communications (RCOM) has launched what it says is India's first 4G enterprise VPN solution.

Branch Connect has been designed to provide wireless connectivity in the last mile to help businesses quickly extend their corporate network to branch sites virtually anywhere in the country. RCOM says the service offers high-performance enterprise-grade connectivity over its LTE network, and claims it has been developed with security as the "most critical" product feature.

The telco adds that if an enterprise's cloud site is already connected to a Reliance MPLS VPN, all the other sites need in order to connect to the corporate network is a plug-and-play *Branch Connect Smart Router*.

Launched by RCOM's India Enterprise Business Services unit, *Branch Connect* is said to be configured so that usage is restricted to business-relevant corporate applications, and is backed by enterprise-grade performance objectives, reporting, service support and features.

Bill Barney, co-CEO, Reliance Communications, reckons that the solution makes enterprise-grade private connectivity ubiquitous in India: "India Inc. is on a steep growth curve. As enterprises extend into under-served urban areas and the hinterland, the need for reliable, fast and secure connectivity comes to the fore. *Branch Connect* addresses these needs squarely and effectively."

Malaysia set for 5G-ready virtualisation

NEC has teamed up with Red Hat, Juniper Networks and Dell EMC to offer an end-to-end, multivendor, 5G-ready virtualisation platform for service providers and enterprises in Malaysia.

The 5G-ready virtualisation platform from NEC comprises products from its Netcracker division. They include hybrid operations management, business enablement applications, and the company's *Virtualisation Development and Operations Centre* and multilayer SDN controller.

It also features Red Hat's *OpenStack* IaaS; Juniper's NFV services platform which integrates physical and virtual elements; and Dell EMC's *PowerEdge*-based NFV solution.

"To stay competitive in a global economy, service providers and enterprises in Malaysia will eventually have the need to adapt to 5G technologies," says Chong Kai Wooi, MD, NEC Malaysia. "With our SDN/NFV 5G-ready solution, companies will be able to speed up the time-to-market for their potential communications services and/or any applications that run on 5G technology, improve cost efficiency, and have the ability to offer new, revenue generating-services."

NEC Corp. Malaysia MD Chong Kai Wooi, says operators and enterprises will eventually have to adapt to 5G in order to stay competitive.

The company claims that while service providers and enterprises currently need six to twelve months to introduce a new service, with its full-service SDN/NFV solution in place the time to launch new enterprise services can be reduced by up to 70 per cent.

NEC is also optimistic that its multivendor 5G-ready virtualisation platform can contribute significantly to its revenues in Malaysia. At present, the company says 50 per cent of its earnings are from carrier solutions, and 50 per cent are from enterprise and public safety solutions.

"As service providers and 5G technology services take centre stage in the near future, we foresee our SDN/NFV solution to contribute 10 per cent to our carrier solutions revenues for the first year, and 30 per cent for the next three years," says Wooi.

Globe covers Philippines

Gilat Satellite Networks will deliver backhaul as a managed service to enable Globe Telecom to rapidly expand its 2G/3G/4G networks throughout the Philippines. Under a five-year, multi-million dollar contract, Globe will use Gilat's VSAT technology to provide mobile broadband data services in remote rural areas that previously had no connectivity. Satellite will also be used to support transmission capacity in the operator's 4G network, as well as for rapid emergency communications in the event of a disaster.

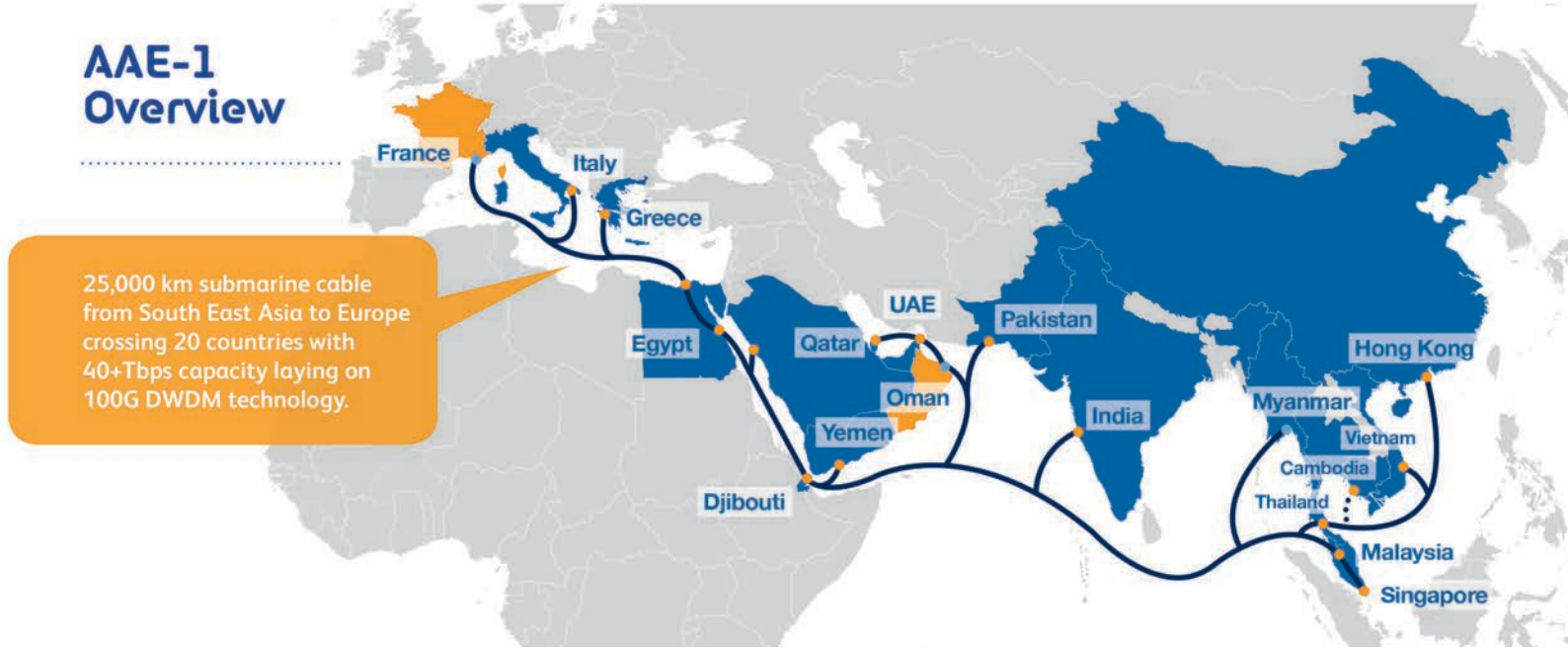
"Frictionless" payments

Indonesian cellco Smartfren has used the Bango mobile payments platform to launch one-click carrier billing payment for *Google Play* customers. Pre- and post-paid subscribers can now purchase content from the app store and pay via their phone bill without the need to register personal details. Bango says that after China and India, Indonesia is the third-largest smartphone market in Asia with more than 55 million users. However, only four million people in the country have a credit card.

Shipping coverage

Globecomm has added the South Indian Ocean passage between the southern tip of Africa and Australia to its Ku-band VSAT network. The operator claims the expanded footprint now provides 100 per cent coverage of all major shipping routes to address new market demands. Globecomm's network already covered the Barents Sea, north of Scandinavia. The company says the extension was in response to its customers having increased transit to the South Indian Ocean area.

AAE-1 Connect



Omantel launches AAE-1 Cross Connect and Extension services across Europe

Omantel offers a 'one-stop-shop' for connecting any landing station on the Asia Africa Europe-1 submarine cable system to the communications hubs of Europe

Omantel Wholesale, a leading wholesale telecommunications provider in the Middle East, has launched backhaul and cross connect services connecting any landing point on the Asia Africa Europe-1(AAE-1) cable to major hubs and internet exchanges in Europe. Its AAE-1 Cross Connect and Extension services accelerate and simplify the way service providers connect from AAE-1 to major metropolitan areas in Europe.

Omantel expands its partners' capacity from the AAE-1 cable system to Frankfurt, London, Amsterdam, Paris and Milan. It provides IP Transit from different Tier 1 operators, seamless connectivity to all the internet exchanges in Europe and backbone connectivity across Europe. Any service provider with access to an AAE-1 landing station can quickly and efficiently extend its reach via Omantel's suite of AAE-1 Cross Connect and Extension 'one-stop-shop' services.

"Our Cross Connect and Extension services make it faster and simpler to connect across Europe and deploy solutions in key global hubs. Whether you have capacity on AAE-1 or just access to a landing station, Omantel can be your 'one-stop-shop' for accessing Europe and growing your reach," says Sohail Qadir, Wholesale Vice President of Omantel. "We're bridging the gap between the East and West by delivering solutions that offer simplicity, efficiency and ultra-low latency."

Besides being the only operator on AAE-1 to have two landing stations in two different countries, Omantel Wholesale is also the first GCC operator to land a submarine cable in Europe with the AAE-1 landing in Marseille via its Omantel France subsidiary. Omantel France is present in Marseille's state-of-the-art 100% carrier neutral Interxion MRS1 and MRS2 data centres that provide a secure, scalable and highly connected environment. Partners are able to choose their preferred backhaul providers across Europe.

"We're developing and deploying simple solutions for our partners and creating new synergies across local and global networks," says Sohail Qadir, Wholesale Vice President of Omantel. "We are friendly, easy to work with and most of all committed to our partner's success. Our express routes across Europe give our partners new options that remove the complexity from connecting across continents and into metro areas in Europe."

AAE-1 is a 25,000 km submarine cable from South East Asia to Europe connecting 20 countries with 40+Tbps capacity and 100G DWDM technology. It covers nearly 50% of the world's population, delivering seamless connectivity that spans the globe. It adds to Omantel's extensive ultra-low latency infrastructure investments globally.

Jazz offloads its tower business in Pakistan

Pakistan's market-leading cellco Jazz (formerly Mobilink) has signed an agreement for the sale of its wholly-owned towerco, Deodar, for PKR98,700m (around USD940m) subject to adjustments.

Deodar has a portfolio of approximately 13,000 towers. It is being sold to Tanzanite Tower which is owned by the Islamabad-based Dawood Hercules Corporation and Malaysia's Edotco Group. The latter is a wholly owned subsidiary of the Axiata Group which last year raised a record USD600m as part of a financing deal for Edotco *(see Wireless Business, Q416 issue)*.

Upon successful completion of the transaction – which is expected before the end of the year – Deodar will enter into a master services agreement with Jazz, whereby it will continue to provide tower services. The initial term of this agreement is twelve years and is renewable at Jazz's discretion for three consecutive periods of five years each.

The sale will be on a cash and debt-free basis. Its proceeds will be used for Jazz's general corporate purposes, the funding of recently awarded spectrum *(see News, p10)*, and repayment of a proportion of its outstanding debt. PKR69,930m (around USD666m) of the PKR79,800m (USD760m) cash consideration is expected to be received at closing, while the remainder will be paid within 12 months thereafter.

Jazz is owned by VEON (formerly VimpelCom) and Global Telecom Holding (GTH). In 2015, Jazz combined with Warid Telecom, the Dhabi Group's mobile operation in Pakistan *(see Wireless Business, Q415 issue)*. As a result of the terms of the Jazz/Warid earn-out agreement, GTH's stake in Jazz will be approximately 83 per cent following the sale of Deodar.

Deodar has a portfolio of around 13,000 towers in Pakistan and will continue to provide tower services to Jazz for at least 12 years.

Hytera and Motorola lock horns in patent disputes

Motorola Solutions is taking further legal action against Hytera. But the Chinese firm has now also filed complaints against its US rival, accusing it of patent infringement.

As part of its ongoing dispute, Motorola Solutions has filed new complaints with the regional court of Mannheim in Germany that also target Mobilfunk, Hytera's German operation.

Motorola alleges that Hytera's two-way wireless communication devices with improved squelch functionality are infringing its European patent number EP1139562 B1. It is seeking an injunction preventing the company from offering and delivering products with this squelch feature in Germany, as well as the recall and destruction of what it describes as "infringing" products and various damages.

With these additional actions in Germany, Motorola now has five pending IP litigations against Hytera. They include separate patent infringement and trade secret misappropriation complaints filed with US authorities in March, and a complaint previously filed with the regional court of Düsseldorf in April.

Mark Hacker, general counsel and chief administrative officer of Motorola Solutions, says: "We are confident that the steps we are taking globally will be effective in stopping Hytera's unlawful conduct."

Hytera has so far responded by accusing Motorola Solutions of infringing its patent that covers its sound adjustment control technology.

On 28 August, the firm announced that it had filed a lawsuit in a federal district court in Ohio stating that Motorola was infringing its US patent number 9,183,846. The complaint asserts that Motorola "unlawfully misappropriates" Hytera's patented technology for sound adjustment, incorporating it into its *MOTOTRBO* portable radios.

Hytera is also alleging contributory infringement and says: "Motorola has been and still is indirectly infringing [the] patent by actively inducing direct infringement by other persons who use products that embody one or more of the claims of the patent while Motorola had knowledge of the patent, knew, or should have known, that its actions would induce direct infringement by others, and intended that its actions would induce such direct infringement."

Hytera says it is seeking damages and will pursue further relief "as appropriate".

The company adds that it currently holds 480 issued patents, including 269 for DMR, TETRA and PDT digital products. Andrew Yuan, the company's president of North and South America, says: "Hytera is an adamant advocate of intellectual property rights. We will look to enforce our patents in court in the US and worldwide."

Intelsat-OneWeb merger collapses

Intelsat has terminated its proposed merger with OneWeb.

The combination of the two companies was announced earlier this year in a share-for-share deal *(see Wireless Business, Q1 2017 issue)*. But on 1 June, Intelsat said that following the expiration of the deal on the previous day, the minimum tender conditions for the exchange offers and consent solicitations had not been satisfied.

A company press statement said: "The Issuers have not accepted any of the Existing Notes for exchange; any Existing Notes tendered for exchange will be promptly returned to holders, and the Exchange Offers and Consent Solicitations have accordingly been terminated."

According to Intelsat CEO Stephen Spengler, there were many stakeholders' interests that needed to be satisfied in the "complex" transaction, and bondholders were unwilling to accept the terms of the exchange offers presented.

Japan's SoftBank Group owns 40 per cent of OneWeb and had agreed to make a cash investment of USD1.7bn in exchange for common and preferred shares of the combined company. But although this is now off, Spengler said the pre-existing commercial agreement between SoftBank, Intelsat and OneWeb will still continue.

"Under this agreement, we plan to jointly develop integrated solutions utilising both of our fleets and to act as a sub-distributor to SoftBank for the attractive application segments of mobility, energy, government, and connected car," said Spengler. "As we create integrated services for these applications, we expect to accelerate and enhance our goal of unlocking new and larger opportunities in the communications landscape."

DragonWave in receivership

DragonWave has gone into receivership. In recent months, the Canada-based microwave backhaul specialist has de-listed from the Toronto Stock Exchange (TSX) and NASDAQ, and seen a number of its board directors resign.

Following an application from Comerica Bank as agent for DragonWave's senior lenders, the Ontario Superior Court of Justice has appointed KSV Kofman as receiver and manager over all of the company's property, assets and undertakings. In mid-August, the court approved an expedited sale process for DragonWave's business and assets. It set an offer deadline of 15 September 2017 and a target transaction closing date of 29 September.

In a statement issued online, the company's CFO Patrick Houston said: "The receiver has advised that numerous parties have already shown interest on an unsolicited basis since its appointment and these parties have all been included in the prospective purchaser list."

He added that the company continues to operate "business as usual" during the sales process, and that all current orders and new orders will be delivered as usual.

According to reports earlier this year, DragonWave had been struggling to repay debts of CAD17.2m, and had been trying to pursue alternative financing. On 28 July, the TSX suspended trading of the company's shares and KSV Kofman was

appointed as receiver on 31 July. The following day, the board of Peter Allen, Claude Haw, Cesar Cesaratto and Lori O'Neill resigned their board director positions with immediate effect. In the US, DragonWave was de-listed from Nasdaq on 2 August.

According to James Bagnall of the *Ottawa Citizen*, two "seismic events" stripped DragonWave of 60 per cent of its annual revenues in just two years. He claimed one of these was a "technical glitch" that led to the vendor stopping shipments to a customer in India. The other was Nokia's acquisition of Alcatel-Lucent, which was a major competitor, effectively killing more than half of DragonWave's sales.

Connecting the IoT from space

Iridium Communications is aiming to explore collaborative partnerships with so-called 'NewSpace' players, particularly those in the small satellite low-power arena.

"We envision a future where numerous diverse satellite architectures interwork to support the dramatically expanding IoT universe," says CEO Matt Desch.

Iridium has already signed an MoU with emerging company Magnitude Space. Headquartered in the Netherlands, it is planning to build a network of 18-24 small satellites that will deliver LPGAN connectivity to remote areas of the world. A commercial launch is planned for 2Q18.

Magnitude Space claims its technology will offer a cost-effective and reliable option for companies in need of very low-power monitoring and tracking systems that require longer life battery and infrequent non-real-time messaging solutions.

Under the MoU, the two companies will begin discussions on how to collaboratively expand opportunities for space-based IoT services with the development of LPGAN (low power global area network) technologies.

"Our partnership has the potential to bring two networks together, addressing the total IoT connectivity proposition present in the market today," says Ernst Peter Hovinga, CEO, Magnitude Space.

Iridium says IoT is currently its fastest-growing line of business and saw commercial data subscribers increase 20 per cent YoY in 2Q17.

Huawei launches new partner programme

Huawei has launched a new global partner programme backed by an investment of USD250m.

The *Solution Partner Programme* includes independent software and hardware vendors, systems integrators, and consulting partners. Huawei says it will provide them with the technical, marketing and sales resources they need to design, build and market solutions based on its technologies. The investment includes USD70m for co-marketing projects.

The new programme, which is due to go live in October, will bring together all solution partners previously working with the vendor in separate programmes run by its Enterprise Business Group, Carrier Business Group, and Products and Solutions unit.

Huawei claims its solution partner programmes have already attracted more than 1,000 partners. It says that the number of OpenLabs, where partners can collaborate and test new solutions, has grown from five to 16, and that there will be a total of 24 by 2020.

CyanConnode in Indian smart metering deal

CyanConnode has received a USD1.1m purchase order for a smart metering deployment for the state-owned Indian utility company Uttar Gujarat Vij (UGV).

This is CyanConnode's first contract award from its new partner, Genus Power Infrastructures, which supplies to multiple utilities and is said to have India's largest installed meter base.

The purchase order is for more than 23,000 smart meters. These will be deployed over the next 18 months for UGV customers in Naroda, Ahmedabad.

CyanConnode will supply its standards-based hardware, services and headend software licenses to Genus. It says the software will be charged on a per meter per year basis with an annual maintenance contract, delivering a recurring revenue stream over the initial four-year contract term.

UGV will use a narrowband mesh network solution based on CyanConnode's IPv6 LoWPAN *Advanced Metering Infrastructure*. Genus will integrate this with its meters, and also provide system integration and project management to UGV.

Operating in the northern parts of Gujarat, UGV serves more than three million customers which, according to CyanConnode, provides "substantial scope" for future follow-on orders. The vendor adds that the deployment will also support the connectivity of smart city and IoT applications through one network in the future.

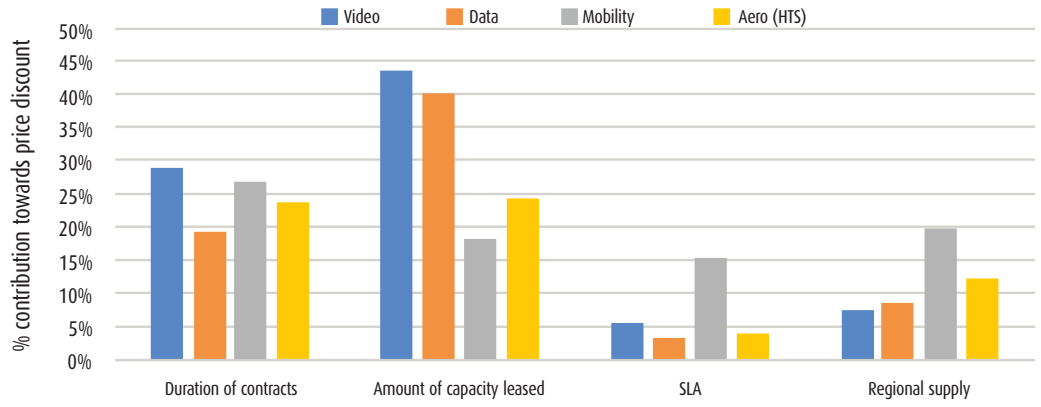
Satellite market pricing set for further falls

Satellite pricing is expected to further decline, according to NSR's latest Satellite Capacity Pricing Index.

With operators and service providers focusing on volume business in data

NEW APPOINTMENTS

Date	Name	New employer	New position	Previous employer	Previous position
25/4/17	Adeline Lum	Neural Technologies	CFO	Oracle	Director of business operations for APAC applications
8/5/17	Michael Foley	Grameenphone	CEO	Telenor Bulgaria	CEO
19/6/17	John Colvin	Mimosa Networks	SVP of global field operations	Calix	SVP of Sales for the Americas
30/6/17	Gregory Lee	Nokia	Head, Nokia technologies	Samsung Electronics North America	President & CEO
30/6/17	José Manuel do Rosário Toscano	Intelsat	Head of international government affairs & asset management,	International Telecommunications Satellite Organisation	Director general & CEO
18/7/17	Jean-Philippe Gillet	Intelsat	VP & GM of broadband	Intelsat	VP EMEA
18/7/17	Mark Rasmussen	Intelsat	VP & GM of mobility	Intelsat	VP Americas
18/7/17	Robert Cerbone	Intelsat	VP & GM of media	Time Warner Cable	VP & GM for wireless products
21/7/17	Tony Gray	TCCA	CEO	Regional business director	P3 Group
21/7/17	Phil Kidner	–	–	TCCA	CEO; retiring as of September 2017
27/7/17	Matthias Kassner	EnOcean	VP product marketing	EnOcean	Product marketing director
8/8/17	Michael J. Van Rassen	Rajant	EVP of business development	US Army	Programme manager
8/8/17	Ed Preston	Rajant	Programme manager	Northrop Grumman Information Systems	Chief engineer
28/8/17	Nischal Gupta	Sterlite Tech	Chief transformation officer	Flipkart	Head of corporate strategy execution
28/8/17	Manish Sinha	Sterlite Tech	CMO	QuikrHomes & Commonfloor.com	EVP & business head
28/8/17	Sanjeev Bedekar	Sterlite Tech	Chief delivery & technology officer, telecom services	Telesonic Networks	CEO
7/9/17	Anil Daulani	CyanConnode	MD India	Tech Mahindra	Global Head & VP utilities



Some of the key factors influencing price reductions in the satellite market. SOURCE: NSR

and mobility verticals, the analyst says pricing has plummeted over the past couple of years from a high USD3,000-4,000 per MHz per month, to below USD1,500 per MHz per month.

According to the index, there are several factors contributing to the decline. In total, it says 13 factors can exert influence over pricing depending on a company's growth strategy and sales positioning, consolidation in its value chain vertical (operator, service provider or anchor customer), customer relationships and deal contracts.

NSR analyst Gagan Agrawal says that while the factors shown in the chart above represent satellite leasing contracts historically, other influences, such as SLA ("premium versus frugal" maritime customers), regional oversupply and HTS fill rates below 40 per cent, and high spectral efficiency leading to low per Mbps pricing and bargaining power, are all becoming more important leading to large retail/wholesale discounts.

He notes that data/backhaul deals have consistently come in at prices under USD500 per Mbps per month during this year.

"Some of the most prominent examples of the deals include backhaul capacity leased at sub USD400/Mbps/month in Western Europe and Africa, aero capacity leased at sub USD700/Mbps/month in Southeast Asia, and video capacity at sub USD2,000/MHz/month in North America," says Agrawal.

NSR expects mobility and data pricing to drop between five to 15 per cent and 10 to 30 per cent globally in the next year. For a leasing economy to maintain/grow top line revenues, it says operators would need anchor customers in the aero, backhaul and broadband businesses for their upcoming satellites and, in addition, fight off competition from new entrants to maintain the relevance of their ageing FSS fleets.

Given these price drops, Agrawal reckons a wholesale business with a pseudo-lease or mixed lease-service model could be one of the winning strategies for operators to adopt.

"Application specific fleet consolidation and downstream customer consolidation strategy is yet to be seen in the market, and strategic partnerships matching wholesale distribution network to HTS architectures have the potential to support the pseudo-lease model. A near to medium scenario with a large fund backed telco (e.g. Softbank) merging the lease and service economies for a particular region can't be ruled out."

He continues by saying that a mixed lease-service business on the operator's end or upstream vertical integration on the service provider side has potential to grow top-line revenues for either of the players in the value chain. "Ultimately, the companies which pivot early based on efficient fleet consolidation and customer matching, stand a chance in winning the pricing battle," he concludes.

CLX purchases Dialogue

CLX Communications has acquired Dialogue Group, the UK-based global provider of mobile messaging and security services, at a price of GBP32m (around USD41m) on a cash- and debt-free basis. CLX has also secured financing through a credit facility provided by Svenska Handelsbanken and Danske Bank.

Founded in Sweden in 2008, CLX specialises in cloud-based communications services. It says the acquisition of Dialogue will help it in its aim to build what it claims will be the world's leading CPaaS (Communication Platform as a Service) company.

Through the acquisition, CLX says it will strengthen its customer base in the UK and Australia and add Tier 1 operator connections in New Zealand, Singapore, Malaysia, Bangladesh, Vietnam, Cambodia, Japan, Philippines, Indonesia and Egypt.

In addition to delivering messaging solutions to enterprises, Dialogue provides A2P SMS monetisation software and services to MNOs around

INVESTMENTS, MERGERS & ACQUISITIONS

Date	Buyer	Seller	Item	Price	Notes
25/4/17	BICS	TeleSign Corporation	Acquisition	USD230m	BICS claims the combination of its global network & reach to MNOs with TeleSign's cloud platform & "state-of-the-art" mobile identity & authentication solutions creates the first global end-to-end Communication Platform as a Service (CPaaS).
22/5/17	VEON	Sberbank	Loan	RUB110bn	The five-year agreement will refinance existing loans between Sberbank & VEON's subsidiary, VimpelCom Holdings, as well as provide additional funds for general purposes.
26/5/17	Hytera Communications	Sepura Group	Acquisition	GBP74m (reported)	Hytera has now completed its acquisition of Sepura. It's added around 700 staff to its organisation & expanded its European operations with innovation centres in the UK & Spain. Hytera founder & president Qingzhou Chen said: "With enhanced capabilities, we can better serve local markets & help to address increasing security challenges in Europe."
30/5/17	Cevian Capital	Ericsson	5.6% stake	USD1bn	Said to be one of Europe's largest activist investors, Cevian Capital is now Ericsson's third-largest shareholder, but is likely to raise its position to be come the biggest, according to some reports. Cevian co-founder Christer Gardell has blamed Ericsson's board for doing "a very poor job" and is looking for people with greater industry experience.
22/6/17	Globetouch Inc.	Teramatrix	Acquisition	NA	Globetouch will integrate Teramatrix's *xFusion* platform to create IoT applications that support connected cars, autonomous driving, predictive maintenance & edge intelligence.
12/7/17	CommScope	Cable Exchange	Acquisition	NA	US-based Cable Exchange manufactures a variety of fibre & copper cables, trunks & related products used in high-capacity data centres and other enterprise applications.
28/7/17	Motorola Solutions	Airbus	Plant Holdings	NA	Plant Holdings includes Airbus' DS Communications business which provides command centre software for fielding emergency calls & citizen emergency notifications in North America.
9/8/17	Investor group	Globecomm Systems	Company	NA	An investor group led by HPS Investment Partners & funds managed by Tennenbaum Capital Partners have entered into a definitive agreement to acquire Globecomm from a New York-based private equity firm. Financial terms have not been disclosed. Due to be completed 3Q17.

the world and primarily in APAC. It's claimed that the company processes around 1.7 billion messages annually across more than10 countries.

The merger will also add *Sentinel*, Dialogue's security software solution for mobile operators, to CLX's product portfolio.

Integration work will start immediately. It is expected to take 12 to 18 months and is targeted to be completed by 3Q18.

Mobile Mark acquires Comtelco

US-based antenna specialist Mobile Mark has agreed to acquire Comtelco Industries which makes a wide range of LMR antennas for both mobile and site installations. Following the acquisition, which is expected to take effect in June 2017, Comtelco's manufacturing facilities will be moved from its existing location in Illinois to Mobile Mark's facilities, also in Illinois. Mobile Mark says this will allow continued use of Comtelco's 'Made-in-the-USA' badge.

In separate news, Mobile Mark has acquired the X-WAV and TMA antenna ranges from Luxul Wireless, a brand of Legrand. According to the firm, Luxul's products hold a "unique place" in the wireless industry with their patented designs and quality construction.

Mobile Mark president and CEO Michael Berry says: "The acquisition of Luxul Wireless' X-WAV and TMA antennas will immediately expand the range of antenna solutions we can offer our customers and will position us to develop additional innovative antenna solutions."

In brief...

Thaicom's next satellite will be partially controlled by the government. Rather than being called *Thaicom 9* as originally planned, it will now be known as the "national satellite". The aim is to channel the benefits of the space economy to the general public. According to local reports, the rest of Thaicom's satellites will eventually fall under the new business operative framework. Deputy prime minister Prajin Juntong told the *Bangkok Post* that state-owned CAT Telecom will probably be assigned to partly operate and manage the satellite. The new satellite is scheduled to be launched to 119.5°E in 2019.

Sri Lanka Telecom (SLT) plans to separate from its mobile subsidiary Mobitel and list it on the Colombo Stock Exchange. The government has a 49.5 per cent stake in SLT and plans to sell its interest in Mobitel as part of its wider ambition of selling off publicly owned companies. According to the local *Business Times*, the government is looking to raise at least USD1bn to settle the "uneconomical debt" it inherited from the previous administration. It also hopes privatisation will help make Mobitel more competitive.

Viettel Global is planning to launch operations in Indonesia and Nigeria. At its AGM earlier this year, the Vietnam military-owned telco said investments in the two countries would create conditions for it to continue to grow its interests in other countries. Viettel reported a 21 per cent YoY decline in revenues last year, with its networks in Mozambique and Burundi particularly suffering due to forex issues. But it did see earnings growth in Tanzania, Cameroon, Mozambique and Haiti. The company also has subsidiaries in: Laos, Cambodia, East Timor, Peru and Myanmar. Operations are due to begin during 1Q18.

The Axiata Group's Business Services division has signed a four-year agreement to lease capacity over Thaicom's *IPSTAR-1* for the provision of broadband services in Indonesia. Under the deal, Axiata will use multi-transponder 1Gbps high throughput capacity from the satellite that orbits at 119.5°E. As well as direct home and enterprise broadband access, it plans to use the capacity for mobile backhaul. Launched in 2005, *IPSTAR*-1 (also known as *THAICOM-4*) includes 87 Ku- and 10 Ka-band transponders.

LATEST COMPANY RESULTS

Date	Company	Country	Period	Currency	Sales (m)	EBITDA (m)	EPS (units)	Notes
17/7/17	Telenor	Norway	2Q17	NOK	31,470	12,719	(0.08)	Total revenues increased by 2%; reported mobile subscription & traffic revenues grew by 3%. Operator says "strong" revenue growth in Bangladesh & return to growth in Thailand were among the highlights for the quarter. Customer growth also reported in Pakistan & Myanmar.
18/7/17	Ericsson	Sweden	2Q17	SEK	49.9 (bn)	–788	(0.30)	Reported sales down 8% YoY; plans to accelerate actions to cut costs & ensure it can meet target of doubling 2016 operating margin beyond 2018.
27/7/17	Intelsat	US	2Q17	USD	533.2	417.9	(0.20)	Total net loss of USD23.8m for the quarter. Total on-network revenues reported decline of USD7.9m to USD485.9m as compared to 1Q16.
27/7/17	Nokia	Finland	2Q17	EUR	5,629 (bn)	1,196	0.08	Overall reported net sales for period compared to EUR5,577bn in 2Q16. Net sales for MEA reported as EUR435m compared to EUR402m for 2Q16.
28/7/17	SES	Luxembourg	1H17	EUR	1,048.7	687.1	0.56	Expected improvement in YoY development between 1Q17 (-4.2%) & 2Q17 (-1.9%) led to overall reduction of 3.1% for 1H17 compared with prior period.
3/8/17	VEON	Amsterdam	2Q17	USD	2,417	977	0.11	Total revenue increased 12.3% YoY and 3.7% organically. Mobile service revenue grew 4.3% in organic terms, with data increasing by 30.5% YoY. Fixed-line service revenue declined by 11.5%.
11/8/17	Singtel	Singapore	1Q18	SGD	4,232	1,269	NA	Operating revenue up 8%, but underlying net profit down 4%. Airtel's pre-tax profit contribution dropped 42% despite what was said to be "strong" cost management & lower depreciation in Africa.
12/8/17	Reliance Communications	India	1Q18	INR	3,591 (cr)	543 (cr)	(3.90)	RCOM says India's telecom sector continues to be "very adversely" impacted by competitive intensity on a scale never witnessed before. Its consolidated revenues for the quarter are down 33% YoY, while EBITDA is down 65.2% YoY.
16/8/17	Cisco	US	FY17	USD	48.0 (bn)	NA	1.90	Total revenue USD12.1bn, down 4%, with product revenue down 5% but service revenue up 1%. APJC up 6%.
16/8/17	Sri Lanka Telecom	Sri Lanka	1H17	LKR	37.4 (bn)	11 (bn)	NA	Group reports 2% YoY growth. Claims its mobile operation, Mobitel, became South Asia's first to successfully field test Pre-5G LTE A Pro. It says it achieved 855.9Mbps throughput using advanced CA in TD-LTE 2500MHz band, & over 700Mbps cell throughput on a single TDD carrier using Massive MIMO.
24/8/17	ZTE	China	1H17	RMB	54.01 (bn)	NA	0.55	First-half revenue increased 13.1%, powered by growth in mobile network & smartphone businesses. Carrier Networks division accounts for 59.9% of revenue.
30/8/17	Axiata Group	Malaysia	2Q17	MYR	6.1 (bn)	2.3 (bn)	0.05	Earnings grew by 3% – the group's highest quarterly revenue to date. Data revenue grew almost 11% QoQ to now account for 44.1%of service revenue.

Airbus promises "new era" in PMR communications with TETRA server

Airbus reckons its new IP-based *Taira Tetra Server* for PMR networks can replace conventional switches

MANUFACTURER: Airbus

PRODUCT:
Taira Tetra Server

MORE INFORMATION: www.securelandcommunications.com

and operates at much lower costs. According to the company, the server is smaller than a typical switch and works more efficiently and economically while still providing high service availability.

It has also been designed to be easily managed as it fits into existing IT environments. Airbus says using modern IT server technology in the framework of a TETRA network enables operators to integrate a TETRA system into their existing data centres. The network can then be operated with the same processes and personnel used for other IT services.

The *Taira* consists of standard solutions with virtualisation layers. Airbus says this ensures true hot standby redundancy even in extreme situations.

It adds that thanks to the virtualisation of COTS hardware, server capacities can be exploited in a better way. For instance, Airbus says the server enables the installation of TETRA in complicated and narrow surroundings, such as in mining, airports or in underground systems, for example.


© AIRBUS

The company goes on to claim that all this helps operators to reduce their opex, and marks the start of "a new era" in critical communications infrastructure.

Monitoring tool can reveal 'silent unhappy customers'

MANUFACTURER:
SpatialBuzz

PRODUCT:
RF measurement tool

MORE INFORMATION:
www.spatialbuzz.com

SpatialBuzz has launched a new handset measurements tool to help MNOs to identify customers receiving poor service levels.

It works by collecting radio related measurement data in real-time. Using a unique set of algorithms, SpatialBuzz claims its solution allows cellcos to geospatially visualise RF conditions on the network. It says the tool is quick and easy to deploy, and can be embedded into existing operator self-service apps.

The tool retains anonymity for the customer, and is said to be optimised to minimise battery usage. Subscribers can choose to opt-in or out of the service at any time.

According to SpatialBuzz, device measurements not only help diagnose dissatisfaction hotspots faster, they also help identify where dissatisfaction might be increasing. It adds that the new tool also allows for a "deeper, relevant and more meaningful" conversation to be had with customers experiencing network problems.

Furthermore, the company says hotspots of 'silent unhappy customers' can be revealed by using the tool for subsequent experience optimisation and engagement.

G+D SIMs for secure connection of IoT devices

G+D Mobile Security reckons its *IoT Attach* and *IoT Advance* SIMs are "essential solutions" for connecting billions of IoT devices.

It says the two modules have been developed in cooperation with reference mobile operators and IoT application providers. According to the company, the dedicated SIMs not only offer the benefit of network protection to MNOs, but also protect IoT data and help tackle the major concern of IoT device lifecycle management.

IoT Attach and *IoT Advance* are

MANUFACTURER:
G+D Mobile Security

PRODUCT:
IoT Attach & IoT Advance

MORE INFORMATION:
www.gi-de.com

the first in a series of IoT-specific products from G+D. While further form factors are under development, the company says the current solutions offer operators the required services and performance with "ultimate" flexibility.

Both SIMs come equipped with end-to-end security which secures data from the IoT endpoint, through the LPWAN (low power wide area network), and onto the application server.

In addition, it's claimed *IoT Advance* provides further flexibility in terms of power optimisation, root-of-trust for firmware updates over the air, and QoS.

Infinera launches *XTM II* for metro packet-optical apps

Infinera has unveiled its next-generation packet-optical platform for delivering rich Layer 0, Layer 1 and Layer 2 services with high density, low latency and low power consumption.

A key component of the new *XTM II* platform is the 400G Flexponder. This is a dual, 200G muxponder that uses 16QAM for high-capacity transport, or a dual 100G transponder that uses QPSK for longer reach operation.

Infinera says the device provides 400G of line and client capacity per slot, giving an eight-fold density increase over the previous generation.

Including optics, it adds that the device operates at as low as 20W per 100G service which it believes is the lowest power consumption per 100G available in the industry on any WDM-based platform.

The *XTM II* also includes the *EMXP440* transport switch which provides Layer 2 packet-optical switching with dual 100/200G ports and 12 or 24 10G ports.

The switch supports CE and MPLS-TP, packet transport with sub-50ms protection, MEF CE 2.0 service creation, and QoS-aware traffic aggregation.

MANUFACTURER: Infinera

PRODUCT: XTM II

MORE INFORMATION:
www.infinera.com

R&S signal generator offers lowest possible phase noise

Rohde & Schwarz (R&S) has introduced a high-end analogue RF and microwave signal generator.

The *SMA100B* has a frequency range up to 20GHz and is claimed to be the most powerful analogue signal generator on the market. R&S says it provides the "purest" signals with the "lowest possible" phase noise at all offset frequencies (1GHz, –152dBc/Hz, 20kHz offset). A 6GHz instrument generates up to 38dBm RF output power, and a 20GHz instrument generates up to 32dBm in the microwave frequency range.

The vendor adds that harmonics are extremely low across the entire frequency range; above 6GHz it says they are even significantly lower than 70dBc at 18dBm output power. Non-harmonics are also said to be below 110dBc at an output signal of 1GHz.

The *SMA100B* is also claimed to be the world's only analogue signal generator that can simultaneously provide a second, independently configurable, extremely pure and synchronised clock signal up to a frequency of 6GHz. As a result, R&S says users can characterise ADCs with a single signal generator.

MANUFACTURER:
Rohde & Schwarz

PRODUCT: SMA100B

MORE INFORMATION:
www.rohde-schwarz.com

New cellular router offers power versatility and SDN management

Lancom Systems has extended its range of LTE/4G cellular routers with a new *700* series device. The *730-4G* is aimed at supplementing network infrastructures with LTE/4G and, when used in combination with the vendor's routers, is said to be "ideal" for intelligent backup scenarios.

The *730-4G* has an integrated LTE/4G modem with 2G/3G support, and provides a wireless broadband connection at speeds of up to 100Mbps.

Power can be supplied via a GbE connection with PoE support (as per IEEE 802.3at). As a result, Lancom says the device can be positioned to take direct advantage of the best available cellular signal without expensive cabling for the power supply or for external LTE/4G antennas. Alternatively, the device also operates with the standard power supply unit it is shipped with.

The *730-4G* can be managed either with Lancom's conventional management tools or from the *Lancom Management Cloud (LMC)*. It's claimed the *LMC* is the world's first management system to employ SDN technologies for the intelligent orchestration, optimisation and control of an entire network (SD-WAN, SD-LAN and SD-WLAN). The firm says this "greatly" simplifies the management of installations of any scale, from small to very large.

MANUFACTURER:
Lancom Systems

PRODUCT: 730-4G

MORE INFORMATION:
www.lancom-systems.com

Wi-Fi Alliance adds indoor positioning

The Wi-Fi Alliance says its new certified *Wi-Fi Location* feature has "advanced" capabilities to meet growing market demand for mobile location-based services (LBS) indoors. It believes this will enable the creation of new, feature-rich applications and services that will benefit many markets including enterprise, retail, manufacturing and healthcare.

Based on the Fine Timing Measurement (FTM) protocol from IEEE 802.11-2016, it's claimed *Wi-Fi Location* delivers metre-level accuracy for indoor device location data. By leveraging the ubiquity of Wi-Fi networks, it is said to deliver accurate and reliable position data without the need to deploy a separate or proprietary network infrastructure.

Wi-Fi Location works by determining the distance between two Wi-Fi devices, such as an AP and smartphone. It then measures the time that it takes for the wireless signal to travel from one device to the other.

Until now, devices typically determined indoor location by measuring signal strength, which has limited accuracy, or fingerprinting, which is more difficult to maintain, according to the Wi-Fi Alliance.

The first *Wi-Fi Location* products which comprise the testbed for interoperability certification include Broadcom's 802.11ac *Acculocate* AP, Mediatek's *MT663X* 802.11abgn/ac Ref. STA, Realtek's *RTL8812B*, amongst others.

MANUFACTURER:
Wi-Fi Alliance

PRODUCT: Wi-Fi Location

MORE INFORMATION:
www.wi-fi.org

ALSO LOOK OUT FOR

Researchers develop wearable power sources

Researchers at the UK's University of Surrey are developing technology that will allow people to act as their own power source through 'smart' clothing.

The wearable power sources are triboelectric nanogenerators (TENGs). These energy harvesting devices convert the movements of materials that produce static charge into usable electricity. This can then be stored in batteries or supercapacitors, and used to charge mobile phones or power medical devices. It's claimed large scale TENG networks could also provide household power requirements in off-grid areas.

The researchers have introduced a new model of the TENG concep which was originally invented by Prof. Zhong Lin Wang at Georgia Tech. The researchers say they have improved the sensors and energy generating devices that can be made into wearable applications, such as sewn into a tee-shirt like a patch (*pictured below*), or attached inside a pair of shoes.

Principle project supervisor and Advanced Technology Institute director Prof. Ravi Silva says: "Wearable TENGs can be made from natural fabrics, such as cotton or wool, so the idea is carbon-friendly 'renewable' technology that could be used for years."

TENGs could also be used in a sensor pad on a pavement which, when stepped on by pedestrians, would create the energy needed to light streetlamps. They could also be placed inside a tyre and connect to the vehicle's battery to generate electricity.

There are plenty of technological solutions to cost-effectively connect the unconnected, including Google's ambitious *Project Loon* that has attracted much interest in Asia.

Flights of fancy

Billions of people around the world have yet to make their first phone call, let alone access the internet. Connecting them is going to prove to be industry's toughest challenge yet, as RAHIEL NASIR discovers.

Five billion people across the world are now mobile subscribers. That milestone was reached earlier this year and, according to the GSM Association (GSMA), a further 620 million users will be added by 2020 to reach almost three quarters of the global population, with Asia driving the growth *(see Wireless Business, Q217 issue)*.

But in its *Global Mobile Trends 2017* report published in September, the GSMA warns that the rate of growth is slowing. It says that while it took four years to move from four billion global subscribers to five billion, reaching the next billion will take longer and will be the "toughest challenge" yet.

And with 50 per cent of the world's population still not online, the report says: "The digital divide is greatest in India and sub-Saharan Africa which account for 42 per cent of the world's unconnected, with more than 60 per cent of their respective populations not yet on the internet."

At current rates of progression, Ericsson predicts that mobile broadband will provide network coverage to around 95 per cent of the world's population by 2022. So will that be sufficient for wireless service providers? With dwindling ARPUs continuing to afflict mobile operators everywhere, what incentives do they have to invest in rolling out their networks to remote and rural areas?

Sort your costs out

Canada-based NuRAN Wireless has developed cost-effective mobile network infrastructure to enable rural connectivity in emerging markets. Bradley Shaw, the company's MEA regional manager, believes that there are profits to be made in such low ARPU environments, as long as operators make the right equipment choices. "You just have to be efficient with the capex and the opex. Operators had no interest in expanding service into remote rural areas with traditional infrastructure because it meant operating at a loss. We now see operators rolling out sites based on NuRAN, and soon-to-come *OpenCellular*, for less than USD30,000, and paying back the investment in less than 18 months. Some low-traffic sites even get built for USD10,000, all inclusive. The efficiency in terms of spend is critical when you're working in low ARPU environments."

OpenCellular is one of the initiatives being developed by the Telecom Infra Project (TIP). Established in 2016, TIP describes itself as an "engineering-focused" collaboration between operators, suppliers, developers, integrators and startups. Their aim is to come up with fresh technologies, examine new business models, and drive investments into telecoms. Its *OpenCellular* project group focuses on the development of wireless access platforms and is co-lead by experts from NuRAN Wireless, Facebook, Keysight, amongst others.

Earlier this year in June, NuRAN presented details of its new *OpenCellular* product, the *OC-2G* to TIP members. The company said that the base station will be integrated with its proprietary software stack and base station controller in order to form a complete RAN solution for carriers looking to expand their footprint to communities of 400 to 1,500 inhabitants.

But, as has been well documented in the industry and as Shaw goes on to reiterate, it's not just a question of deploying mobile infrastructure in remote and rural areas. For example, he says: "Voice traffic, as we all know, is declining and data services are increasing. The use of data and the increase of ARPU through data services is largely device-driven, but in rural areas you have very low penetration of smartphones."

Of course that is likely to change moving forwards with the GSMA pointing out that, like subscriber growth, smartphone uptake is also being driven by developing markets. In fact, in its *Global Mobile Trends 2017* report, the association said that five markets are forecasted to account for more than 40 per cent of the 1.6 billion new smartphone connections by 2020, of which four are Asian – India, China, Indonesia and Pakistan (the other country is Nigeria).

The power to succeed

However, the challenges of remote and rural connectivity cannot simply be solved by building low capex and low-cost networks and making affordable handsets available. From Asia to Africa, another basic problem in many emerging markets is a lack of grid power.

"We are seeing sites that are being closed down because they are not profitable," says Shaw. "Why is that the case? The operator is running a diesel generator which is, say, five hours from the closest urban environment. So the cost of purchasing the diesel on top of the cost of shipping it makes that site unsustainable. Whereas if the operator had put in a solar, low-powered base station, the returns from that site might be marginal but at least it would still be breaking even."

NuRAN itself offers several products here, including the *LiteCell 1.5* which it claims is the world's "most affordable, lowest power consumption, and easiest to deploy GSM base station". Specifically designed to reach the next billion subscribers, it is said to only consumer 65W, thereby minimising the capex associated with solar panels and batteries, or opex in the case of diesel-powered sites.

The firm adds that the hand-carried, tower-mounted *LiteCell*, does not require any machinery to install, nor any kind of shelter to protect it. Antennas connect directly to the unit, while an all-IP interface makes it easy to connect to any IP-based terrestrial or satellite backhaul. Earlier this year, Globe Telecom announced that it would use *LiteCell 1.5* for the next phase of its ongoing rural connectivity programme in the Philippines *(see News, Q217 issue)*.

Of course, NuRAN is not the only company to make specialised infrastructure for remote and rural mobile sites. Since 2004, India's Vihaan Networks Limited (VNL) has been developing and offering low-powered base stations that can be run using solar energy as part of its *WorldGSM* system. The company, which is part of the Shyam Group, says its systems has since been deployed to rural areas in India, Nepal, Myanmar, Indonesia, Bolivia, Bhutan, Kenya, Uganda and Ghana. Last year, Indian state-owned telco BSNL (Bharat Sanchar Nigam Ltd) awarded VNL an INR1,648 crore infrastructure project for providing connectivity in more than 4,000 villages in remote areas of Arunachal Pradesh and Assam.

Another innovative infrastructure specialist that made its debut in the telecoms market a few years ago is Range Networks, the US company that claims it developed the industry's first commercial open source cellular system. Range says its software runs on off-the-shelf hardware that is typically less than 20 per cent of the cost of custom hardware to deliver full-featured mobile services. It reckons this allows the operator to make a profit while charging a price that "almost any" subscriber can afford.

Range has designed its system to support different radio interface protocols. It says the system can run as virtual machines on the same standard *Linux*-based server hardware while sharing the same 'IP core'. The same software is utilised for microcell to macrocell coverage, with the operator or systems integrator mixing-and-matching COTS hardware for the most appropriate, complete coverage solution. The solution provider can either virtualise network functions or implement a self-contained *Linux* OS base station.

"This means that a greenfield carrier can start with a simple 2G network and, over time, develop a mixed 2G-3G-4G system, using whatever technology is best adapted to particular sites," states the firm. "Core network upgrades are just capacity upgrades, replacing existing servers with more cores or faster processors as the traffic volume increases, or by adding incremental software upgrades to provide new features, such as MMS, as they become available."

In 2013, working in collaboration with the University of California at Berkeley, Range installed a new network at two villages in Papua, Indonesia. It says these villages lacked any mobile coverage, and that the nearest town that offered connectivity was a four-hour drive away.

According to Range, its engineer had the network up and running after spending just one day on site. A small hydro-generator was used to provide enough power to keep the network active. After only two months of operation, the company says the network was profitable, and that further earnings were used to help fund a local school.

One project that has been garnering headlines over the last few years is *Project Loon*. The initiative is being developed by Google as a way of putting broadband within reach of millions of currently unconnected people. It involves 12-metre tall balloons that act like floating mobile towers. They fly on stratospheric winds at altitudes twice as high as commercial planes, and are fitted with low-powered electronics to beam an internet connection down to the ground. As one *Loon* drifts out of range, another moves in to take its place.

The project has undergone trials in many countries, notably in South Asia. For instance in Indonesia, it has been tested by the country's three biggest cellcos *(see News, Q415 issue)*, while in Sri Lanka the government has bought a 25 per cent stake in a joint-venture setup with Google in return for the spectrum that will be allocated for the project *(see Wireless Business, Q116 issue)*. But in February 2017, it was widely reported that the ITU blocked Google from using the same frequency as Sri Lanka's public broadcasters over fears of interference.


Bradley Shaw, Regional manager MEA, NuRAN Wireless

"The use of data and the increase of ARPU through data services is largely device-driven, but in rural areas you have very low penetration of smartphones."

Faster than fibre – the new space race

When it comes to connecting remote and rural users, satellite technology comes into its own in terms of its speed of deployment and ubiquitous coverage.

But at the same time, critics often point out the high price of satellite capacity which, it would seem, is at odds with the idea of MNOs drawing a profit by investing in building networks to low ARPU outposts.

The satellite industry is countering by talking about decreasing satellite prices, particularly in terms of the cost per megabit rather than cost per megahertz. And if the analysts are to be believed *(see Wireless Business, p14)*, the market looks set for further price falls as the latest generation of smart and efficient high throughput satellites from the likes of ABS, Intelsat, Yahsat, et al, find their way into space.

But the real game-changer is likely to come with the launch of the low-Earth orbit satellites (LEO) that have been much talked about over the last few years. Even the GSMA in its *Global Mobile Trends 2017* report believes that satellite "has re-emerged from the ashes of failed attempts in the early 2000s" as an alternative connectivity option. It said the technology could provide an alternative backhaul option in reaching rural unconnected areas in emerging markets and serve as a complement to mobile networks, offering capacity wholesale to operators.

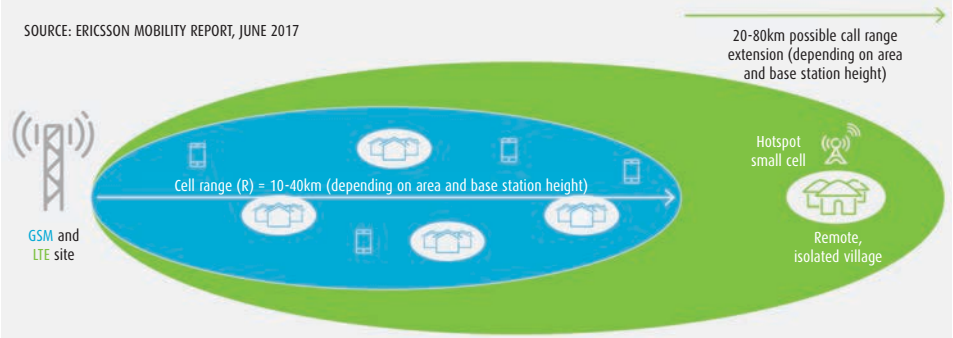
One of the companies that has attracted some big name backers for its LEO mission is OneWeb. With directors from major players such as Airbus, Bharti, Coca-Cola, Intelsat, Virgin and others on its board, the company's aim is to fully bridge the digital divide by 2027.

OneWeb says its small satellites will feature fewer components and weigh less than 150kg, thus making them easier to produce at scale and cheaper to launch. Once in space, they will create a 'mesh' style network by intelligently interlocking with each other to create a planet-wide footprint.

Working with manufacturer Airbus and its launch partner Virgin Galactic, OneWeb plans to send its first 10 satellites into space early next year. Assuming these successfully pass all in-orbit tests, the full launch campaign will begin six months later with services going live in 2019.

OneWeb will ultimately use a constellation of 648 satellites orbiting the Earth at an altitude of around 1,100km. The company reckons this closer position will result in much better web performance, and is targeting latency of around 30 milliseconds – that's much lower than the 240ms delay geostationary satellites suffer from as they circle the planet at an altitude of approximately 35,786km above the equator.

US-based LeoSat is aiming to go even better



Example of solutions for providing mobile broadband coverage in remote rural areas.

with its constellation of around 78 to 108 high-power Ka-band satellites that are planned for launch in 2019. They will use polar orbits to provide full global coverage, and each one will be interconnected using unique laser links. Once uplinked to the constellation, LeoSat says data will travel from satellite to satellite until it reaches its downlink destination – there is no need to interconnect with any third-party network or any satellite gateway infrastructure to carry data.

According to the company, all this effectively creates an optical backbone in space which is about 1.5 times faster than terrestrial fibre backbones. It promises an average latency of below 120ms, which would make it better than terrestrial fibre. LeoSat's website explains that it is all down to physics: "Light travels faster in free space than it does in a fibre optic cable once that cable reaches a certain length. Our services will start making up the extra distance [light] has to travel back and forth to the spacecraft (at 1,400km), and then get ahead of fibre. That critical cable length is about 5,000-5,500km, subject to the type and age of cable, the amount of switching panels on the route, the latitude of the begin and endpoints of the connection, to name a few variables."

2G, 3G, 4G or 'white elephant'?

When building networks in greenfield sites today, MNOs may face a dilemma: should they invest in basic but higher margin 2G networks, or enable first-time users in remote and rural areas to 'leapfrog' technologies and benefit from faster but pricier next-generation infrastructure?

"You have got to look at the device penetration in these areas," advises Shaw. "The way that operators can do that with 100 per cent certainty is to put up a 2G network, cover everywhere, and then see what devices are registering on their network. Where they find there are pockets of high-penetration 3G devices, build 3G networks. And if by some chance they find pockets of very high 4G-enabled devices, they should put up a full LTE base station."

Ericsson agrees here. In its *Mobility Report* published in June, the vendor offers detailed advice about how operators should go about choosing the right generation mobile technology.

For instance, in areas already covered by 2G, it says factors such as demand for connectivity, availability of device types, cost sensitivity among mobile subscribers and operator business case will influence whether upgrading to 3G or 4G coverage will be preferred as an initial solution.

One of the ways operators can decide which sites to upgrade from 2G to 3G and/or 4G is by using CDRs associated with the existing network. Ericsson says the data here can determine which 2G sites have the highest number of expected mobile broadband-capable users.

Another useful exercise for MNOs is to see how their spectrum assets match the capabilities of their subscribers' device capabilities. "Existing spectrum assets, spectrum re-farming opportunities and device penetration (supported technology and bands) influence the revenue potential of 3G and 4G deployments," states the report.

But the GSMA is keen to point out that operators should avoid a 'if you build it, they will come' type mentality. Despite the fact that most advanced countries now have national 4G networks, its says take-up patterns are mixed. It even describes India as an anomaly: "Coverage is out of sync with consumer demand. With operators only able to reduce pricing so much in an already competitive market, the risk is that 4G becomes a 'white elephant'."

So what about delivering mobile broadband to areas where there is no coverage, 2G or otherwise? Here, Ericsson says that any villages that are within 2G coverage zones, can be upgraded with 3G or 4G. Villages outside these zones can then install an outdoor high-gain antenna that can be used to provide fixed wireless broadband access to important hotspot sites within the community.

"This solution requires low investment and the 4G site can serve a hotspot that is located 20-80km outside the 2G coverage range," says the report. "In this scenario, the school or hospital is equipped with a roof-top antenna which, as an example, would get 3Mbps downlink speed (wireless indoor coverage and LTE modem connected to, for example, a Wi-Fi router) at a distance of 100km away from the 4G-upgraded base station site using 2x10MHz of spectrum."

Making the connection

Clearly, connecting the next billion people requires a monumental effort, and the responsibility does not lie solely with the operator. An entire ecosystem of vendors, developers, regulators, governments, etc., has to be mobilised in order to make it happen.

The GSMA has developed a *Mobile Connectivity Index* that measures and quantifies the barriers to mobile internet access across four key enablers: infrastructure; affordability; consumer readiness; and content. The index is built up through 39 specific indicators, such as mobile tariffs, handset prices, spectrum, local incomes, etc., to ultimately give each country an aggregated score from 0-100 for each of the four enablers.

According to the index for 2016, Australia topped the rankings of 150 countries with an overall score of 87.3. It was followed by Norway (85.5), New Zealand (85.2), Finland (83.9) and Singapore (83.4). The latter is the only South Asian country covered by this magazine to feature in the higher rankings – the next is Malaysia which comes in at number 48 with a score of 69.85 *(also see GSMA Mobile Connectivity Index table, below).*

At the other end, countries at the lower end of the scale were mostly African, with Niger at the bottom with an overall score of 17.2. It was only slightly outperformed by the DRC (17.7), followed by Chad (20.2), Guinea (20.3) and Afghanistan (23.1).

Thus, mobile coverage is not the only barrier according to the association's *Global Mobile Trends 2017* report. It states: "The largely rural populations and lack of fixed line infrastructure make extending coverage a long-standing challenge for many developing countries. Of the 3.7 billion not yet on the internet, around a third (1.2 billion) live outside a 3G or 4G signal and so could be considered excluded because they don't have fast enough coverage.

"The corollary is equally important: for two thirds of the unconnected, coverage is not the problem. Affordability, content relevance, literacy skills and gender factors are all part of the discussion." ■

GLOBAL POSITION 2016	COUNTRY	OVERALL SCORE 2016	OVERALL SCORE 2015	OVERALL SCORE 2014
5	Singapore	83.41	82.64	79.96
13	South Korea	82.12	81.71	77.79
19	Hong Kong	80.01	77.85	76.56
21	Japan	79.17	77.16	75.95
45	China	70.73	67.34	63.41
48	Malaysia	69.85	67.02	64.86
54	Thailand	68.05	64.56	62.49
59	Brunei	66.35	64.82	62.18
65	Mongolia	64.50	56.30	52.52
77	Philippines	61.80	57.99	54.89
79	Sri Lanka	61.06	54.06	50.43
85	Vietnam	59.65	55.10	51.60
100	Indonesia	52.17	49.03	46.80
104	Cambodia	50.12	41.79	38.96
105	Myanmar	49.90	44.67	39.80
107	India	48.54	43.70	39.68
109	Bangladesh	48.40	44.94	41.62
112	Laos	46.99	42.22	36.49
113	Bhutan	46.42	41.50	36.40
115	Nepal	44.43	38.03	34.20
126	Pakistan	37.46	34.49	32.63
146	Afghanistan	23.06	21.25	18.86

Extrapolated data for Asian countries from the GSMA's *Mobile Connectivity Index.* SOURCE: GSMA INTELLIGENCE

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Top of the class

Thaicom's *IPSTAR* – said to be the world's first high throughput satellite – has been playing a crucial role in providing broadband internet access to remote schools in Thailand.

Connecting schools and universities, especially in remote and rural areas, is vital for the provision of high quality and up to date teaching and learning.

Formerly known as Shin Satellite Company, Thaicom is a subsidiary of InTouch Holdings, the biggest telco in Thailand and the owner of AIS, the country's largest mobile operator.

Thaicom currently operates a fleet of five spacecraft including *IPSTAR (THAICOM 4)* which was launched in August 2005 and is claimed to be the world's first high throughput satellite. Orbiting at 119.5°E, *IPSTAR* is said to have a capacity of 45Gbps and includes 87 Ku- and 10 Ka-band transponders with beams covering India and the Asia-Pacific region.

The satellite has played a key role in connecting schools in remote parts of Thailand.

For example Chiang Rai, the country's northernmost province, has a population of around a million people who live in isolated remote communities and subsist through farming and tourism. They are scattered throughout vast, mountainous and heavily forested lands with little telecoms infrastructure in place.

As a result, many rural schools in Chiang Rai are simply beyond the reach of broadband internet. According to Thaicom, it is not viable to roll out terrestrial infrastructure in such areas due to the high cost of installing copper, while a WLL that uses microwave is also unsuitable for very harsh terrain or locations that are 20km away from the nearest PSTN link.

Therefore the concept of teachers and students enjoying fast, reliable and always-on broadband access to digital libraries has been considered unfeasible for many remote and rural schools. But now, some secondary schools in the province have been provided with broadband internet access via *IPSTAR* and the distance learning and rural development projects initiated by Mae Fah Luang University (MFLU) and the National Telecommunications Communication.

Based in Chiang Rai, MFLU has developed e-books and documentaries for both remote teachers and students, and uses satellite broadband connectivity to deliver online educational content to them. Students can also submit homework online via the satellite connection.

The impact of broadband internet on the teachers' instructional style has been dramatic. Thaicom said that instead of spending most of their time standing in front of the classroom and talking, teachers are now giving project-based activities. Furthermore, instead of relying on textbooks, they are now directing students to research educational materials using the internet. The connectivity has enabled remote students to access updated online educational content that is usually not available in their textbooks or in the school library.

In another deployment, this time on the other side of Thailand, *IPSTAR* has also helped to bring connectivity to the remote southern province of Pattani. Around 90 per cent of its population (approximately 540,000 people) live in rural areas which, like Chiang Rai, lack telecoms infrastructure.

As part of its *Education on Demand in Classroom* project, Bangkok-based Sat-Ed Systems is providing remote schools in the country with access to digital libraries. Using broadband internet connectivity enabled by *IPSTAR*, Sat-Ed's IPTV platform delivers video on-demand from its digital libraries direct to TVs in the classroom. Thaicom said that by using a simple remote control, teachers can navigate through a series of high-quality videos and students can answer on-screen questions. It added that the videos can be paused, rewound, forwarded or stopped, resulting in a more flexible learning environment.

Schools in the rural province of Pattani in Thailand are benefitting from Sat-Ed's IPTV video on-demand learning platform.

The IT team at India's SOA University realised they had to offer a secure Wi-Fi environment that could handle a large capacity of concurrent mobile devices.

Only a WLAN provided by Aruba was able to deal with network traffic at Universiti Malaya.

WLANs provide campus-wide connections

Located in Bhubaneswar, India, Siksha 'O' Anusandhan (SOA) University offers higher education programmes in a wide range of disciplines including engineering, medicine, management, and law.

In recent years, Wi-Fi-enabled mobile devices have become increasingly ubiquitous, building a strong momentum for the so-called 'BYOD' ('bring your own device') trend in both enterprises and academic institutions. As a result, users are demanding reliability and high-performance mobility for internet services. In order to meet these demands, administrators at SOA University realised they had to offer a secure Wi-Fi environment that could handle a large capacity of concurrent mobile devices. But they faced several challenges when it came to providing mobile-ready campus Wi-Fi.

Firstly, since the university encompasses a wide area, the deployed access points needed to support fast roaming as users moved from one AP to the next. Secondly, given that SOA could potentially have up to 1,100 students online at any one time, each with multiple mobile devices, the WLAN infrastructure needed to be robust and able to operate reliably in high-density environments. And thirdly, the university wanted to provide differentiated access privileges for faculty members and students to ensure the security of sensitive data.

After surveying solutions offered by several vendors, SOA chose 4ipnet's *WHG405* and *WHG515* WLAN controllers with *EAP110* indoor APs. According to Taiwan-based 4ipnet, the controllers enabled browser-based user authentication, providing an easy and intuitive method for students to login.

Furthermore, it said role-based policies allowed administrators to enforce firewall rules and limit internet usage of individual users. For example, students could be prohibited from browsing *Facebook* during class time, while bandwidth throttling would prevent the campus network from being overwhelmed by HD video streaming and other high-capacity applications.

In the event of illegal internet activities such as music or movie downloading, IT staff could use detailed usage reports, such as HTTP Web and NAT Conversion logs, to quickly trace the source of the activity. 4ipnet said these user management and logging features of its *WHG* controllers created a secure and reliable Wi-Fi environment for every user at the university.

The company added that its "cost-effective" *EAP110* APs provide up to 300Mbps for 802.11n clients, and include comprehensive features. For example, VLAN tagging allowed the university to segregate network traffic and limit broadcast domains, while Layer 2 firewall helped prevent unnecessary packets from entering the network, freeing up airtime for additional data transfer. It's claimed that the most significant benefit came from integrating the *EAP110*s and *WHG* controllers. 4ipnet said this enabled SOA's IT team to perform centralised access point management and monitoring, rogue AP detection, and load balancing between APs.

The WLAN solution has allowed the university to deliver a next-generation mobile e-learning experience. From network services to user monitoring and AP management, 4ipnet said its system's features helped simplify network administration and guarantee high performance and security.

Established in 1904, Universiti Malaya (UM) in Kuala Lumpur has more than 30,000 students, staff and faculty from more than 90 countries. Its alumni include many prime ministers and presidents.

As a renowned research establishment with 17 research centres, almost every aspect of UM's academic mission depends on digitally connecting its students and staff. So when the university's Ethernet switches were approaching end of life and an edge refresh was needed, users increasingly sought expanded wireless access. But UM's IT team realised that paying for a system-wide upgrade and expansion of redundant wired and wireless networks was incompatible with their cost-reduction goals.

Continued reliance on Ethernet as the primary form of network access would require the replacement of more than 250 Ethernet switches, the addition of another 300 to support the growing number of users, and the installation of 7,200 new cables just to provide basic campus coverage. The total cost was expected to exceed USD1.97m, and once completed it still would not address the growing need for mobility.

In addition to being costly, students had stated that Ethernet was their last choice for network access. Moreover, planned voice over Wi-Fi and wireless CCTV projects meant that some expansion of the wireless network was necessary.

UM undertook a thorough investigation of its current and future requirements for network access. Topping the list were high network availability and security: performance needed to equal or exceed the broadband experience users had at home; while network security included protection of the main campus as well as several additional remote sites.

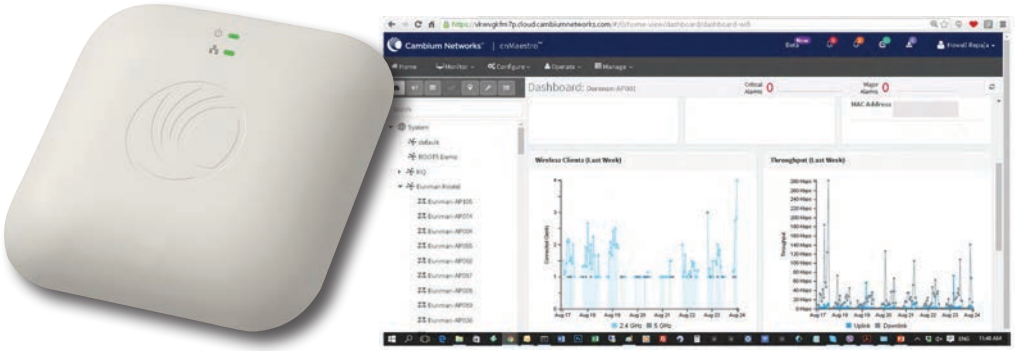
Both security and management needed to be centralised in order to efficiently deliver robust service level agreements. UM also wanted a single SSID for its wireless users, having already discovered that too many SSIDs tended to confuse users and overwhelm the help desk.

As a result of its investigation, the university came to the conclusion that only an adaptive wireless LAN could meet its needs. This would not require much of the existing Ethernet network as an adaptive WLAN would have sufficient bandwidth and provide the necessary stability to meet the needs of most users. UM's IT staff realised that the deployment of a pervasive wireless network would further accelerate the migration away from Ethernet, making it unnecessary to replace most of the legacy switches. They also learned that because wireless APs cost around one-third to one-sixth as much as the switches they replace, there was an added incentive to replace as many switches as possible with wireless access points.

UM had previously deployed a wireless network, but found that this was insufficient to meet its new objectives. As well as a WLAN system that could provide a single SSID for both data and voice applications, its IT team wanted to be able to set privilege levels based on device or user identity and roles, and centrally manage everything with easy-to-use tools. They selected Aruba Networks (now owned by HP) for the campus-wide network.

The company's wireless controllers are centralised in a single data centre to meet the university's network management requirements. Aruba's *AirWave Wireless Management Suite* was selected as the primary management tool, and provides visibility into every network and device, automates most management functions, and tracks users and usage history. It's claimed that centralising network management and providing remote diagnostics and updates have lowered IT overhead while increasing network uptime.

In addition to encryption and authentication services, the new network features secure guest



Above: Cambium Networks' *cnPilot e400* indoor access points support 256 concurrent clients. **Right:** the *cnMaestro* network management system enables Dunman High School's IT department to view Wi-Fi clients and throughput.

access and automated rogue detection to address UM's security concerns. Aruba said its policy enforcement firewall monitors and controls bandwidth utilisation on a per application, device, location, time of day, user or group basis, thus ensuring that the network is available at all times for essential applications.

According to the firm, wireless APs cost around one-third to one-sixth as much as the switches they replace. As a result, UM was able to make considerable savings and it's claimed that these added up to more than USD1.42m in the first year thanks to eliminating the ports, cables, switches, and labour costs associated with the campus-wide closet refresh and network expansion.

Aruba adds that while network edge rightsizing provided the original incentive to deploy a WLAN, the network itself may soon become the foundation for a new generation of technology innovations. Looking forward, UM believes the WLAN will spark new innovations simply by virtue of the unfettered network access it provides. While voice, video and data are currently the most important applications, the university said the availability of pervasive connectivity will lead to the development of new collaborative, research and learning applications.

Meanwhile south of Malaysia in Singapore, Dunman High School (DHS) also now has campus-wide Wi-Fi, this time thanks to Cambium Networks.

DHS is one of the few academic institutions on the island that has an attached student hostel. In mid-2016, it needed a Wi-Fi connectivity solution to provide complete, high-capacity coverage for data and file transfers, streaming video and social media. This was required for the school's two buildings that were used by more than 350 students, faculty and staff across a combined 14 floors of dormitories, offices, refectories and common areas.

Local wireless engineering and systems specialist Roots Communications was tasked with the deployment. It used Cambium Networks' Wi-Fi technology as part of the system designed to meet DHS' high-capacity needs, and claimed to save about 20 per cent on equipment costs compared to access points from rival manufacturers.

Roots installed the vendor's *cnPilot e400* indoor Wi-Fi solution which included devices that support 801.11ac, 2x2 MIMO, dual band frequencies, 256 concurrent clients, and 16 SSIDs. The *cnMaestro* system is used to manage the network.

According to Cambium, its system was easy to deploy and rapidly connected the school's living areas with no disruption. It added that the network offers reliable and complete coverage across the entire campus which includes classrooms, administrative offices, dormitories and common areas.

With fewer user complaints and noticeably less downtime than the former system, the network's performance is said to have satisfied students, staff, as well as DHS' admin departments.

"Young people, especially students, demand the most from Wi-Fi," said Chong Wen Loon, senior manager, Roots Communications. "*cnPilot* provides them the streaming video and file transfer they need, while also pleasing the school finance team who wants an affordable solution with a low total cost of ownership."

Smart classroom transforms medical education in Vietnam

Located in Northern Vietnam, the Thai Nguyen University of Medicine and Pharmacy (TNU-UMP) was originally founded in 1968 as Bac Thai Medical University. Now, almost half a century later, the university is said to have grown into a leading medical institution in Vietnam, and claims it has made a great impact on the health and overall well-being of both Thai Nguyen's citizens as well as people living across all of the Northern provinces.

However, as the nation's health needs have changed, its medical universities have faced challenges in training a workforce that can respond to the needs of a population now dealing with the threats of chronic and emerging illnesses.

This is particularly the case in rural, mountainous and other underserved areas. Here, facilities, curricula and teaching approaches are often based on outdated concepts of instruction and learning, and classes are often held in large group lectures with minimal use of modern, student-focused techniques that are known to be most effective.

Launched in 2016, the Improving Access, Curriculum and Teaching in Medical Education and Emerging Diseases (IMPACT MED) Alliance was established to improve medical education in Vietnam by giving graduates the skills and knowledge to address local health challenges. The five-year alliance is supported by USAID in collaboration with the country's Ministry of Health, universities of medicine and pharmacy, and industry partners that include Johnson & Johnson, Samsung, Bravo, GE, Roche, 3M, BD, Microsoft and CLAS Healthcare.

All the partners work to institute a more active learning approach, incorporating innovative curricula, training in modern instruction, and the use of technology and online content to enhance student learning. Training led by Harvard Medical School educators produces faculty with improved skills in curriculum design and science and clinical teaching, and creates a community of faculty to develop innovation in medical education.

In September, alliance member Samsung and the Partnership for Health Advancement in Vietnam worked together to improve conditions for active learning at TNU-UMP. Samsung supported the design of a 'smart classroom' with interactive and interconnected smart boards and tablets, while the Partnership for Health Advancement provides training and technical support to the university's faculty in course design and new interactive, learner-focused teaching methods.

In pilot projects of its *Smart Classroom Solution* elsewhere in the world, Samsung has been supplying teachers and entire classes with their own personal devices, and has provided a complete digital education package consisting of tablets, a server and software. For these projects, the school software suite includes the company's *Interactive Management Solution*, *Mobile Learning Management System*, and *Student Information System*.

Prior to the deployment, TNU-UMP's Dr. Nguyen Thi Binh would stand in front of nearly 100 students who sat in row after row with pen in hand, transcribing her every word. With such a large and crowded room, she found it difficult to engage her students in discussions and to have interaction with and between them. Binh also worried that the students would leave her classes with adequate knowledge but limited ability to apply that knowledge in real-life medical situations.

In the new smart classroom, she can now integrate multimedia, clicker questions and other interactive tools into her lecture to better engage her students. In the future, with additional training and technical support from the project, Binh looks forward to providing her students with the highest quality medical education.

An additional smart classroom was also launched in 2016 at Ho Chi Minh University of Medicine and Pharmacy. ■

Dr. Nguyen Thi Binh of Vietnam's Thai Nguyen University of Medicine and Pharmacy gives a lecture in a newly redesigned classroom. PHOTO: HAIVN

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Evolving network architecture for the web-scale era

The IoT and shift to cloud-based applications are redefining how underlying networks are designed, operated and developed, as FADY MASOUD explains.

The IoT is shaping our day-to-day lives – it is estimated that thirty billion devices[1] are expected to be connected to the internet in 2020.

Moreover, cloud-based applications are also changing today's enterprise landscape, from the products manufactured and the services offered to the way enterprise employees interact with each other, or with customers and partners. In fact, enterprise applications are doubling every 2.5 years, and global cloud traffic is expected to increase almost four-fold between 2015 and 2020[2].

As the cloud relies heavily on data centres, annual global data centre IP traffic (the data centre to data centre traffic known as 'east-west') is expected to reach 15.3ZB by 2020[2], up from 4.7ZB in 2015.

The fast-paced proliferation of internet-connected devices and the paradigm shift to cloud-based applications are fuelling major disruption and redefining how the underlying networks are architected, operated and evolved.

There was a time...

The evolution of optical transport networks from asynchronous and proprietary – for example, Asynchronous Transfer Mode (ATM), Token Ring, or fibre distributed data interface (FDDI) – to synchronous and standards-based (such as SONET/SDH) in the early 1990s has changed the telecoms landscape forever.

[1] www.mckinsey.com/industries/high-tech/our-insights/the-internet-of-things-sizing-up-the-opportunity

[2] siliconangle.com/blog/2016/11/11/global-cloud-traffic-to-increase-by-3-7-fold-by-2020-cisco-says/

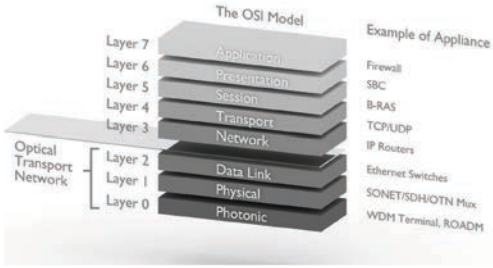

Figure 1: The Open Systems Interconnection model and examples of corresponding network appliances

Pre-defined frame rates, containers and multiplexing hierarchy unlocked interoperability between different carriers' networks and allowed the extension of optical transport networks to reach all four corners of the world. Voice protocols comprised the majority of traffic carried across the network, with fixed bit rate (typically 64kbps) and pre-determined (or predictable) traffic patterns.

Simultaneously, Ethernet has evolved in data rates as well as in traffic engineering and management capabilities to provide a ubiquitous, simple and cost-effective way for data networking over ATM, Token Ring, FDDI, etc.

Accompanying this evolution, the seven-layer Open Systems Interconnection (OSI) networking model was introduced in the mid-1980s. This was the reference architecture to which the different types of optical terminals were designed and built *(see figure 1 above)*.

"Layer 0" has been added to reflect the advancements of WDM and its new wavelength-based routing and switching capabilities. Later on, the concept of "Layer 2.5" was added to reflect MPLS and VLAN technologies.

In the late 1990s and early 2000s, the optical networking industry witnessed numerous technology breakthroughs in hardware and software that led to the creation of a new breed of optical platforms. This generation offers networking capabilities in adjacent layers to further maximise return on investment and simplify network operations *(see figure 2 below)*. This was the birth of a still-evolving new type of optical equipment called packet-optical transport systems (P-OTS).

The rise of the ICPs

The proliferation of the internet and the paradigm shift in broadband access and optical networking have fuelled the creation of many online content providers. Most internet content providers' (ICPs') revenue streams are from online advertisements and monthly or yearly subscriptions for access to content such as movie or music streaming. Ensuring that end users have constant access to content is therefore crucial for every ICP's business model. As a result, they tend to spend heavily on their networks, particularly on data centres and cloud infrastructure. It is no surprise that the share of capex is increasingly coming from major ICPs.

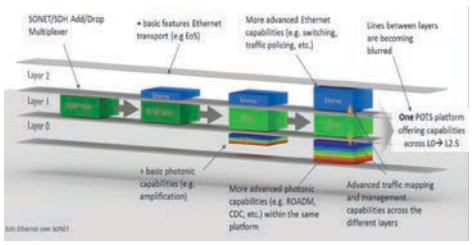

Figure 2: The arrival of packet-optical transport systems highlights how the lines are becoming blurred between the different layers in the OSI model.

The rise of the ICPs added a new type of player to the telecoms landscape. With hundreds of millions of end users (or even billions for some) spread all over the globe, an unheard-of demand for scalability and traffic growth, and significant revenue streams directly related to end users' QoE, ICPs have become a major driving force for new equipment that can offer unprecedented levels of network performance, automation and programmability.

With an ICP business model in which content is king and must be accessible anywhere, anytime and on any device with the highest level of quality, it became clear to the industry that the 1980s-era OSI model architecture underpinning the delivery of this content has reached a tipping point. It no longer supports the constant evolution in networks (e.g. NFV, SDN, etc.), nor the new service delivery model based on cloud applications, service virtualisation, etc.

OSI's heritage of function- and layer-specific network appliances, closed and proprietary protocols, rigid networking capabilities, and high operational costs sparked the urgent need to evolve toward a simpler, more efficient and agile architectural model to underpin the accelerated adoption of cloud-based networking.

Welcome to the New World

The new model consolidates and simplifies cloud service delivery and networking into two layers where all networking layers (Layer 3 and below) are represented by the transport layer, while all application layers (Layer 4 and above) are grouped under the cloud services layer.

The transport layer contains the transport functions from Layer 0 (photonic) to Layer 2.5 (packet switching), or even to Layer 3, offering 'packet-aware' transport capabilities. This layer sets the guidelines and principles for the transport of data streams, whether between end users and data centres or between data centres with bursty and often unpredictable traffic patterns.

The transport layer also defines the features and capabilities that increase network agility and performance and sets the cost points for new benchmarks in service delivery and cost-effectiveness, all key ingredients to the successful deployment of any cloud application.

Moreover, the transport layer is the cradle of numerous open concepts and projects (e.g. *Telecom Infrastructure Project* or *TIP*, etc.) aimed to ensure seamless interoperability between networking equipment vendors across the lower layers in the OSI model. The transport layer's support of open networking helps network operators smoothly transition and evolve their existing infrastructure to the cloud with ease and efficiency. It elevates network infrastructure from rigid and dedicated to shared and highly virtualised, thus allowing operators to maximise the utilisation of existing assets and defer premature capex-heavy network overbuilds.

The cloud services layer contains all applications, functions and services that run

Figure 3: Evolution from OSI to transport and cloud layer model.

in the cloud, including consumer and business applications, VNF, SDN-based service creation and orchestration tools, software frameworks and applications for big data and machine learning.

The rise of ICPs and their business model, where content must be delivered to hundreds of millions of users across the globe with the highest levels of quality, has driven the creation and development of numerous breakthroughs in defining protocols and building smart software tools. This enables large-scale task automation and programmability to streamline operations, eliminate the sources of human errors, and reduce operating costs. The massive demand for connectivity driven by the IoT and cloud-based consumer and business applications is evolving toward a model in which real-time network decisions are made autonomously (cognitive networking) over highly virtualised hardware and software resources.

The new model also defines an efficient communication and information sharing channel between the two layers through open and standards-based APIs such as RESTCONF, NETCONF/YANG and gRPC. These interfaces ensure an efficient and bi-directional information flow between the two layers to turn the network (transport layer) into a dynamic pool of resources for service requests triggered from the upper layer (cloud layer). This dynamic interworking model provides all the building blocks and mechanics to enable network-wide task automation, proactive network monitoring, dynamic bandwidth allocation and much more, as depicted in *figure 3* above.

Elevating the transport layer to web-scale

The transport layer plays a vital part in enabling cloud applications. By underpinning service requests created in the cloud services layer, which are often characterised by being spontaneous, dynamic in nature and requiring high capacity, the transport layer acts like a dynamic and instant pool of resources to provide scalable, secure and efficient connectivity as requested by upper-layer applications.

Network performance and its ability to meet the demand of the cloud services layer's applications are the cornerstone for any successful deployment of consumer or business cloud applications. Therefore, the transport layer must have the following attributes:

High capacity and seamless scalability: Technology breakthroughs in optical transport networking – such as super-channels, integrated photonics and advanced modulation schemes – unlock the ability to transport massive capacity over unprecedented distances to underpin the continuous demand for bandwidth and meet the stringent requirements of high-performance cloud applications. Transport networks must be scalable to meet future growth without network interruption or a massive infusion of capital.

- **High level of efficiency and cost-effectiveness:** While the network is key for the successful operations of all cloud providers, it represents a cost centre where opex can be lowered by choosing equipment that offers low power consumption, reduced footprint, and low cost per transported bit.
- **High level of task automation:** To deal with massive data streams and bursty, often unpredictable traffic patterns between end users and data centres or between data centres, cloud providers can leverage smart software tools to automate recurring tasks, enhance service management, and streamline operations. Emerging technologies like software-defined capacity (SDC) offer providers a network model with pay-as-you-deploy bandwidth, flexible bandwidth pools, and movable bandwidth across the infrastructure to instantly respond to forecasted and unforeseen events.

  They can also take advantage of new types of operational procedures centred around easy and rapid installation, provisioning (e.g. zero-touch), streaming telemetry, and proactive maintenance.
- **Support of open concepts/frameworks:** Many cloud providers value openness and seamless interoperability between networking equipment vendors across layers. In fact, numerous cloud providers are founding members of open concept projects and initiatives such as the *Open Compute Project* (*OCP*), *TIP* and many others. Hence, optical transport networks must support open networking concepts to help smoothly transition and evolve existing infrastructure to the cloud with ease and efficiency.

The cloud and IoT are redefining how networks are architected, operated and evolved. The fast-paced proliferation of internet-connected devices and the paradigm shift to cloud-based applications are driving an architectural evolution toward a new model based on a transport layer and a cloud services layer.

In order to better adapt to this new era of hyper-connectivity and web-scale, an intelligent transport layer leverages the latest technology breakthroughs to reach an unprecedented level of scalability, efficiency and automation. ■

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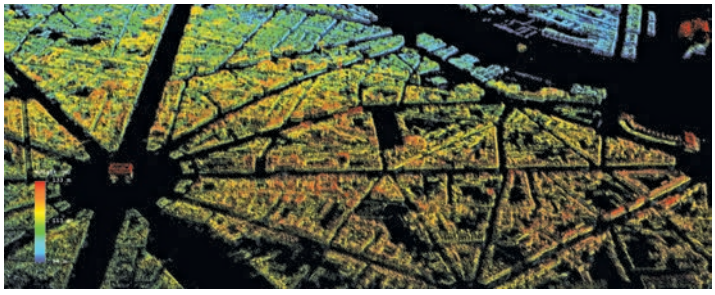
New algorithms for evaluating satellite data helps create 3D maps

Researchers from the Technical University of Munich (TUM) claim to have set a world record in information retrieval from satellite data.

Using three million measurement points in one square kilometre from image stacks captured by *TerraSAR-X*, the researchers created '4-D' point clouds of Berlin, Las Vegas, Paris and Washington D.C.

Germany's *TerraSAR-X* is said to be the world's highest resolution civilian radar satellite. It has been orbiting the Earth at an altitude of around 500km since 2007, sending microwave pulses to the planet and then collecting their echoes.

However, these measurements only yield a 2-D image with a resolution of one metre, as Xiaoxiang Zhu, professor for signal processing in Earth observation at TUM, explains:



Using satellite tomography, researchers can map Paris in 3D, and show the deformation and subsidence of structures down to the millimetre. PHOTO: UNIVERSITY LIBRARY OF TUM

"The significance of the images is limited by the fact that reflections from different objects that are at an equal distance from the satellite will layover with each other. This effect reduces the three-dimensional world to a two-dimensional image."

TerraSAR-X flies over a region of interest every eleven days but its orbital position is not always the same and varies by 250 metres. As a result, the researchers use radar tomography to localise every point, and a variety of radar images taken from different perspectives are combined to create a 3-D picture. Additional compressive sensing methods are then applied to improve resolution by 15x.

Zhu has developed her own algorithm which makes it possible to reconstruct the third and even fourth (time) dimension. Since the images are taken at different times, the resulting 4-D model reveals tiny changes with a precision of around one millimetre per year, for example, the thermal expansion of buildings in the summer or deformations resulting from subsidence below the Earth's surface.

"The method is suitable for the detection of danger points. Satellite technology can thus make an important contribution to making our urban infrastructure safer," says Zhu.

Her team now plan to create four-dimensional models of every city in the world. The scientists will use various Big Data sources for the first time – measurements from satellites will be fused with data from Open Street Map and the practically unlimited stream of images, text and activity patterns provided by social networks.

Fleet to build nano satellite network to backhaul IoT

A new company is embarking on a global tour to raise funds to launch a constellation of nano satellites connecting billions of devices with the IoT.

South Australia-based Fleet Space Technologies secured USD5m in funding in April to help it launch its first two satellites in 2018. It has booked its first satellite launch with SpaceX with a second deployment planned for the middle of the year. The company aims to have a constellation of more than 100 of its nano satellites, which measure just 30 x 30 x 40cm, in orbit by 2022, potentially connecting up to 75 billion devices to the IoT.

CEO and co-founder Flavia Tata Nardini says: "With one satellite in low Earth orbit you more or less cover all of Earth – almost 90 per cent of the planet. So the first two [launches] will do a couple of tricks for us: they will show our tech and start connecting our first customers,

CEO Flavia Tata Nardini needs funding for over 100 nano satellites.

and they will secure frequencies." Nardini did not say exactly how much investment is being sought in the latest bid but it is hoped that it will fund at least half of the constellation.

Fleet believes nano satellite technology is ideal for creating a low-bandwidth global network to directly connect the millions of digital sensors already in the IoT.

It adds that vital remote areas, such as the Great Barrier Reef and Amazon Rainforest, could also significantly benefit from improved connectivity. Nardini says: "We are working in the Amazon Rainforest where people physically measure 500,000 trees a year with calipers in the middle of nowhere because there is no connectivity. People? You can do this with a sensor."

Eurasia Tunnel critical comms system features FM break-in

The Eurasia Tunnel, the first undersea road tunnel to connect two continents, has been equipped with a public safety network from Cobham Wireless.

The multi-band, multi-technology coverage solution provides the emergency services communication within the 5.4km tunnel which links two areas of Istanbul and spans both Europe and Asia.

The customised solution incorporates Cobham's digital channel selective repeaters and band selective repeaters. It supports UHF, VHF, DMR and FM technologies to ensure emergency services and operational teams can communicate at all times throughout the tunnel.

The network features two master sites. These include one combiner and one optical master unit, and sit at either end of the tunnel with one providing essential backup coverage. The sites are connected via fibre to multiple remote locations.

Each of the master sites contains a VHF repeater for communication between ambulance services, one UHF repeater each for the police and fire departments, and DMR for Istanbul's Disaster and Emergency Management Authority. In addition, a break-in system enables operational teams to access the FM channel and alert drivers to safety issues via their in-car radios.

The entire system can be overseen and controlled off-site using Cobham's *Active Element Manager*. Also, as the digital off-air repeaters are software-based, the company says new features can be easily added via a remote download.

Cobham was awarded the contract in September 2016 and worked with integration partner Yapı İDİS to install the system. The deployment was completed within three months in time for the Eurasia Tunnel's inauguration in December 2016.

The 5.4km tunnel links two areas of Istanbul and spans both Europe and Asia.

DAS used to integrate operators

Copenhagen's new Royal Arena has overcome the problem of integrating three wireless carriers onto a single common DAS (distributed antenna system) with the help of US wireless specialist Microlab.

The 35,000m^2 multi-use venue opened earlier this year in February. It has a capacity of up to 16,000 seated and standing guests for cultural and musical shows, and up to 12,500 spectators for sporting events.

Eltel Networks, the Sweden-based technical services provider for critical infrastructure networks, carried out the DAS deployment at the arena. Lars Jessen, the company's business development manager, says: "Our challenge was to integrate a triple-band, high-power MIMO DAS solution for three operators. The main challenges were combining all services and operators in a compact, low-loss POI [point of interface] design with high performance and low PIM."

Microlab provided the solution with two POI designs, the *DCC601-B19* and *DCC601-B22*. These include nine inputs supporting different output configurations, and cover the Royal Arena's many sectors.

The vendor says its designs integrated the three carriers with three operating bands into common outputs. It claims that they also provided low loss solutions while achieving very low PIM and better than 55dB inter-band isolation to the passive DAS installation.

RSCC upgrades compression and multiplexing system

The Russian Satellite Communications Company (RSCC) has upgraded compression equipment at its Shabolovka Technical Centre in Moscow.

It says the refurbishments will give a boost to TV channels and media companies who want to more effectively use their orbit-frequency resources, as well as improve the quality of broadcasts without increasing costs.

The compression system is part of RSCC's technology platform, enabling it to provide what it describes as a "comprehensive, one-stop shop" service to broadcasters. The platform comprises space capacity, the radio-electronic facilities of the company's space communication centres, a programme package generation complex, and a terrestrial network. Services provided through the platform are focused primarily on media structures that distribute their content in Russia's cable television networks.

RSCC's Shabolovka facility in Moscow is one of six technical centres operated by the company and is said to have capabilities beyond teleport services.

RSCC operates six space communications centres. As well as Shabolovka in Moscow, which offers more advanced technical capabilities, there are teleport facilities in Dubna, Medvezhyi Ozera, Skolkovo, Zheleznogorsk, Khabarovsk.

Established in 1967, RSCC owns Russia's largest satellite constellation. Its current fleet of 12 spacecraft covers Russia, CIS, Europe, Middle East, Africa, Asia-Pacific, Australia and the Americas. It also runs its own fibre network in Russia.

The company's terrestrial spacecraft control complex monitors not only its own satellites but also those of other operators, such as Eutelsat.

Brazil FPSO fleet connects with ITC Global

ITC Global is delivering communications services to seven floating production, storage and offloading (FPSO) vessels located offshore Brazil for an unnamed oil and gas service company.

The customer provides floating production solutions to the offshore energy industry over the full product lifecycle and specialises in the construction and operation of FPSO vessels. These have been outfitted with ITC Global's VSAT solution to enable the fleet to manage essential business communications and applications. The new infrastructure components include dedicated bandwidth links ensuring speed and uninterrupted service. All services include ITC's round-the-clock network monitoring and support.

This latest deal for ITC follows the successful deployment of its services to four vessels in West Africa last year. It represents the second of three deployment phases for the customer's globally dispersed FPSOs as part of a three-year, multimillion-dollar contract that also covers North America.

Panasonic acquired ITC Global in 2015. It's claimed the combined company has become the world's largest buyer of commercial space segment with coverage spanning all major oil and gas hotspots, and more than 98 per cent of the busiest maritime routes globally.

The Panasonic network is comprised of traditional wide beam and HTS capacity as well as planned extreme high throughput satellite (XTS) capacity.

KBR and Cambium connect 2017 Tour of Britain

Cambium Networks and Wi-Fi specialist KBR helped to keep thousands of people online during the recent *Tour of Britain* cycling event.

KBR used 16 of Cambium's *cnPilot e500*s outdoor access points for the nationwide event which ran from 3-9 September. As well as providing Wi-Fi coverage to spectators, staff and media at the finishing line of each of the tour's eight stages, the APs also enabled internet access for the event's hospitality suites, public viewing spots and the sponsors' exhibition.

KBR used Cambium's outdoor APs to provide Wi-Fi coverage at the finishing line of each of the tour's eight stages.

In addition, the network was used by staff to collect race statistics and information, as well as provide them with reliable communications and connectivity to the service vehicles.

KBR has provided Wi-Fi at the annual *Tour of Britain* for the last four years. Speaking before the event began at the end of August, the firm's technical director Gareth Tomlin described Cambium's solution as "incredibly easy to deploy". He said this was crucial when setting up eight different Wi-Fi networks in different cities over eight successive days.

He added that depending on the size of the run down to the finish line, KBR could put up as many or as few APs as required and mesh them together quickly and efficiently.

"This overcomes the complexities this situation presents, with potential challenges including the network's physical infrastructure, the number of people accessing the service, and the Wi-Fi range," said Tomlin.

"Watershed" moment as first SACS link is installed

Angola Cables has moved a step closer to completing the South Atlantic Cable System (SACS) with the installation of the first direct subsea link between Africa and South America.

In what has been described as a "watershed" moment for African internet, the link was officially launched on 9 August in Sangano, Angola.

SACS was first announced more than two years ago. The 40Tbps system is being built by NEC and is now expected to begin operations during 1Q18. When it is completed, SACS will stretch more than 6,500km connecting the Angolan coast in the municipality of Quissama to Fortaleza in Brazil.

In a separate announcement made in early July, Angola Cables said construction had begun on its data centre in Fortaleza. It said the Tier III facility will play a crucial part in promoting Africa's digital inclusion and empowerment and providing high-speed internet at some of the lowest latency speeds between the two continents.

The link was officially launched in early August at an event attended by José Carvalho da Rocha, the Angolan Minister of Telecommunications and Technologies (sixth from right), business leaders and shareholders.

According to the company, it currently takes around 300 milliseconds to connect between Angola and Brazil. SACS is expected to reduce latency to approximately 60 milliseconds.

Two key routes will run from the Brazilian data centre: SACS will connect Fortaleza to Luanda and is expected to be completed by mid-2018; meanwhile Angola Cables' Monet system will connect Miami with both Fortaleza and São Paulo and is due to be completed by the end of 2017. The data centre also aims to accommodate more connections from the cable-dense region of Fortaleza. Clients who have already signed in Brazil include Prefeitura de Fortaleza, Claranet and AmLight.

Eutelsat launches *Konnect Africa*

Eutelsat has begun what it describes as its "bold ambitions" for broadband in sub-Sahara Africa with the launch of its much-vaunted *Konnect Africa* initiative.

On 6 June, the company launched services in Benin, Cameroon, Kenya, Lesotho, Nigeria, South Africa, Swaziland, Tanzania and Uganda. This followed an earlier announcement confirming that the *Konnect Africa* initiative was back on track thanks to a partnership with Yahsat *(see News, Feb-Mar 2017)*.

Eutelsat says it will deliver "innovative" services including packaged offers inspired by 'pay-as-you-go' models and Wi-Fi hotspots schemes. It says Wi-Fi hotspot access will be available for a "few cents" while family offers will be optimised for a "few dozens" of dollars. High-grade enterprise services are also proposed to enable video-conferencing, storage, multimedia content development, and safe and reliable communication.

Some of the first partners to support *Konnect Africa* include: AfrikaNet GoSat; Bentley Walker; China Telecom, which is establishing communication links between Africa and Asia-Pacific; Terrace Projects, a managed satellite service solution provider in South Africa; amongst others.

Eutelsat says it will give partners the means to succeed through dedicated commercial, marketing and technical support. The company adds that it will also train and reward local installers to enhance service quality and drive more talent into the industry.

Router helps break underwater record

Cradlepoint has helped a Dubai radio presenter break the world record for broadcasting live underwater.

The cloud-based network solutions specialist supplied one of its routers to Channel 4 104.8 FM radio presenter Stu Tolan, enabling him to set a new record of five hours, 25 minutes and 25 seconds.

The owner of the radio station, Al Murad Group/Channel4 Radio Networks, uses Cradlepoint devices for pop-up networking in remote areas while on the air.

Channel 4 presenter Stu Tolan was broadcasting from the 11m litre aquarium tank at Dubai's Atlantis Palm Resort.

Muhammed Rafeeque, the firm's assistant manager IT, headed the technical team at the record-breaking event. "We used an *AER2100* router to provide the connectivity between the radio studio and the outside broadcast location. It was critical to have uninterrupted uptime to ensure that the record was achieved."

Tolan beat the previous record of four hours and 33 minutes set by a UK radio station. He achieved the feat in the aquarium at Dubai's Atlantis Palm Resort on 13 May, and was submerged three metres below the surface in the 11 million litre tank as he played music, conducted interviews, and talked to his listeners while surrounded by 65,000 marine animals, sharks and stingrays.

Avalanche detection devices using IoT connectivity

Wyssen is using IoT connectivity in its monitoring systems that help detect and prevent avalanches in the Swiss Alps.

The company uses various systems such as radars, infrasound sensors, geophones, etc., and artificial triggering techniques with explosive charges. It designs and manufactures avalanche towers which are solar powered and fitted with a deployment box holding the battery, electronics and the charges.

What's said to be a "sophisticated" algorithm is used in combination with sensors to provide an early warning of increasing avalanche activity in a given area based on detection of infrasound emissions.

All the data monitored by the towers (including feedback from weather stations), along with the results from radar installations and sensors, and footage from cameras, is sent to a central control centre where they can be analysed. Should action be required, an explosive charge can be detonated once it is confirmed no humans are in the danger area.

Due to the remote nature of the towers and the need for resilient, mission critical connectivity, Wyssen integrated multi-network SIM cards from PodsystemM2M into its devices.

According to PodsystemM2M, its solution includes global connectivity across multiple networks on one SIM, connection to the best signal on device start-up, and the ability to automatically swap to a backup network if signal is lost. It claims this gives the "most reliable and flexible" coverage for Wyssen's devices wherever they may be situated.

"The flexibility of the PodsystemM2M SIM card was paramount", says Wyssen engineer Bejamin Meier. "We wanted a single SIM card, interchangeable for each device that makes up our system. This makes management of the SIMs simple and straightforward."

Real world 5G tests

The RAPID 5G consortium has conducted 5G tests to examine the possibilities of running extremely high-speed data transfer rates of up to 10Gbps at very low latency to a large number of devices. The trial was led by Polish telco Exatel in a Warsaw shopping centre, which broadcast 4K and 8K video streams from 5G antennas to a computer fitted with VR goggles at speeds of 800Mbps. This tested the interoperability of the network infrastructure, focusing on the conversion of the video transmissions from back-end fibre networks to the 5G mobile spectrum in use.

China-UK HTS research

China and the UK will work together on research into high throughput satellite capacity and 5G mobile satellite systems. This follows the signing of a two-year research contract between China Academy of Space Technology and the UK's University of Surrey's Institute for Communications Systems. "The collaboration will include training and advanced radio and networking research," says ICS director Professor Rahim Tafazolli, adding that the lab will cement the relationship between China and the UK in the strategic area of satellite communication networks.

Gfast council for broaband

The US-based Broadband Forum has launched the Gfast Council to help facilitate the rapid deployment of the new gigabit broadband access technology. The council provide a centralised source of expertise and will inform the market through events, white papers, use cases and other resources. It will also promote a certification programme for interoperable products. According to the Broadband Forum, Gfast means faster deployments by extending fibre to existing wiring infrastructure.

Connect overcomes WiMAX and Wi-Fi-based outages

Connect has upgraded its network using InfiNet Wireless' equipment.

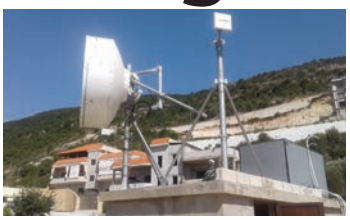
The Lebanese ISP uses a WiMAX network at 2.3GHz to serve residential customers, but the platform is limited to 5Mbps for downlink and 2Mbps for uplink. This meant it could not meet the high bandwidth requirements demanded by its premium residential and corporate customers.

To serve these users, Connect had to use Wi-Fi-based PTP solutions. But the frequency bands it was operating in started to suffer from major interference issues, resulting in a further drop in capacity and decreasing reliability.

"Links would go down frequently and we had to deploy field engineers to troubleshoot outages and maintain the network daily," says Jubran El Ayan, the company's RF manager. "Not only was this a drain on our resources and added significant costs to our operations, but we had several unhappy customers which was starting to hurt our reputation and revenue streams."

Connect deployed InfiNet's *InfiLINK XG* as part of its backbone network. The radio is said to be capable of reaching a peak net throughput of 500Mbps in 40MHz of spectrum and more than 130Mbps in 10MHz. It then installed the *InfiMAN 2x2* range of PTMP solutions to connect customers with higher bandwidth needs. More than 30 base stations and 250 subscriber terminals were implemented across Lebanon in just a few months.

El Ayan says that while the previous Wi-Fi-based PTP links were cumbersome to manage and also expensive to procure and deploy, this is no longer the case with the *InfiMAN 2x2* platform. "All we need to do now is set up a base station sector in a specific area and we can provide, almost instantly, a large number of customers with high bandwidth connectivity, all achieved without disrupting any other customer or our wider network."



InfiNet's technology has given Connect a more reliable and higher performing network across Lebanon.

Ooredoo goes indoors with Ranplan

Ooredoo will use Ranplan's *iBuildNet* RF indoor planning tool for designing in-building networks across its operations in Asia, the Middle East and Africa.

The Qatari telco says it will use the solution to help develop networks in offices, shopping malls, underground rail systems, stadia and many other facilities. It reckons this will enable it to keep pace with growing coverage needs and all the complexities that come with 5G and the Internet of Things.

Ranplan claims its *iBuildNet* planning tool provides unique simulation capabilities for multiple network services at a mobile device level. It reckons that this assists RF engineers in evaluating QoS, even in the "most complicated" deployments.

Ranplan CEO Alastair Williamson says: "In addition to dealing with complex structures, terrains and materials, radio planning for indoor environments must also take into account issues such as interference with macro cells and support for multiple-system technologies."

iBuildNet includes 3D modelling with what's described as a "fast and accurate" 3D ray-tracing propagation engine. It is also said to feature "powerful" data analysis to automatically optimise access point locations, antenna type, power and channel assignment for dense DAS, small cell and hetnet deployments.

Williamson claims the tool has been proven to reduce the cost of designing and implementing such networks.

TETRA secures Guarulhos International

Guarulhos International Airport (GRU) in São Paulo, Brazil, is using a TETRA system from DAMM to secure passenger safety and improve efficiency.

It has deployed the Danish vendor's fully redundant *TetraFlex Indoor High Power 7* carrier platform. This is said to offer a secure and reliable voice and data system which enables airports to efficiently respond to any potential danger. It includes features such as Dynamic Group Number Assignment (DGNA). According to DAMM, this makes it easy to create dynamic work groups used for apron services such as luggage handling, jet-fuelling and catering.

The new IP-based, decentralised network was designed, installed and commissioned by local DAMM partner ALCON Engenharia. Its CEO Gilberto Koza says *TetraFlex*'s open API offers easy integration of third-party applications like the Siemens dispatcher solution, and was key to the airport.

GRU is said to be Brazil's number one airport in terms of cargo passenger traffic, and reportedly saw more than 38 million customers in 2015. It has undergone an intense transformation since it began operations in 1985, and in May 2014 the airport inaugurated TPS3, a new passenger terminal geared toward international flights.

GRU is said to be Brazil's number one airport in terms of cargo passenger traffic.

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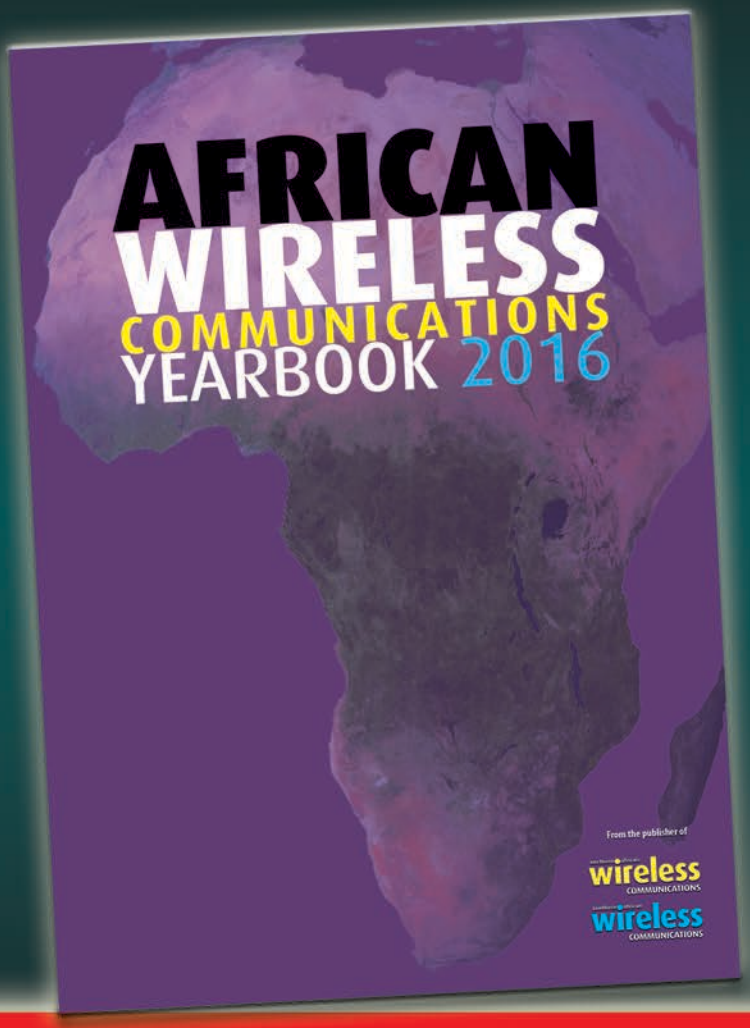

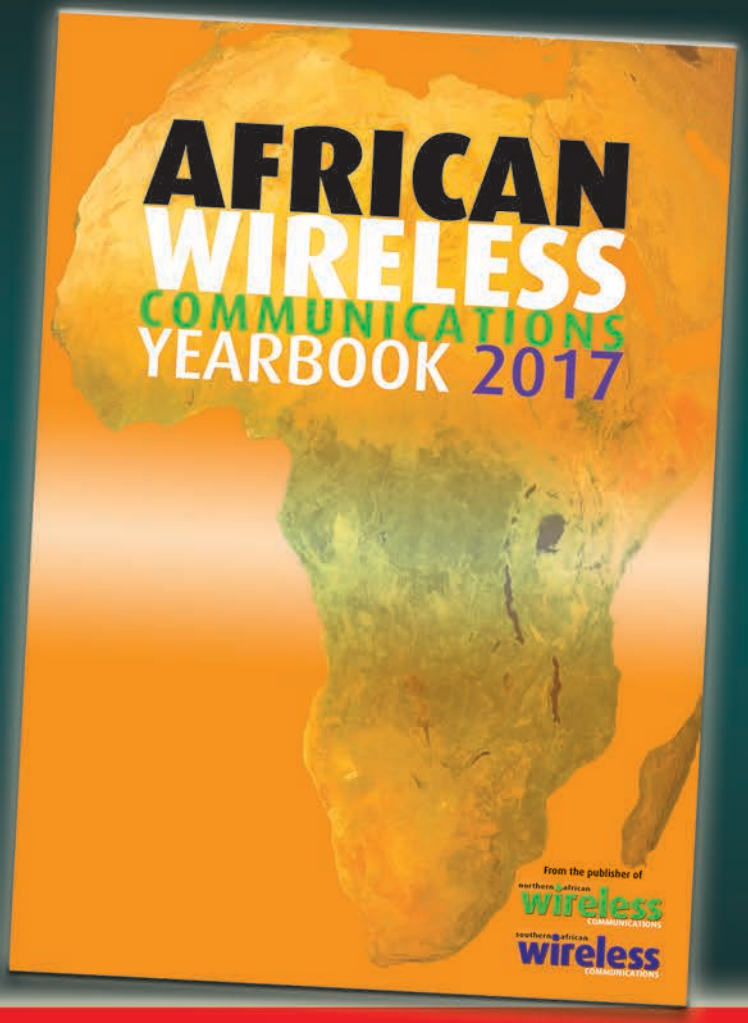

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