ACE

The Africa Coast to Europe (ACE): a 17,000 km long broadband optical submarine cable between Africa and Europe

Phase 1 project

3 segments in service:
- France-Senegal,
- Senegal-Cote d'Ivoire,
- Cote d'Ivoire-Sao Tome & Principe.

16 countries connected on the coast, 2 landlock countries.

Phase 2 project

Phase 2, under construction or planned:

- **Extension from Sao Tome & Principe to South Africa**

- **Canary Islands, Benin & Nigeria, Operational May 2015**

- **Cameroon, Democratic Republic of Congo, Angola, Namibia**

ACE,

With its large bandwidth and high quality transmission technology, supports the present and future growth in telecommunication traffic between Africa and the rest of the world, reduces digital divide and drives economic and social growth.

France
Portugal
Canary Islands
Mali
Niger
Mauritania
Senegal
Gambia
Guinea
Ghana
Benin
Nigeria
Liberia
Cameroon
Equatorial Guinea
Sierra Leone
Côte d'Ivoire
Gabon
Sao Tome & Principe
Democratic Republic of Congo
Angola
Namibia
South Africa

— PHASE 1, in service
••• PHASE 2, under construction or planned

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ACE

In focus:
Backhaul

Setting new sights on backhaul

Rahiel Nasir,
Editorial director,
African Wireless
Communications
Yearbook

The number of submarine cables that now surround Africa and have been landing on its coastlines over the last few years has certainly been a fillip to broadband connectivity in some parts of the continent. But as well as being used for broadband what about fibre's other great promise – its ability to backhaul mobile networks? Here, operators need more terrestrial cable deployments that reach far deeper inland.

In 2014, a new chapter began in the story of fibre in Africa as Liquid Telecom announced it had created the continent's first fully redundant regional fibre ring (*see p.92*). Although the company uses wireless technologies including satellite to complement its network, it believes that only fibre will be able to provide the speeds and capacity needed by LTE base stations.

However, much of the demand for increased mobile connectivity will come from rural areas, where terrestrial infrastructure is either unable to meet demand or is simply non-existent. Even Liquid admits it is just "too costly and time-consuming" to lay fibre for cell sites covering smaller populations in such areas.

Thus, what could be regarded as fibre's weaknesses is where wireless technologies come into their own. For instance, Intelsat says the introduction of HTS (high throughput satellite) will deliver additional capacity that will enable the expansion of 4G networks. It says this will lead to an increase in MNOs utilising satellite backhaul and satellite-based rural telephony extensions, as it allows them to cost-effectively increase their customer base in areas that were previously inaccessible.

Northern Sky Research (NSR) forecasts that HTS will propel the global market for satellite backhaul in the coming years. In its *Wireless Backhaul via Satellite* report published in April 2016, the firm predicts that current and next-generation solutions will generate revenue streams from USD1.7bn in 2014 to USD5.3bn by 2024.

According to the report, traditional fixed service satellite (FSS) capacity in C- and Ku-bands has so far been the most prevalent solution used for backhaul and trunking in land areas and has begun to address the need for 3G services. But it adds that less expensive and higher throughput capacity is challenging the economics of traditional FSS where erosion of the revenue base is leading to an 'HTS play' by operators that own traditional FSS transponders.

While non-geosynchronous HTS is still in its infancy, NSR believes it promises better latency with the likes of O3b making inroads in backhaul, trunking and mobility platforms. It adds that although few details on LEO (low Earth orbit) HTS programmes have been released, if one or two of these are launched, total capacity will increase manifold leading to price pressure for all offerings.

So where does that leave microwave? Infrastructure specialists such as RFS believe operators in Africa are still highly reliant on the technology for backhaul despite the advent of fibre. It says although some regions elsewhere in the world are reducing the number of microwave links used for long-distance backhaul or for new installations because of the existence of fibre, this is not something it has seen in Africa. According to RFS, given the complexity of doing civil works (especially in the continent's big cities), and fibre being prone to vandalism and theft, microwave is still the dominant choice as a backhaul solution.

Then there are other technologies such as free-space optics (FSO) which uses light propagating in free space to wirelessly transmit telecoms data. Although FSO has been around for some time now, its use in Africa has not been common.

However in April 2015, Nigerian ICT solutions provider WaveTek successfully deployed AOptix's Laser-Radio Technology (LRT) in Nigeria.

Lagos is the largest city in Africa with a population of more than 20 million people. It is the landing point for four major submarine systems that connect Nigeria to Europe: SAT-3/WASC/SAFE; ACE; GLO-1; and Main One.

With the undersea cables largely in place, the challenge was to pull all that network capacity into the continent's population centres and bring connectivity to underserved markets. Speaking at the time, WaveTek said fibre was not viable in most situations across Africa given its costs and the challenges of deployment created by difficult terrain. It added that microwave was unable to provide the bandwidth and range needed, and could not withstand humidity and heavy rains in Nigeria.

In Lagos, a seven kilometre FSO link from AOptix was used to connect capacity from the submarine fibre cables to a distribution point in the city.

According to WaveTek CEO Ken Spann the FSO link survived Nigeria's rainy season and delivered 100 per cent uptime. "The technology has significant potential to bring broadband mobile connectivity to underserved populations in Nigeria and across Africa," he said.

Fibre – the backbone for backhaul

In 2014, Liquid Telecom announced it had created Africa's first fully redundant regional fibre ring. Spanning 20,000km, the East Africa Fibre Ring runs from Kenya to Uganda, Rwanda, Tanzania and back into Kenya, connecting these countries to each other as well as to the rest of the world. Built at a cost of USD20m, it was said to be Africa's largest single fibre network and also linked to the region's five main subsea cable systems: WACS, EASsy, SEACOM, SAT3 and TEAMS.

Liquid Telecom uses wireless technologies and satellite to complement its network but it believes that only fibre will be able to provide the speeds and capacity needed by LTE base stations. Speaking at the time, Ben Roberts, CEO of the company's Kenya operations, said: "In Africa, most people access the internet over their mobiles, and so LTE networks are already commercially deployed with more being built. LTE base stations need mega amounts of bandwidth that can only be provided by fibre. We have already started laying fibre to LTE base station sites that have been built by a variety of operators and independent tower leasing companies. This fibre then interconnects with our pan-African fibre backbone."

The dedication to fibre continued strongly into 2015. The company partnered with CEC to build a new fibre link between Lusaka and Livingstone, and claimed it would offer the "most reliable high-speed" broadband connectivity in southern Zambia.

The 500km fibre connection was built at an estimated cost of USD5m and now provides additional capacity, increased redundancy and route diversity. It starts in Lusaka, transits through eight southern

The record was achieved at Alcatel-Lucent Submarine Networks' test bed facility in Villarceaux, France.

circuit towns including Choma, Kafue, Kalomo, Mazabuka and Monze, before terminating at Victoria Falls in Livingstone. From there, it interconnects with Liquid Telecom's fibre network in Zimbabwe. Onward international access is enabled via the group's pan-African satellite and fibre networks which connect to the subsea systems mentioned above.

The Lusaka-Livingstone link was completed in time for the United Nations World Tourism Organisation General Assembly, part of which was held in Livingstone in August. Fibre was also laid to connect all the major hotels and airports. CEC Liquid Telecom then went on to build out to the border towns of Kazungula and Sesheke to connect with Namibia and Botswana.

Connectivity to Europe will see a boost following the extension of the African Coast to Europe (ACE) submarine cable. This will help transcontinental phone calls as well as provide extra broadband capacity. Phase two of ACE connects Angola, Congo-Brazzaville, the Democratic Republic of Congo, Namibia and South Africa to the fibre backbone. There will also be an extension linking Cameroon. At its most northerly end the system links to Portugal, Spain, and France.

Orange is the main backer in the USD700m ACE system which will cover 17,000km after its second phase is completed by the end of 2016.

The MTN Group became a member of the ACE consortium in August 2015. According to the group's GM for network, IT projects and carrier services, John Unterhorst, the operator acquired an eight per cent stake. He said MTN's involvement, which is reportedly worth USD50 million, will facilitate the extension of the cable to South Africa. "MTN will build and provide the ACE cable landing station and backhaul in South Africa. Until now, MTN's participation in ACE has been through its subsidiaries in Benin, Liberia and Guinea Conakry," said Unterhorst.

July saw an announcement of a breakthrough that promises to further reduce backhaul and other data costs. Alcatel-Lucent Submarine Networks (ASN) claimed to have set a new record for data transmission over a distance of 10,000km using real-time processing prototypes of its 300Gbps modulation technology.

ASN, the undersea cables subsidiary of Alcatel-Lucent (now owned by Nokia), explained that this would help optimise the performance of submarine cable systems that have already seen the costs of internet delivery and other telecom related services "slashed by almost half " in Africa.

The record was achieved during a simulation of a 10,000km network at ASN's lab-based test bed in France. It combined the 300G 8QAM technology of the firm's *1620 SOFTNODE* platform with its second-generation *Coherent Submarine Fibre 2* cable.

According to Alcatel-Lucent, 8QAM technology can optimise both existing and

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KEY BACKHAUL PRODUCT LAUNCHES IN 2015

MIMOtech's *Janus AirDuplex* (below right) is a range of "ultra-high" capacity microwave backhaul radios that use a new patented technique called *Air Division Duplexing (ADD)*. This combines MIMO and full duplex transmission to achieve claimed data rates of up to 1Gbps in a single 28MHz channel, and 2Gbps in 56MHz bandwidth.

The company said the radios are suitable for small cell, microcell and macrocell mobile deployments for a range of technologies including LTE/°LTE-A and potentially 5G, providing a cost-effective alternative to fibre and millimetre-wave links for enterprise and government applications.

ADD uses spatial multiplexing to double capacity and spectral efficiency. With an antenna separation of typically only 100mm, MIMOtech said it can be considered as a quasi single-aperture antenna from the point of view of licensing, site rental cost and implementation.

The firm said opex/capex are reduced due to lower spectrum and site rental fees, lower maintenance, while software definability offers downstream savings in upgrade costs.

Gilat Satellite Networks' *CellEdge* comprises a small cell that is optimised to provide the ability to deliver cost-effective 2G and 3G cellular services via satellite to unserved areas. Gilat said it has an 80W total average power draw, including both the small cell and VSAT in a typical configuration, and therefore "significantly" lowers capex in the terminal and solar power generation.

The firm claims its technology also minimises satellite space segment overhead by applying efficient voice and data compression combined with satellite bandwidth allocation on demand. Gilat said this can reduce satellite opex by up to 80 per cent compared to traditional solutions.

The company hopes *CellEdge* will enable operators to overcome high rollout costs, lack

new undersea systems, enabling operators to deliver more than 15Tbps per fibre pair on transoceanic systems – that's equivalent to 2.25 million HDTV channels streamed simultaneously.

ASN added that the timing of its technology "seems appropriate" for Africa as most countries are currently migrating their broadcast systems from analogue to digital.

Looking to the skies

There are always likely to be areas in Africa that won't be cost effective to connect using fibre cables. Last year saw more operators and deals struck for satellite as the favoured option for backhaul.

For instance, ISP Presta Bist is now using O3b to provide backhaul from Chad to the internet. The company, which is also a pay TV operator, delivers consumer and business services across Chad via its national network of wireless broadband and VSATs.

Presta Bist CEO Moussa Radjab said: "The broadband services we will now be able to offer are far superior to anything possible using current fibre connections or GEO satellites."

This is another win for O3b which regards the Sahel region as a high priority. The company views Burkina Faso, CAR, Chad, Mali and Niger as key satellite backhaul opportunities because they are all landlocked and suffer from erratic terrestrial fibre connections that are dependent on neighbouring countries.

Satellite is also being used in a two-year deal worth USD7.5m for Gilat Satcom. It will provide satellite backup for a "leading mobile communications company" in the DRC. As part of the agreement, the unnamed operator will use satellite to

CEO Zainadin Dalsuco said Intelsat will help ENTM to quickly scale its network.

backup its cellular, fibre, and backhaul networks in the DRC's four largest cities: Goma, Kinshasa, Kisangani and Lubumbashi.

Gilat Satcom added that it had been providing satellite broadband connectivity to enterprises and ISPs in the DRC since 2008, most recently using O3b's satellites.

Mozambique will also be gaining backhaul capacity thanks to satellite. Empresa Nacional de Telecomunicações de Moçambique (ENTM) is now delivering broadband connectivity to enterprises, and provides cellular backhaul to support residents in remote areas with the help of Intelsat.

Under a multi-year agreement, ENTM is using C- band capacity on *Intelsat 902* at 62.0°E to provide dual band connectivity for local mobile operators as well as for its own transport network. According to Intelsat, for a country such as Mozambique that is susceptible to heavy rainfall and flooding, C-band spectrum is particularly useful given its known performance and durability in adverse weather conditions.

"Our customers expect and deserve fast, reliable and continuous broadband connectivity regardless of location or weather," said ENTM CEO Zainadin Dalsuco. "By partnering with Intelsat, we can quickly scale our existing network to meet the increasing broadband demands in

the remote areas of Mozambique and ensure that our network infrastructure is robust enough to retain and, as needed, quickly restore service to local cellular operators and their customers throughout the country."

Intelsat added that with mobile penetration rates in the country at around 69 per cent, its partnership with ENTM will enable the operator to provide a reliable and always-on broadband service that will enhance customer satisfaction.

On a more continental scale, a new satellite will be aiming to increase backhaul capacity as well as access to broadband for Africa. The end of the year saw Eutelsat Communications revealing the next step in its broadband strategy for the continent with the order of a new-generation HTS from Thales Alenia Space (TAS).

To be launched in 2019, the all-electric spacecraft will be the first to use Thales' new *Spacebus Neo* platform, and Eutelsat claimed it will offer "unprecedented" operational flexibility when operational.

The firm said its baseline mission will be to provide 75Gbps of capacity across a network of 65 spot beams that together provide "quasi-complete" coverage of sub-Saharan Africa. The satellite will address direct-to-user consumer and enterprise broadband services with dishes sized from approximately 75cm. It will also be used for community networks connected to Wi-Fi hotspots, mobile backhauling, and rural connectivity.

During 2016, Eutelsat will have the option to upscale the satellite to significantly increase overall throughput and service areas. The company has decided that its African broadband business, including sales, will be managed by a newly created London-based affiliate.

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of backhaul and power infrastructure, as well as low consumer uptake and ARPU.

With *iQ.linkXG v9.5*, **Comsearch** believes it's created the first microwave link design tool tailored for small cell backhaul, where non line-of-sight (NLOS) conditions often apply. The upgraded version is also said to make it much easier to configure microwave links powered by adaptive modulation radios.

According to the company, small cell planning can involve both LOS and NLOS paths, the latter of which presents a special challenge to designing networks where signal loss predictions are
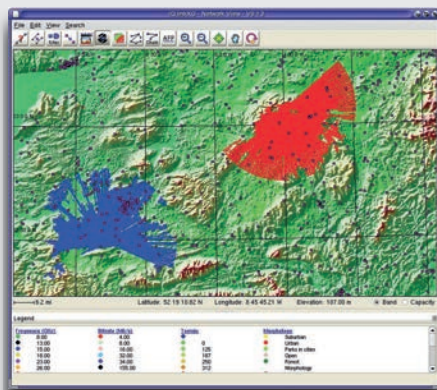
critical. Comsearch said it has developed unique and proprietary models that look at the true obstruction environment along a path to better calculate losses. It said these models have been validated with a major radio vendor using existing network designs

and integrated into the latest version of *iQ.linkXG*.

In addition, Comsearch said the use of adaptive modulation radios has made it difficult for link designers to quickly engineer microwave paths. It added that power, fade margins and predicted performance must be evaluated for all the modulations configured for a path, not just one.

Cambium Networks launched a 900MHz version of its flagship *PMP 450* point-to-multipoint wireless platform. It said the new *PMP 450i* access point allows for deeper frequency propagation to suit the needs of rural broadband deployments, SCADA and sensor data backhaul, and even video surveillance applications.

TAS claims *Neo* offers a fully modular platform with a smart Ka HTS payload for "unrivalled flexibility and maximum throughput". It says the all-electric version of the platform combines high efficiency and light weight, and will also mean Eutelsat will benefit from more cost-effective launch options. The all-electric *Neo* is currently capable of carrying payloads weighing more than 1,400kg, and with power exceeding 16kW. Starting in 2016, TAS promises that the platform will be able to handle payloads up to 2,000kg, with record power of 20kW.

Traffic demands

As operators scramble to find more capacity from various providers or upgrade their own hardware, it's easy to forget the size of the problem that needs to be solved. Annual IP traffic will triple over the next four years and will reach a record two zettabytes globally in 2019, according to Cisco's annual Visual Networking Index (VNI) forecast.

Factors expected to drive traffic growth include global increases in internet users, personal devices and M2M connections, faster broadband speeds, and the adoption of advanced video services.

Doug Webster, Cisco's VP of service provider products and solutions marketing, said: "It took 32 years – from 1984 to 2016 – to generate the first zettabyte of IP traffic annually. However, as this year's VNI forecasts, it will take only three additional years to reach the next zettabyte milestone with more than two zettabytes of IP traffic annually in 2019."

In Middle East and Africa, the index predicts mobile data traffic will grow 15-fold from 2014 to 2019, and will reach three exabytes per month by 2019, up from 199.5 petabytes per month in 2014.

Cisco forecasts that by 2019, 41 per cent of mobile connections in the region will be from smart devices, an 11 per cent increase from 2014. It expects consumer mobile traffic to grow 16-fold from 2014 to 2019, a CAGR of 74 per cent.

According to the VNI, there were 1,200 million mobile-connected devices in MEA in 2014. This will rise to 1,676 by 2019, with 4G connections growing 32-fold from 2014 to 2019, a CAGR of 100 per cent.

3G connections are forecast to be 54.4 per cent of total mobile connections in the region by 2019, compared to 19.4 per cent last year. This means 3G will overtake 2G in the next few years, as second-generation connections will represent 31.6 per cent of total mobile connections by 2019, compared to 80 per cent in 2014.

Extra capacity pops up

The start of 2015 saw two announcements concerning new African PoPs.

Firstly, Telstra said it was aiming to provide greater connectivity and redundancy options for businesses operating across the continent with the launch of a new PoP in Johannesburg. The Australian telco said the facility builds on its existing network-to-network interconnection across 16 African countries which include Kenya, Mozambique, Zimbabwe, amongst others.

It claimed the deployment of a PoP in South Africa represents "another step" in its international expansion, and will act as a gateway for businesses looking to grow their footprint across South Africa and beyond. "South Africa is an emerging power, with one of the fastest-growing internet economies in the world," said Bernadette Noujaim Baldwin, Telstra's head of connectivity and platforms portfolio,

Bernadette Noujaim Baldwin said Telstra was seeing growing demand from foreign firms based in South Africa.

global enterprise and services. "With these economic conditions in mind, we're seeing demand for data connectivity throughout South Africa grow as an increasing number of Asian, European and American headquartered businesses look here for long-term growth opportunities."

She also explained that Telstra needed an expert local provider and therefore launched the new PoP in partnership with Gauteng-based pan-African telecom services provider Internet Solutions (part of Dimension Data).

Telstra has licenses in Asia, Europe and the US, and says it can now offer access to more than 2,000 PoPs in 230 countries and territories across the world.

The second announcement came with East African carrier Wananchi Telecom saying. It has partnered with Epsilon to connect its customers in Africa to more than 170 countries around the world. Wananchi is using Epsilon's *Global Network Exchange* and carrier grade IP network for the delivery of outsourced services to support the growth of its wholesale telecoms business.

Epsilon deployed a 'virtual PoP' in Telehouse's *East London* UK data centre and at *SmartHub Fujairah* in the UAE, enabling Wananchi to access more than 500 carriers and network service providers.

In addition to network infrastructure, Epsilon also provided a remote support service for cabling, installations and PoP management. As part of the deal, Epsilon

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According to **Cambium**, the propagation characteristics of 900MHz frequencies "outperform" many others and are ideal for connecting subscribers and sensors that are difficult to reach.

It said the *PMP 450i* (pictured right) has the same capacity as its other *PMP 450* radios, and provides the infrastructure needed to deploy networks in non-line-of-sight and remote environments.

Cambium said users of its *PMP 100* systems can now upgrade and unlock 900MHz capacity with the *PMP 450* platform. "We expect to achieve three to four times the amount of available bandwidth in the same channel size, even in the same noisy and interference prone environments," claimed the firm.

Proxim Wireless has combined a WLAN access point with a carrier class wireless point-to-point backhaul radio and integrated them into a single ruggedised enclosure for outdoor deployments.

The *ORiNOCO QB-9100* (shown right) features Proxim's *ORiNOCO* 2.4GHz AP and *Tsunami Quickbridge* 5GHz PTP backhaul radio. The company said combining the two functions into a single unit is designed to

reduce hardware footprint, capital outlay, and recurring site rental costs.

With its very high throughput 866Mbps data rate, jumbo frame support, and IEEE 1588v2 synchronisation, Proxim said the *QB-9100* products provide all the necessary features and capacity for backhauling small cells. Moreover, the integrated 802.11n AP enables the offload of data to Wi-Fi.

will have access to Wananchi's extensive African network footprint, giving it greater local presence.

Droning on about tower maintenance?

2015 saw the successful completion of site audits using remote drones. The Communications Regulatory Authority of Namibia (CRAN) carried out audits of 25 broadcast transmission sites using remotely piloted aircraft (RPA). The aim of the project was to determine the RF performance characteristics of identified sites and masts, installed antennas per mast, and the operational broadcasting services on every antenna, including an assessment of spectrum usage.

The audits were carried out on behalf of CRAN by German-based specialist LS telcom. Its software and services are designed to address the efficient use of RF spectrum in broadcast, PMR, mobile and microwave networks. The firm conducted the audits using RPAs which were each equipped with an onboard camera as well as measurement and sensor systems.

In contrast to other measurement services, LS telcom said its auditing took place without affecting operational services and without direct involvement of network operators. It added that the detailed measurements, recordings, and visuals of each site and mast infrastructure did not require core site or building entry, or power reduction of services.

"The site audit produced very detailed and informative results," said CRAN COO Jochen Traut. "This is the introduction of an exciting phase of efficient telecommunication regulation in Namibia." The regulator has now incorporated the results of the audits into its central database for future referencing and compliancy assessment.

Dave Rehbehn, VP international division, Hughes Network Systems

As part of a feature first published in the April-May 2015 issue of *Northern African Wireless Communications*, we asked Hughes' Dave Rehbehn how important backhaul was as a satellite application for Africa.

"I am going to answer that from a couple of different directions. Talk to the cellular operators and if they can get fibre that's going to be their number one choice. And if they can get microwave with a reasonable number of hops that's going to be the next choice. The fact is satellite, historically, is the option when you don't have anything else.

"Having said that, mobile operators are keenly interested in expanding their services. And what were starting to see is operators using satellite to go to greenfield service areas because they can get the backhaul connectivity immediately and it's good quality. I think that what will happen is that over time, as terrestrial develops in terms of capacity, the cellular operators will figure out a way to get terrestrial in there."

While Rehbehn was painting a picture about satellite from the mobile operators' perspective, he was quick to point out that when it comes to Hughes' view, cellular backhaul is seen as a very important application.

"The reason is that, number one, it is a very high value service offering on the part of satellite service providers. And number two, it is an area where there is very good potential as we see more high throughput satellite [HTS] systems deployed because what these systems enable is a lower cost per bandwidth capacity. That cost of the capacity

has always been one of the key issues with satellite backhaul for cellular networks.

"So we have a new generation of satellites coming up – Intelsat has *Epic*, Yahsat is already in service over Africa and the Middle East, Avanti is in service [etc.], and these satellites have a lot of capacity that enables lower cost for the service. So we think we can change the equation of satellite backhaul for cellular systems with these new generation of HTS. That will make it more cost-effective for cellular backhaul satellite applications.

"In addition, from the infrastructure side of it, we see more so-called small cells from the likes of Huawei, Ericsson, Nokia, etc. Instead of having a macro site that costs hundreds of thousands of dollars and requires a tremendous amount of power, infrastructure providers are able to provide a small cell which, maybe doesn't have a huge amount of capacity, but is very cost-effective and can be powered by solar.

"So from the infrastructure side we see small cells enabling more cost-effective rural deployments. And from the satellite side we see HTS enabling a lower cost of bandwidth. Together, we think this really does create some significant opportunities for satellite backhaul and cellular traffic."

When it comes to small cells, satellite can also play a more direct role here. For example last year, Gilat Satellite Networks announced *CellEdge*, a small-cell-over-satellite solution to provide MNOs with a cellular infrastructure solution to connect remote areas (*see p93*). Gilat worked with Intelsat and deployed its system for Canadian operator RuralCom. So from a purely technological perspective, does satellite have the edge over fibre and microwave?

"You mentioned Gilat and they have an integrated small cell that they resell. As I said before, Ericsson, Huawei, Nokia – all of those guys have very good small cell

Metro Ethernet Forum
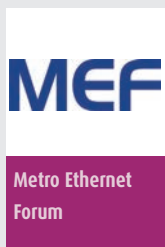
The year ahead: In its *Backhaul for rural and remote small cells* white paper published in June 2015, the Metro Ethernet Forum (MEF) said small cell technologies are "coming of age" thanks to scaling of deployments in residential, enterprise and now urban markets.

The forum believes these maturing technologies can now be applied to a range of rural and remote use cases that may not otherwise be viable using traditional deployment approaches.

"Small cells are well suited to deployment in rural villages, remote industrial sites, on

transportation, and for temporary networks," stated the paper.

In summarising the key aspects that must be considered when designing and deploying the transport network, the MEF said remote deployments by definition are far from existing network infrastructure and thus are potentially expensive to backhaul with terrestrial links.

However, it also pointed out that rural deployments are not necessarily remote and may be 'in the next valley' from a larger town with connectivity. As a result, shorter range backhaul and copper connectivity can be used here.

The paper also highlighted the fact that backhaul to remote areas is likely to have

limited performance. For instance, it said as little as 50kbps capacity is sufficient to provide a basic 2G voice and SMS service. Data service bandwidth is also likely to be limited by the willingness to pay for backhaul bandwidth, and while latency of around 300ms one way is tolerable for voice, it can limit TCP connection bandwidth if acceleration technologies are not implemented.

According to the MEF, Ethernet adoption has been accepted by the vast majority of operators and service providers across the global industry. The forum believes its Carrier Ethernet 2.0 for Mobile Backhaul standard brings answers to the challenges associated with managing rapid backhaul data growth while scaling costs to new revenues.

products with an IP interface and they have done a bunch of optimisation. Our view has been to integrate effectively with those products as opposed to trying to force fit our solution onto a operator. That's just our approach to the market.

"Unequivocally, if you've got fibre, people are going to use fibre. In that context we have seen projects where satellites will be used as a backup mechanism (and they are very effective for that). We can dynamically allocate capacity based on a fibre link going down."

However with microwave, Rehbehn believes the argument is not so cut and dried. "You start to deal with microwave hops; and to go out and build a bunch of microwave hops you have to start worrying about things like the power generators, and it may or may not make sense.

"If microwave is already there, that's fine, you are not going to use satellite. But would it be more cost effective building a microwave link versus a fibre link versus a satellite link? Hands down, it's probably always going to be more cost-effective with satellite, at least initially."

When asked if these competing technologies have had an impact on Hughes' backhaul business in Africa, Rehbehn acknowledged it had. What the company has seen is a number of deployments where operators have used satellites to connect a particular area, increased the subscriber base there, which then justifies an investment into a terrestrial backhaul technology.

"And then they will take that satellite and move it somewhere else. Some do keep it for backup, but we have seen quite a few who then just take that satellite equipment and move it somewhere else and develop another area."

**Lionel Chmilewsky,
CEO,
CBNL**

Lionel Chmilewsky regards 2015 as a "successful year" for CBNL as it supported a growing customer base across 14 African countries, as well as a further 31 markets across the globe.

"From our offices in Kenya, Nigeria and South Africa, we have served the continent's largest operators with backhaul and enterprise access networks, including MTN, Vodacom and Airtel.

"CBNL's growth has been driven by the uplift in capacity we can offer with our latest *VectaStar 600* point-to-multipoint (PMP) microwave platform that has strengthened our position as the largest supplier of PMP microwave solutions in Africa and the world.

"By offering up to 1.2Gbps per sector and 14.4Gbps per hub site, we have grown our business into markets that were typically served by point-to-point (PTP), enabling us to offer the same high-capacity with a dramatically improved business case. This was recently highlighted by a Real Wireless[1] report that found PMP microwave offers up to 50 per cent TCO savings when compared to PTP.

"The report also found PMP microwave can enable an ISP to connect 67 per cent more customers, and generate 1.8x higher return on investment than PTP for the same upfront investment. The surge in data demand, coupled with slowing operator revenues[2], have brought a sharp focus on more cost effective strategies and opened up the market to more innovative technologies such as this."

According to Chmilewsky, a key trend over the past year has been the maturity of the African enterprise market and the demand this has created for higher capacity fixed broadband.

"Modern organisations now depend on secure, reliable and fast connectivity to enable a wide range of business-critical activities. The rise in cloud applications has also changed the shape of traffic, with demand growing for more symmetrical services.

"Carrier-grade broadband, such as this, often requires both an uplift in capacity and the provision of guaranteed bandwidth 24/7. In many cases, the legacy unlicensed or WiMAX technology used to connect businesses has run out of steam.

"As a result, we have seen an increased uptake of licensed PMP that offers the same cost effective architecture, while boosting capacity and offering dedicated bandwidth with a very high quality of service."

Chmilewsky also says there's a growing adoption of SDN (software defined networking) on the continent. "Throughout 2015 an increasing number of operators have woken up to the potential of utilising SDN to optimise their last-mile. From our own work with Airtel Kenya, we have seen how SDN can enable operators to unlock spare capacity on the backhaul network to roll out additional enterprise access sites.

"This technique is especially effective in locations where capex is limited as it allows operators to maximise their existing network assets and generate valuable new revenue streams. With Strategy Analytics forecasting[3] that utilising SDN in backhaul could save operators in Africa and the Middle East USD368 million by 2017, it looks set to be a vital strategy for years to come."

Chmilewsky says 2015 saw the continued roll out of 4G with 129 operators now investing in projects across 39 African countries[4]. He believes LTE is driving innovation in wireless backhaul.

"This includes some highly innovative use cases where operators are using LTE spectrum to deliver data-only connectivity. With low fixed broadband penetration in many markets, the new services facilitated by LTE give consumers and businesses vast socio-economic opportunities.

"As with all data heavy networks, operators are developing new backhaul strategies to ensure every bit of data is transported in the most cost effective way. This is essential to build an attractive business case in low ARPU markets and the latest wireless backhaul technologies are playing a leading role in facilitating this."

Cisco forecasts that EMEA will have the highest mobile data growth of any region, with traffic expected to increase by 71 per cent in 2016[5]. As most of this is predicted to come from Africa, Chmilewsky points out that the region's operators need to be prepared.

"[Traffic increases] will be driven both by a younger population demanding increased access to mobile content and an increasing number of new businesses accessing online services. This will further enforce the need for operators to innovate in order to increase capacity of their networks and maintain a sustainable business model.

"As in 2015, local economic dynamics will continue to influence network strategies. We have seen last year that fluctuations in commodity prices, such as oil, can significantly impact economies that are reliant on extractive industries.

"When prices decline, local currencies often weaken against the dollar, the major currency for technology purchases. Because end users pay the operator in local currency, the net effect of this is that the 'dollarised' ARPU decreases commensurately and so a given network may no longer show a positive ROI.

"While this can deter investment altogether, it also represents an opportunity for operators who are able to exploit new, more cost effective technology to out-compete others in this difficult environment."

[1] New study finds latest PMP can deliver almost twice the ROI for MNOs and ISPs compared to traditional last-mile infrastructure, January 2016, www.realwireless.biz
[2] Top telecoms companies: Talk is cheap, but data leads the way, March 2016, www.theafricareport.com
[3] Mobile Backhaul Savings from SDN May Be Bigger Than Previously Expected, February 2014, www.nfvzone.com
[4] 4G/LTE network projects and launches in Africa (2016), January 2016, www.balancingact-africa.com
[5] Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2015-2020 white paper, February 2016, www.cisco.com

Chmilewsky concludes by saying a key aspect of CBNL's new projects in 2016 will be the continued roll out of its *VectaStar 600* solution. "This new platform will enable PMP hub sites to be built that offer a quicker time to market and better ROI. This not only provides the transformation capacity our customers need to launch new services, but also holds the scalability and business case to support long term growth."

Semir Hassanaly, Market director cellular backhaul & trunking, Newtec

s fibre the answer to backhaul in Africa? As part of a feature first published in the April-May 2015 issue of *Northern African Wireless Communications*, Newtec's Semir Hassanaly told us that the continent's markets are leveraging a wide array of backhaul communication technologies.

"Varying landscapes, population density and capacity needs have driven the need for microwave, fibre and satellite infrastructures. Early deployments were based on microwave and satellite, with the demarcation point based on having line of sight and distances above the number of microwave hops to justify the recourse to satellite.

"The recent advent of undersea cables and fibre has modified the landscape especially for coastal regions which can be accessed more easily. However, needs are still diverse. Many regions have a high mobile penetration rate with 3G and even 4G technologies, while other countries remain satisfied with 2G. A few countries (Nigeria, South Africa, etc.) are booming and demanding huge capacity. In the latter cases, the increasing data traffic can justify the use of fibre in urban regions while more remote areas still rely on traditional means.
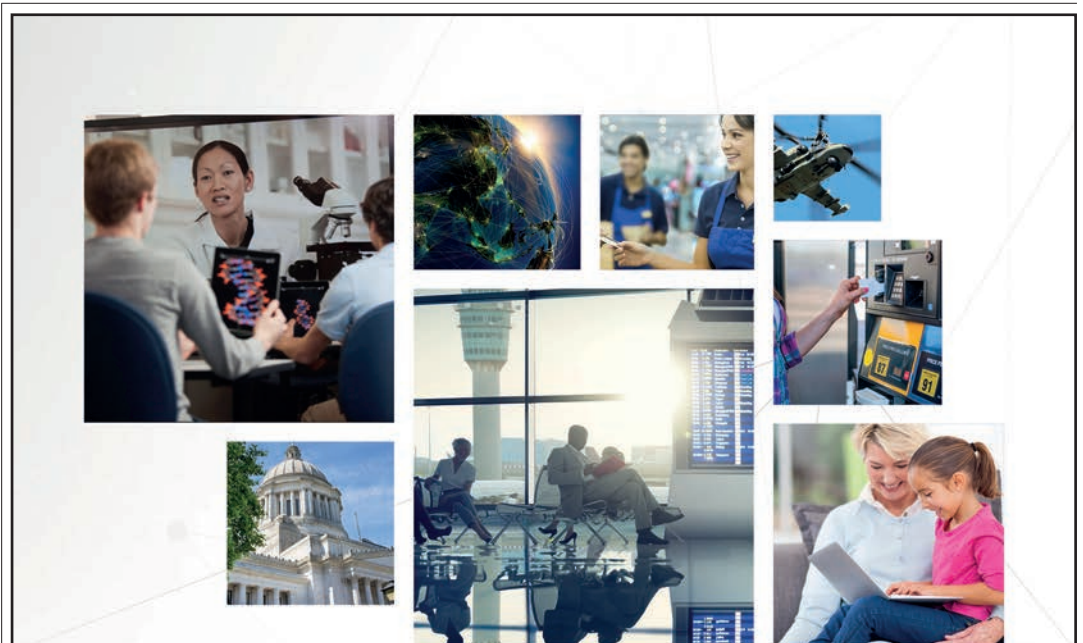
"But fibre is not always the answer. It can suffer from reliability issues (cuts, theft, etc.) and it is expensive. As a result, it is unlikely we will see it in remote and distant regions any time soon.

"Meanwhile, the progress made with other technologies opens up further opportunities. Microwave technology can carry gigabits of traffic today, while high throughput satellite (HTS) and a multiservice platform like Newtec *Dialog* are ideal for newer mobile architectures and optimal for fibre backup. The combination of HTS and *Dialog* also brings the cost of satellite down to the point where it can be very competitive.

"Finally, the choice between fibre, microwave or satellite is pragmatic and driven by three parameters: availability (fibre is most ideal in urban regions); economics (fibre is expensive, which makes microwave, if line of sight allows a limited number of hops, or satellite the most cost-effective solutions); and marketing (satellite provides quick go-to-market).

"Capacity requirements can be very acute and in the end it is these three parameters which operators will consider when making the decision on which backhaul method to choose.