chapter

Fixed wireless access

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The connectivity challenge in 2017: a cry for a more African-centric spectrum policy

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Africa (particularly sub-Saharan Africa) needs a different spectrum policy to bridge the connectivity divide. It should focus on: low frequency spectrum (VHF/UHF) for terrestrial networks; satellite spectrum for remote areas; unlicensed spectrum to complement licensed spectrum for internet connectivity; and dynamic spectrum use of both low frequency and satellite bandwidth. The continent should not be distracted by the current 5G craze either.

At the inaugural ICT Indaba[1] held in Cape Town in 2012, ministers responsible for ICT said: "We declare access to broadband communication as a basic human right in Africa and commit to increasing broadband penetration to approximately 80 per cent of the population by 2020. This common vision draws its basis from the positive impact exerted on economic growth through increasing accessibility, affordability and availability to broadband by all."

Three years later, the UN General Assembly approved a new set of 17 'Sustainable Development Goals' (SDGs). While eliminating poverty is the top priority, among the 169 goals the UN hopes to achieve by 2030 is SDG Target 9c.

Echoing the Cape Town declaration above, this calls upon nations to "significantly increase" ICT access and "strive to provide universal and affordable" internet access in least-developed countries by 2020.

However by late 2016, according to GSMA data, sub-Saharan Africa could still only boast of 42 per cent unique mobile voice users despite more than 700 million subscriptions, thanks to multi-SIM ownership. Furthermore, 75 per cent of people in Africa are offline, according to the latest ITU figures.

So who in Africa believes that the Indaba proclamation of 2015 or SDG Target 9c will be achieved on the continent any time soon? There are three root causes of the profound digital divide gap in Africa: (i) accessibility to connectivity in terms of infrastructure (Africa is a vast continent to cover with wireless signals); (ii) affordability due to poverty (most sub-Saharan Africans earn less than USD1.25 per day); and (iii) lack of awareness of the benefits of being online.

The DSA believes that the spectrum policies needed to achieve these goals/targets for Africa are not the same as those that have so richly connected OECD economies. Africa has been wrongly applying OECD spectrum policy/priorities for too long, thus inadvertently contributing to the digital divide.

The key strands of an African-centric spectrum policy should focus on the following:

1. Low frequency spectrum (sub1GHz) for terrestrial accessibility
2. Spectrum for affordable satellite connectivity, such as C-, Ku- and Ka-bands, particularly for remote areas without terrestrial infrastructure
3. Unlicensed spectrum access, including Wi-Fi, as more than 80 per cent of wireless data goes over Wi-Fi
4. Dynamic spectrum use: (a) for low frequency spectrum bands (e.g. VHF, UHF) by utilising dynamic spectrum access regulations like TVWS (TV white spaces); (b) dynamic spectrum access of mid-band satellite frequencies such as C-band

Licensed sub-1GHz spectrum

China Mobile is the world's biggest mobile operator and is currently reported to have more than 816 million subscribers. While it expects to have 1.4 million LTE base stations in China[2], a much-larger sub-Saharan Africa, which comprises more than 40 countries, can only afford a total of 250,000 base stations. Elementary physics clearly points to the use of low frequency spectrum (sub 1GHz, if not even sub-700MHz) since their propagation is much better.

It is important Africa exploits 900MHz, 800MHz and the recently-won 700MHz frequencies speedily and efficiently. However, even in addition to these frequencies, 450MHz LTE should now also be a consideration by all African regulators. But sadly, very few countries even know about this band as the vendors do not promote selling low-frequency equipment when they can sell higher frequency equipment multiple times more (>3 typically).

Satellite spectrum

Africa is just so big that it will never be fully geographically covered by only terrestrial base stations. Satellite can usefully and viably complement terrestrial solutions in order to provide much-needed ubiquitous

[1] 'Indaba' is a Zulu word for a council or meeting of indigenous peoples of Southern Africa who gather to discuss an important matter.

[2] www.rcrwireless.com/20160317/carriers/china-mobile-expects-1-4-million-lte-base-stations-year-end-tag23

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coverage demanded by the "connectivity is a human right" imperative. The continent has been a big defender of C-band[3] satellite services for broadcast services as well as for backhaul applications.

Unlicensed spectrum and Wi-Fi

Unlicensed rather than licensed spectrum and TVWS technology are arguably more important to bringing internet connectivity to the almost billion unconnected people in Africa. The continent must revisit its arguably sclerotic spectrum policy of the last decade and adopt dynamic spectrum allocation in both TV and satellite bands.

Unlicensed spectrum is the predominant and preferred way people access the internet with more than 80 per cent of traffic going over Wi-Fi. It already offers an invaluable complement to licensed spectrum: the European Broadcasting Union estimates that 71 per cent of all wireless data to mobile devices in the European Union was delivered using Wi-Fi. For smartphones and tablets in particular, Cisco has found that daily data consumption over Wi-Fi is four times that of cellular.

Unlicensed spectrum, and particularly Wi-Fi, has:

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[3] C-band generally refers to the RF band from 4 to 8GHz. However, the range of C-band satellite transmission frequencies of 3700-4200MHz are typically used in Africa to receive TV and radio channels using larger satellite dishes. The 6GHz satellite uplink, given its primary use of transmitting video content, has far fewer sites than even the 3700-4200MHz that is used for distribution to more satellite dishes.

[4] Dynamic Frequency Selection, Dedicated Short Range Communications, Earth Exploration Satellite Services, Fixed Satellite Services & Intelligent Transportation Systems.

❖ Put internet and information access within reach of everyone
❖ Driven significant economic development in OECD economies
❖ Provided a clear sandbox for innovation

Because Wi-Fi networks are inexpensive, flexible, and scalable, they can be deployed rapidly to meet consumer demand for internet access.

However, unlicensed spectrum has so far played second fiddle by a long mile to licensed spectrum in Africa as in most other developing countries. Unlicensed spectrum has a major role to play in driving broadband deployment and economic development, yet many broadband plans in most countries on the continent do not even mention unlicensed spectrum and/or Wi-Fi.

Regulators must make unlicensed spectrum a key part of their broadband strategy by ensuring that there is sufficient unlicensed spectrum available and that it remains open for innovation. Indeed, the DSA would encourage two key further actions for Africa beyond prioritising unlicensed spectrum access and Wi-Fi.

Firstly, the region's spectrum regulators and policy makers must make themselves aware of the emerging new globally harmonised channel plan for Wi-Fi applications, particularly how sharing would happen with incumbent technologies/services in different parts of the band (e.g. with DFS, DSRC, EESS, FSS, ITS[4], Radiolocation). Some African voices must be heard in these discussions.

Secondly, African spectrum regulators and policymakers must also make themselves aware that there are moves afoot to increase the amount of spectrum available to Wi-Fi, particularly with newer standards such as 802.11ac and .11ax which

can work with up to 160MHz channels. To get more 160MHz channels requires more allocation to Wi-Fi or sharing. DSA is therefore supporting the goal enabling Wi-Fi in the 5925-6425MHz range using dynamic spectrum access technology to share with incumbents which, in OECD countries, include microwave and satellite uplink users.

Dynamic spectrum allocation

This is a must-have consideration particularly across key bands such as VHF/UHF (using TVWS regulations) and C-band

Spectrum sharing – or more broadly, dynamic spectrum allocation – is an approach that allows secondary users to access the abundant spectrum holes or white spaces in licensed spectrum bands.

What does this really mean? Let us consider the two highly contended bands of UHF (470-694MHz) or satellite C-band (3700-4200MHz)/6GHz uplink.

The UHF band is internationally harmonised via ITU regulations across all of Africa and is allocated for terrestrial TV broadcasting.

However, as explained earlier, these low frequencies allocated for TV broadcasting in Africa are exactly the type of frequencies needed to provide broader coverage for internet access – indeed, this is why they were chosen for TV in the first place.

However, there is not much terrestrial TV on air in Africa, leading to most of this extremely important spectrum lying fallow. But the preparatory process for WRC-15 rejected calls to allocate these frequencies to mobile use on the continent and maintained the current allocation to terrestrial TV until 2023.

JANUARY – JUNE 2016

Celeno Communications will supply video grade Wi-Fi chips to help Altech UEC deliver a range of high-end 802.11ac capabilities to HD gateways and set-top boxes. Altech UEC specialises in developing digital technology for the converged broadcast and broadband industries in Africa. It says the use of the chips will enable it to offer Wi-Fi networking that delivers reliable throughput as well as the high QoS needed for data and HD video distribution across the home to multiple portable devices.

VAST Networks claims it has launched South Africa's first truly open access Wi-Fi network. The company continues to grow and says it currently offers thousands of hotspots throughout the

country. As an open-access wireless network infrastructure provider, VAST says it is delivering carrier-grade Wi-Fi in Southern Africa. Over the coming years, VAST plans to expand by firstly consolidating the networks it inherited through Internet Solutions and MWEB, and then grow into public spaces where there is high Wi-Fi demand, such as schools. Since launching last November, the company says it now offers internet access at more than 2,200 locations around South Africa, including transport hubs, shopping centres, hotels, hospitals and restaurants. These are provided using infrastructure inherited from the AlwaysOn and MWEB networks.

In what's believed to be the first technology solution of its kind, Cisco and Dimension Data

have teamed-up on an initiative aimed at dramatically reducing the number of rhinos being poached in South Africa. As part of the *Connected Conservation* project, the two companies are deploying a sophisticated monitoring system in a private game reserve adjacent to the Kruger National Park to track individuals from the time they enter until they exit.

During phase one, which has now been completed, Cisco and Dimension Data gathered information from the game rangers, security personnel, and control centre teams. They then installed wireless hotspots around key points to create a secure, point-to-point radio 'Reserve Area Network' (RAN) using Cisco's Wi-Fi and LAN technology combined

Therefore, the only other option left is to share the band, leaving the way open for a globally-harmonised transition to digital television and the continued secondary usage of this high-quality spectrum for TVWS applications.

TVWS regulations would allow this unused spectrum to be used to provide more widely accessible internet by accessing this spectrum on a secondary basis, since the primary usage remains terrestrial broadcasting. Effectively, such TVWS regulations would allow for other variants of Wi-Fi which have been innovated for the TV bands.

To date, unlicensed technologies using high frequency spectrum have been limited to short range communications. However, access to the unused TV white spaces has the potential to extend the unlicensed revolution to long range uses.

The potential applications are nearly limitless and TVWS-enabled technologies can play a critical role in extending internet access. Successful trials have taken place in Africa in South Africa, Ghana, Morocco, Kenya, Tanzania, Malawi, Namibia, *et al*, and rural users are already being connected in many countries including the USA, Ghana and the Philippines.

In the many TVWS rural broadband initiatives taking place around the world, smartphones are already being connected using the technology with Wi-Fi as an intermediary. However, new revisions of Wi-Fi (802.11af) will allow smartphones direct access to this technology. There are likely to be many implications here.

First, a user's home Wi-Fi network will no longer stop abruptly at their front door, instead extending into their local area. Second, the provision of Wi-Fi over large areas such as university campuses and even whole cities is likely to become easier to deploy and more ubiquitous.

Smartphones which can function in remote forests and natural reserves also become a distinct possibility. Over time, mobile network operators are likely to be large-scale users of TVWS, adding the technology to their current GSM and Wi-Fi-based networks.

As noted above, Africa has been a big defender of C-band for satellite use. However, other regions are pushing for this band for 5G and other services.

Once again, the answer for Africa would be dynamic access. The DSA can and should work with the satellite industry to promote sharing using dynamic spectrum access regulations and technologies that provide reasonable protection to the incumbent satellite services.

In the US, the Federal Communications Commission has already pioneered regulations using an approach that allows incumbent access the highest priority, followed by licensed priority access users and lightly licensed general authorised users. This approach already enables sharing with satellite operations in the extended C-band. Such an approach could be used to share C-band in Africa, thus allowing for satellite services to be protected while enabling the critical broadband services of tomorrow.

Broader C-band spectrum also includes the 5925-6425MHz frequencies typically used for satellite uplink and microwave. As mentioned above, new Wi-Fi technologies need additional spectrum channels to be allocated. The DSA believes that dynamic spectrum sharing would allow for sharing of these uplink satellite and/or microwave links with Wi-Fi. ∎

Enterprising wireless

In what turned out to be another quiet year for WiMAX, the technology lost out again when Internet Technologies Angola (ITA) deployed a national network using RADWIN's point-to-multipoint solutions in the 2.2GHz to 2.3GHz band.

ITA CEO Rolf Mendelsohn said: "We sought a solution in the unique 2.2-2.3GHz band that could co-exist with the high transmit power of the 3G cellular network in our capital Luanda and other cities."

He said ITA evaluated several technologies, including WiMAX, before opting for the bespoke carrier-grade wireless broadband solution provided by RADWIN. "Today we can provide high-speed connectivity of 50Mbps and upwards with low latency and guaranteed SLAs."

RADWIN said ITA has deployed "hundreds" of its *5000 JET PtMP* radios to provide a WiMAX replacement in a "tough" radio band. The firm claims the devices offer fibre-like connectivity and scalability at a price point that beats other technologies, including fibre.

ITA provides business-class services to many of Angola's largest corporations. Earlier last year, it opened its new state-

ITA said its new, multimillion dollar HQ means it is now totally independent from an infrastructure perspective.

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with Dimension Data's range of remote network monitoring, routing and switching, and managed services.

Liquid Telecom provided the Wi-Fi at the inaugural *Space for Giants* summit that was held at the end of April in Laikipia, Kenya. The event aimed to help raise the profile of elephant conservation across the continent, and was one of the largest gatherings of African political leaders, philanthropists, celebrities and conservationists. Liquid Telecom Kenya's broadband services supported live video links with global celebrities such as Leonardo DiCaprio and Lupita Nyong'o, and also helped the international media to deliver uninterrupted streaming of events.

JULY – DECEMBER
Telkom supplied the ICT services that supported South Africa's municipal elections held in August. The solution included access for the IEC's WAN through Telkom's VPN services platform. This uses multiple access technologies such as satellite, metro LAN, ADSL, amongst others. As part of a disaster recovery and business continuity solution, all data activities at the IEC's HQ were replicated at Telkom's data centre in Centurion in real time. This ensured that in the event of a disaster at IEC HQ, the recovery site would take over all activities allowing the elections to proceed uninterrupted. In addition to the services it provided for the electoral commission, Telkom also setup a network

of open access free Wi-Fi hotspots in almost 1,000 voting stations nationwide.

The Overseas Private Investment Corporation (OPIC) has disbursed its first funds to Mawingu Networks which specialises in delivering affordable internet into rural Africa. OPIC is the US Government's development finance institution and has committed to financing a USD4.1m loan to Mawingu Networks which is providing solar-powered wireless internet across rural Kenya. The Nanyuki-based company was able to establish its current operating model using an initial grant in 2013 from Microsoft's *4Afrika* initiative and USAID. Using a network of solar powered 'nomadic' wireless internet stations, Mawingu says it provides last-mile connectivity access

of-the-art head office building at Lar do Patriota in Luanda which makes it totally self-sufficient in its infrastructure. Covering an area of 2,300m², the USD12m facility includes: a data centre with systems for redundancy; a network operations centre; a teleport; and a transmission and a power room. The new headquarters also has two fuel tanks with a total capacity of 20,000 litres, and three 700kVA generators.

RADWIN was also the provider of choice when AfricaOnline boosted the broadband service it offers to corporate clients in Ghana with the launch of a new network.

The new symmetrical fixed wireless broadband network was initially designed to cover greater Accra. AfricaOnline Ghana MD Kwadwo Ohemeng Asumaning said: "We plan to leverage our existing customers to encourage them to increase capacity, follow up on clients who churned due to the instability of the previous unlicensed network, as well as target newly established business looking for reliability through a superior service."

While the popularity of 4G and LTE technology is increasing in the region, Asumaning claimed the RADWIN network allows more tailoring of solutions to ensure greater value for money, and is well-suited to companies with several branches that need dedicated uncapped symmetrical bandwidth.

Enterprise customers were the target in another launch that saw Comsol Networks using terminals and relevant hub site equipment supplied by Intracom Telecom. The deployment used the latest generation of the vendor's point-to-multipoint wireless system available at the time, along with its *uni|MS* network management platform.

As well as providing B2B wireless services in South Africa, Comsol said that it offers the country's first and only nationwide open access high-speed carrier grade data network.

Under a five-year deal worth USD9m, the firm will use Intracom Telecom's *WiBA-*

OSDR radio at 28GHz. It's claimed this will enable it to offer "superior" open access Layer 2 last-mile connectivity services to its growing number of corporate customers in more than 200 towns in SA.

Intracom boasted that its product was the only one available worldwide to make full use of Comsol's expanded spectrum assets, reaching up to 56MHz channel, and advanced networking features.

Wi-Fi for the masses

VAST Networks partnered with the City of Cape Town to deploy Wi-Fi to all MyCiTi buses. The first stage of the project involved ten buses across various routes, with commuters being able to benefit from 50MB of free data per day.

The initiative is part of the metropolitan authority's efforts to improve the attractiveness of the public transport system and encourage residents to minimise the use of their cars.

According to VAST Networks, Wi-Fi connectivity is the next step in making Cape Town a "truly smart city". Speaking at the time, mayor Patricia de Lille said: "This is indeed an exciting time for the City of Cape Town as we take another innovative step towards becoming the 'Digital Capital' of Africa. Internet access is also a key part of our strategies to build an opportunity city where we connect residents to resources and economic opportunities."

Elsewhere, Wireless-G said it would use VAST's open access network to grow its own business and brand. The company, which is said to be one of the oldest players in Wi-Fi in South Africa, said that all its *G-Connect* customers would now be able to use their Wi-Fi bundles on almost 2,000 VAST hotspot locations throughout the country.

In yet another deployment, VAST Networks successfully launched what was claimed to be the largest shopping centre

Wi-Fi installation on the continent. The company said consumers and retailers could now benefit from "a reliable and fast Wi-Fi experience" throughout the 130,000m² Mall of Africa in Johannesburg which opened towards the end of April 2016.

Formed in 2015, VAST Networks brought together the Wi-Fi assets of MWeb and Internet Solutions. The company collaborated with partners including Ruckus Wireless on the Mall of Africa deployment. They planned the rollout for more than a year, with technicians working on the site for nearly six months to make sure the Wi-Fi network would work without any glitches once the mall opened for business.

VAST said the teams installed more than 1,000 "highly advanced" APs together with the network backbone to deliver a solution that could not only handle the capacity requirements of more than 300 shops and thousands of anticipated daily visitors, but also cope with ever growing data demand.

VAST Networks CEO, Grant Marais, added that a deployment of this scale is a "massive undertaking by world standards and an African first".

The internet of things hits the big time

2016 saw IoT (Internet of Things) connectivity enabling Shell Nigeria to monitor its remote infrastructure in the Niger Delta.

The Digital Oilfield (DOF) solution now provides pipeline surveillance and wellhead monitoring. It was implemented for Shell by KONČAR, a Croatia-based producer of industrial electronics and power electronics devices and systems.

The company used end-point devices enabled with RPMA (*Random Phase Multiple Access*) network technology from US machine-to-machine specialist Ingenu. This provided Shell Nigeria with field data

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to areas that cannot economically access the internet. OPIC's loan will allow the company to expand connectivity and provide off-grid internet access using TV white space (TVWS) technology.

South Sudanese ISP RCS-Communication plans to double its bandwidth capacity over the next two years, despite most service providers in the country scaling down operations due to economic and other challenges. RCS was one of the first companies in Africa to sign up with the MEO satellite operator in 2013, and uses *O3bTrunk* to connect its WiMAX and high throughput point-to-multipoint networks in

Juba to the internet. The ISP will use additional satellite capacity from O3b as it is said to have now almost exhausted its contracted capacity as demand for bandwidth continues to increase.

Botswana Fibre Networks (BoFiNet) connected the National Stadium in Gaborone and the Francistown Sports Complex with Wi-Fi as part of the country's celebrations of 50 years of independence in September. The operator said its *BOT50 HOTSPOT* provides good coverage within the parameters of the stadiums, allowing users to connect to a speed of 2Mbps even when the venues are at full capacity.
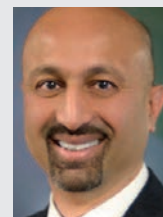
**Kalpak Gude,
President,
Dynamic Spectrum
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**Steve Song,
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Resource Center,
DSA member**

The year ahead: The last ten years has seen an explosion of investment and growth in

The M2M 'Digital Oilfield' system means Shell Nigeria can monitor its remote pipelines and wellheads.

Watly 3.0 was developed after the successful trial of a smaller machine in Abenta Village, Ghana.

about pipeline pressure, temperature and flow. KONČAR's remote terminal units and wireless pressure and temperature transmitters were installed in flow stations, manifolds and wellheads to provide connection to the back office, ensuring reliable information transmission.

According to Ingenu, RPMA uniquely enables devices to connect more efficiently and cost-effectively in both the uplink and downlink. It claims the technology requires fewer towers to provide coverage to large areas – 1:10 compared to 1:30 needed for cellular.

Unlike alternative communications solutions such as satellite, PI to SMS, and GPRS, the company added that its LPWA network technology can be installed using minimal infrastructure, which resulted in a total project cost savings of more than USD1m for Shell Nigeria over the alternatives.

The system was integrated and supported by technology services company Upland Consulting Nigeria. Its president and CEO Bola Awobamise said: "The key criteria for selecting a solution were the technology's ability to cover difficult terrain, power performance, and long-range transmission as well as network scalability, two-way communications, and secure data transmission. RPMA offered all of these

attributes and eclipsed the competition with its connectivity, network capacity, and exceptional value."

Later in the year, however, Comsol launched what it claimed was now the continent's largest Internet of Things network in South Africa.

The *Comsol IoT* is enabled by Actility's carrier-grade *ThingPark* platform. The operator said it will offer broad nationwide coverage, including urban and rural areas, to create an ecosystem that supports the connectivity of millions of devices.

Comsol IoT was deployed on the back of the operator's ZAR1.5bn open access Layer 2 national network, and was due to be available for sensor service termination by February 2017 in major cities. The open architecture, low power wide area network (LPWAN) is claimed to be the "ideal" solution for applications where power-constrained devices are distributed over large geographical areas.

Comsol said that sensors and devices used for utility meters or agricultural monitoring, for example, could achieve a battery life of up to 15 years due to the relatively small data sets and transmission rates enabled by its IoT.

It added that the high costs associated with manual monitoring, replacement of

batteries and GPS devices were also no longer factors for organisations wanting to run a smart operation.

Furthermore, because the Comsol IoT is an open access, open protocol network, the operator said any IoT applications that are developed will be "seamlessly enabled" to the devices and sensors they are meant to support. It believes this will create a "diverse" ecosystem that will serve to take African IoT to the "next level".

Going green

In early 2016, a clean-tech start-up company claimed to have developed a solar-powered machine that could bring internet connectivity, clean water, and electricity to communities across Africa.

Watly uses a combination of photovoltaic and thermal energies to power the *Watly 3.0* thermodynamic computer which, according to its developers, can sanitise more than 5,000 litres of contaminated water (including ocean water) a day, as well as generate electricity and Wi-Fi connectivity. The machine uses solar heat collected by super efficient vacuum-tubes to vaporise and therefore sanitise the water. This process also includes the use of graphene

African telecommunications. Access to high-capacity undersea fibre optic infrastructure has gone from one to more than a dozen undersea cables now reaching most countries in sub-Saharan Africa. This is likely to continue with new undersea cable initiatives planned for launch in the next two years, including the Djibouti Africa Regional Express (DARE) cable, the South Atlantic Cable System (SACS), Africa-1, and Liquid Sea projects.

This trend is unlocking capacity for service providers seeking to expand from 2G and 3G services to 4G capacity; bringing true broadband to citizens. However, a digital

urban-rural divide is growing. While national governments embrace strategies calling for universal telecommunications service, operators are required to use existing networks. In the coming two years, we will also see increased pressure on regulators to make wireless spectrum available in a timely and affordable manner to service providers.

Regulators will have the choice of following the old path of long-term licenses destined to raise the cost of providing service to the same urban areas, or leverage an unlicensed future to enable alternative technologies like WiFi and connectivity opportunities to those

who are still waiting for their on-ramp to the connected future. The last two years have seen dozens of announcements of public and private WiFi services across the continent. This trend will only increase as operators seek to leverage their investments in fibre through the deployment of this low-cost but robust access technology.

Finally, dynamic spectrum access, including TV White Spaces, will come into its own with a number of countries already having draft regulations in place and product manufacturing is likely to reach mass market during that period.

technology. Photovoltaic panels located on the roof generate off-grid electricity to power *Watly*'s internal electronics, and can also be used for recharging external devices.

Each *Watly* can be deployed as standalone infrastructure, but multiple machines can also be used as part of a, "Energynet" which, it's claimed, "can power entire cities and countries". They can all communicate with each other and be controlled with the Central Network Management platform via radio links, existing 3G or 4G networks, and/or satellite.

Watly was funded from Horizon 2020, the European Union's programme for innovation. The development of the system follows the successful trial of a smaller machine, *Watly 2.0*, in the village of Abenta, Ghana. The firm launched a crowd funding campaign with the aim of raising funds to create another *Watly 3.0*, with contributors being allowed to decide where the first model will be placed, with the options being Nigeria, Ghana, or Sudan. Sadly the fund didn't even reach a quarter of its target before the closing date and there's been no reported progress on the creation of another *Watly 3.0*.

Solar power is still not only an ecological solution to powering communications networks, but sometimes also the only realistic option. As part of its ARTES Partner programme, the European Space Agency (ESA) is contributing up to EUR10.7m in funding to support satellite operator Avanti Communications in bringing rural communities across Africa online.

Starting in September 2016, ESA aims to provide affordable satellite broadband connectivity to 1,400 community sites across sub-Saharan Africa over the next two years using Avanti's recently launched *ECO* Wi-Fi hotspot initiative.

The solar-powered hotspots will be hosted at schools that will benefit from subsidised internet access. Consumers and local businesses within range of a hotspot will use the newly developed *ECO* mobile payment app to make micropayments for broadband credits which convert to data usage.

Avanti has partnered with Newtec and a group of leading service providers, combining satellite, Wi-Fi and solar power, to deliver the programme. *ECO* MoUs have been signed with South Africa's Sentech and Ministry of Communications; Wananchi, Intersat and Imarasat in Kenya; and the Tanzania Education Authority.

Many other governments, service providers and other partners are said to have expressed support for the initiative. They include World Bank International Finance Corporation, Telkom Kenya, Internet

Solutions, Safaricom, iWayAfrica, iSat Africa, MainOne, Nynex, TelOne, Quantis, and Discovery Learning Alliance.

Powering connectivity for schools and hospitals

Following the signing of an MoU with the Ministry of Communications, Works and Infrastructure in July 2016, Tigo will help connect Tanzania's schools as part of a partnership that represents the first time the country's government and a mobile operator are cooperating on an ICT project of such scale and scope.

The ministry is identifying and providing a list of schools without computer labs to be connected, while Tigo will facilitate the rollout of internet access points over the following two years. It is sponsoring the infrastructural development that will include wiring classrooms and the installation of WLANs.

Tigo's agreement with the government is part of its *e-Schools Project*. Under this social investment initiative, the operator said it has been able to deliver internet connectivity to 31 public secondary schools in Tanzania, and plans to connect 50 more in the latter half of 2016.

In a separate announcement, Millicom's Tigo operations and Zanzibar Telecom (Zantel) joined the GSMA's *Connected Women Commitment Initiative*. The GSMA's aim is to reduce the gender gap in mobile internet and mobile money services. Tigo said its operations in Chad, Senegal, Tanzania, Ghana and Zanzibar would now follow the lead of Tigo Rwanda which became the first African operator to commit to the initiative in February.

In Madagascar at the end of the year, the Ministry of Posts, Telecoms and Digital Development (MPTDN) announced a project under which wireless broadband infrastructure would be deployed to connect schools and hospitals, while also serving remote and rural areas of the country.

In a press release outlining its plans, the MPTDN said that once the project (which is known simply as 'Wireless Broadband') is complete, access to the infrastructure may be offered for free, or at least at low cost.

A number of local government departments are involved with the initiative, including the Ministry of Education, the Ministry of Public Health, and the Ministry of Finance and Budget. In mid-October, Andrew Rugege, ITU regional director of Africa, and Jean-Jacques Massima- Landji, the representative of the ITU for Central Africa and Madagascar, were in the country to help mobilise the funding required for the venture. ∎

Kamal Mokrani, Global VP, InfiNet Wireless

Malta-headquartered InfiNet Wireless has been doing business around the world for 23 years now, but 2016 marked the first time it exhibited at AfricaCom in Cape Town. The fixed broadband wireless specialist used the event to launch the *InfiLINK XG 1000*, claimed to be the fastest point-to-point wireless radio currently available, as well as the *InfiMAN 2x2 Qmxb*, a smart antenna base station sector unit that is said to use spectral efficiency to deliver twice the performance of rival products.

But that's not to say InfiNet is an African newbie – far from it. The company has worked the length and breadth of the continent, listing deployments in Algeria, Cameroon, Egypt, Gabon, Kenya, Zanzibar, and many others, as part of its African success stories.

Global vice president Kamal Mokrani highlights the diverse nature of the African continent, not only in terms of its geography, but also in its political, economic, social, technological and environmental outlook, with each country and region having its own set of unique challenges and advantages. As a result, he believes you cannot have a "blanket statement" to cover what it is like to do business in the region.

"We have to adapt almost on a country by country basis. Just to give you a rough idea in terms of Africa and what we have done so far, take a country like South Africa, for example. Here, there are two specific sectors that we are focusing on: mining and the WISPs. But go to Egypt, completely the other side of Africa, and it's a different ballgame for us. There today, we are almost entirely focused on homeland security for reasons that we all know. The government is trying to attract back tourists so they've got to secure every single tourist site and they have to make sure that from the minute you land to the minute you take-off again you have a good experience."

Does that mean to say business is beginning to improve again in Northern Africa following the 'Arab Spring' uprisings of a few years ago?

"It's picking up and [governments] are creating what's known as safe city programmes. Border controls in some areas, such as Nigeria with Chad because of Boko Haram, are a sad thing. But for us, from a business point of view, they are actually creating opportunities for working

with different companies such as those specialising in face recognition technology.

"It is not as bad in Africa as it is in the Middle East. Jordan, Lebanon, Syria, Iraq and surrounding countries are much bigger opportunities for us, and we work with business partners in such countries. It's a niche. Around four or five years ago, one of our particular competitors from Canada focused on the oil and gas sector. Okay, so at the time, maybe that was the right decision. But now, because of the oil price having gone so far down, no one is spending on wireless communications, so they are struggling.

"Africa fortunately is so dynamic that anything can happen anywhere, anytime. Take Libya for example. We were doing so well and then overnight everything changed. We were wiring-up the WISP world in Libya so quickly that we could not make products fast enough. And then the political situation changed and everything has been destroyed from every aspect, all the infrastructure.

"I haven't been to Libya for many years and for good reason. But just the other day I had a phone call from one of our old Libyan partners who is a refugee in Dubai today and he said, 'I think things are getting better now, can I count on your support?' And I said, of course, let's sit down and start doing some serious radio planning so that we can rebuild as we go along. So yes, it will come around.

"I also talk to a lot of people in Algeria. It is a stable country today but the president is unwell – so will that be the next to see an Arab Spring revolution? It's a huge country and strategic as well, the gateway between Africa and Europe.

"So that's the big step approach you have to monitor. But that's what I love about Africa. In Europe you go to France, Italy, UK, Spain – it's almost the same. There's not much diversity and you know what to expect, the culture is almost similar. But here in Africa, it is different."
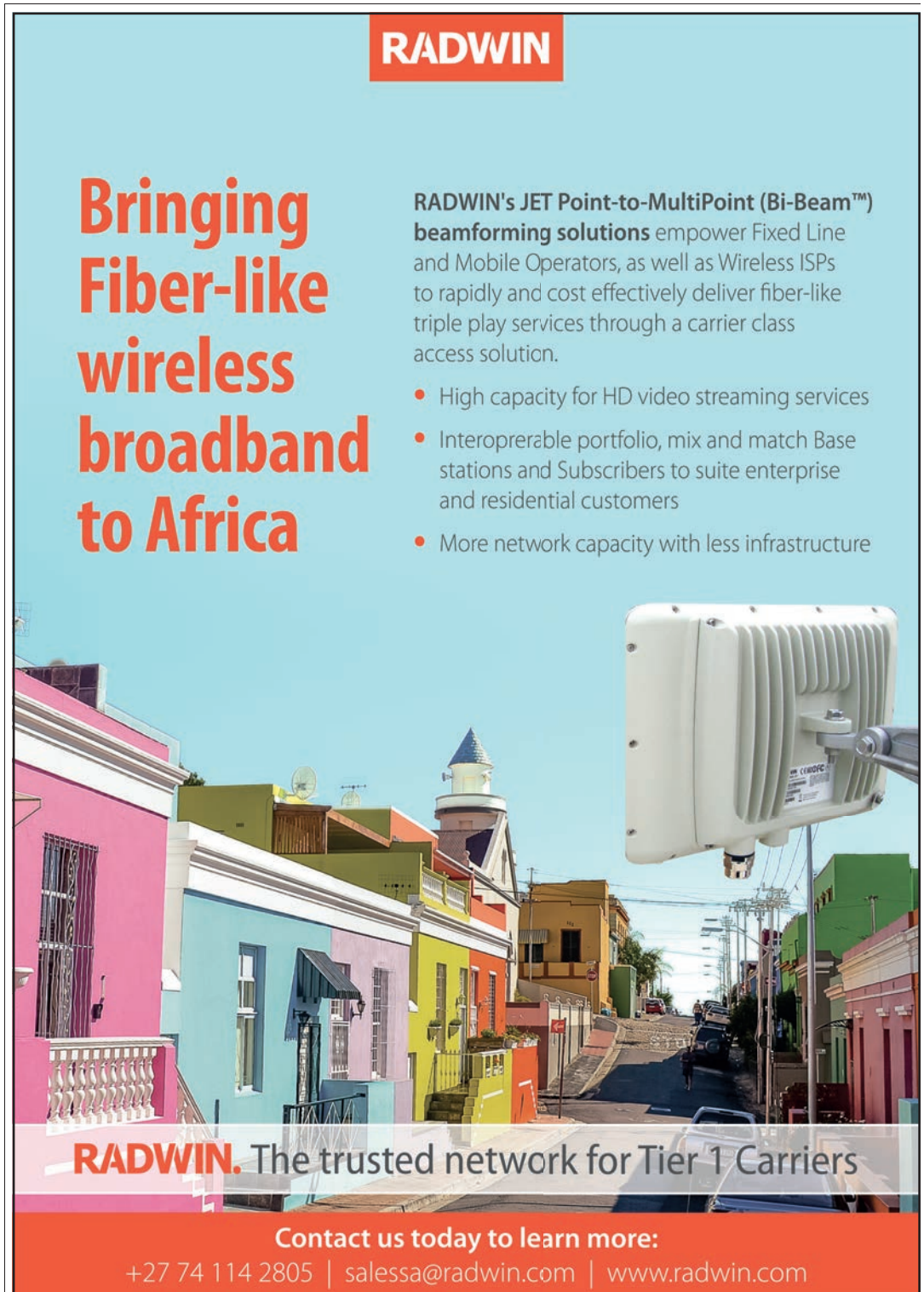
Key markets in Africa

Mokrani identifies Algeria, Egypt and South Africa, as currently the top three Africa countries for InfiNet in terms of sales. With regard to strategic value, he views Western Africa as significant.

"Certainly Cameroon is important because basically you have two big cities there and everything else is rural. So the digital divide is even bigger. We work with a couple of ISPs in the country to really reach even beyond the MTN network (MTN is, to a large extent, also becoming an ISP).

"We have other markets like Senegal which has one of the biggest ports in the world. We provide the management company, Dubai Port World, security of the port, controlling assets, monitoring movements of goods and containers. And even before they dock, the boats are provided with one of our units just to give them television or internet access because they could be waiting two or three kilometres offshore for three or four days."

When asked which African markets are on InfiNet's target list for 2017, Mokrani said he does not like a "scatter-gun" type of

approach, preferring instead to consolidate what the firm already had and ensuring it has a good solid foundation.

"Certainly, the countries that I have mentioned already are the ones where we are going to be spending more time and marketing dollars to establish an even stronger presence. But there are other countries, such as Central African Republic or Congo which are potentially a gold mine – and I literally mean a gold mine as they have so much wealth under the ground. But they're too busy doing other things like killing each other.

"Eventually, those countries may come around, realise that the potential is huge, and say let's develop the resources we have. And every single project in those countries will require communications. You can't have people coming to mine and take the gold out without having airports for them to land at or hotels for them to stay in. And all that infrastructure will be developed with foreign direct investment and we'll come in basically to establish the links."

But coming back to the more foreseeable future, Mokrani explains that the first strand of InfiNet's strategy is to strengthen what it has, specifically the WISPs and the homeland security market which is something that he wants to develop much more.

"In parallel to that, of course, we want to develop all the sectors in the industry. In South Africa, probably 60-70 per cent of our business comes from the mining industry. I want to repeat that experience in other countries which also have a lot of resources.

"So in 12 months time I would love to say to you, 'guess what? Mining has reached the same as our WISPs'. Or if we see some significant steps, for example, LTE being deployed, I would also like to be here in 12 months time and tell you we work with all the operators to provide them backhauling which is what our *XG 1000* is exactly designed to do. It is a sector of the industry in Africa that is relatively new for us. We do a little bit in Africa but we do a lot more in other countries. For example in China, backhauling for China Mobile and China Unicom is perhaps our core business."

Not just about being a "box shifter"

While on a global basis InfiNET offers different solutions for different sectors (for example, it is going to Latin America for the backhauling side as many operators are still migrating to 3G), Mokrani says the aim is to stay diversified but offer the same products with just the application side tailored to the relevant industry sector.

Enterprise fixed broadband wireless will remain the company's core business as Mokrani sees huge growth potential in this area. But he points out that if a vendor cannot add value, it simply becomes a "box shifter".

"It's not about just asking the customer 'how many do you want and what colour do you want?' That's not what we do. When I travel across Africa and I see villages completely isolated, it just makes me wonder. So we are working with a lot with ISPs in different parts of the world and Africa specifically to really bridge that gap between the have and the have-nots, the rural and the urban."

One of the opportunities Mokrani hopes to capitalise on is the demise of previously deployed wireless technologies. For example, he said WiMAX has reached the end of its life and none of its manufacturers are now pouring money into R&D. "So everybody is migrating which is music to our ears. We are not a WiMAX manufacturer but we can actually migrate every single WiMAX network onto our platforms."

Mokrani said WiMAX had played its role but ultimately lacked the capacity to bridge the digital divide. Having said that, he supported the technology when it first emerged. "Around 10 years ago, I was a great believer in WiMAX. I used to work for Marconi in the UK and we were party to the ITU in those days, influencing the specs and doing a lot of work. WiMAX's key principle was interoperability. Rather like Wi-Fi, you could have a base station from one vendor, and the CPE or remote sites from any other.

"But that never happened because Samsung or Tranzeo or whatever other manufacturer of WiMAX would only allow their base stations to work with their CPEs, and that defeated the whole purpose. And then came Mobile WiMAX but again, that never really took off."

Of course it's not easy, and few would disagree with Mokrani when he says that no single technology can provide the universal solution to Africa's digital divide. WiMAX – along with LTE, microwave, satellite, fibre, etc. – represents just one piece in the huge and complex jigsaw puzzle of providing ubiquitous connectivity across the continent.

"Our solutions are in the fixed broadband arena. We do support mobility up to a point. We cover from 2.4GHZ to 6.4GHz, and we're even developing new frequencies. For any wireless vendor, keeping abreast of all these changes, refarming all frequencies, etc., is a nightmare. To do R&D when things are literally changing on a daily basis is therefore challenging.

"For example, about a year-and-a-half ago, the Mexicans opened the 3.0-3.3 frequency band for commercial use. It wasn't there before. I contacted our R&D guys and said there is a huge opportunity in Mexico, we need to do this. Which we did.

"So your business case has to stack up for you to do R&D. Thankfully, we are pretty strong financially, and if we see a niche or a big market, we would be crazy not to go out and develop products. For instance, I was approached by someone to do 26GHz not long ago and my first question was: how big is the market? If it is big enough, we will do it. Of course, nobody can develop everything. You get a lot of small players who say 'no, we will stay at 700MHz because that is our core business and we don't have the resources to do anything else'. And you have the E-band guys at the lower levels who stay there and target the mobile operators who have an interest in that. Would we do E-band? I would not say that we don't have an interest in that. We monitor everything."

According to Mokrani, fibre optics will ultimately be everywhere. But he admits that will take many years, and may not even happen in our lifetime.

"Perhaps Africa will reach the stage where Europe was 20 years ago in 20 years time from now. Or is it a 50-year time window or 100? I don't know. A country like Ghana, for example, is pretty well fibred-up – it is probably one of the most advanced countries in Africa in terms of availability of fibre. But you take countries like Algeria, it is impossible to fibre; the country is huge, the terrain is impossible."

But then these are all part and parcel of the challenges in Africa that drive Mokrani. "I was talking to an oil and gas company in Northern Africa and they said they wanted connectivity and we said we can do that. But then they pointed out a challenge and said: today I have line of sight, tomorrow I have a sand dune, how do I fix that?"

Physics presented the solution for InfiNet, as Mokrani explains: "The atmosphere has different layers and we can actually use our products and have different portables that can reflect signals. Normally, you have two units point to each other for line of sight, and we can put them in such a way that they find the right layer for your frequencies to reflect and connect back to everything. We try and understand as much of the physics as possible so that we can offer what to others seems like black magic."

Ultimately, it's all about giving access to information for Mokrani: "If we provide that link to the outside world, the world will be a better place. I want my tombstone to say: *Here's the guy that made the difference.*"

Nick Ehrke,
Sales director,
Southern Africa,
RADWIN

Though primarily focused on its carrier business, RADWIN saw growth across all of its segments in 2016, according to Southern Africa sales director Nick Ehrke.

"This included big growth in providing key solutions for Africa's largest utility (mobility for first responder vehicles and mission critical CCTV backhaul), as well as providing mission critical communications to the continent's largest integrated energy and chemical company based in Johannesburg."

Ehrke was unable to name the clients here. He went on by saying that RADWIN's carrier business continues to go from strength to strength, with a "major" tier 1 mobile operator having already deployed more than 700 of the company's point-to-multipoint (PtMP) *Jet* base stations throughout South Africa for broadband connectivity.

So how has the firm seen the wireless communications market adapt and evolve on the continent in 2016? Ehrke says: "Operators are having more difficulties with the lack of suitable and affordable spectrum. Many have turned to ISM band, while many more are following suit as the demand for affordable, reliable internet service, and especially high-capacity internet is growing. These operators are seeing fibre, PtMP, copper, LTE and satellite as tools in their toolkit to address the ever growing need for internet services."

Ehrke also believes that real economic growth is a major stumbling block in Africa and represents a significant challenge for the region in 2017. "The problem is exasperated by the real lack of broadband even in dense urban centres. Contracting economies, negative growth, lack of capital liquidity, poor regulatory framework, lack of skills and the high cost of infrastructure are some of the major challenges Africa faces."

Despite all this, he says RADWIN remains very optimistic. Perhaps because of the challenges mentioned before, Ehrke reckons the company will continue to see its business grow exponentially every year. "This is primarily due to our pedigree in carriers – we deliver what the carriers/operators need. They see through marketing hype very quickly, and we have a legacy of delivering solutions that are easy to scale and future proof, that continue to give our customers a competitive edge in their markets."

Ehrke adds that RADWIN will continue to innovate following the addition of its new AIR series to its products portfolio. "Built on our PRO range, with the same scalability, reliability and interoperability, the new products introduce cutting edge innovation so that we are able to drive down costs even further for our customers," he claimed.

Chris Mason,
EMEA sales
director,
Rajant Corp.

US-based Rajant was setup in 2001 to deal with what it describes as "significant shortcomings" in traditional wireless mesh technology, particularly when it came to mobile voice and data networks used by first responders. Its answer was *Kinetic Mesh* – a more robust mesh technology that aims to allow first responder networks to be fully mobile and mobility-enabled, and operate reliably in even the most demanding environments.

In Africa, EMEA sales director Chris Mason claims Rajant's position is growing both in terms of the number of deployments but also in the size of the networks in operational sites.

"Our main footprint in the region has always been in mining, but our expanding channel of authorised distributor and reseller partners are helping Rajant to extend into new markets, such as oil and gas, ports,

municipalities, security and defence.

"Africa remains a buoyant market for Rajant. Sales are increasing, partners are being trained on all aspects of successfully planning, designing and deploying *Kinetic Mesh* networks, and customers are reaping the real benefits and ROI of a properly deployed Rajant network."

Mason says a recent and particularly notable deployment involved the ability to deploy an autonomous drilling rig in a mine in South Africa, controlled and monitored across the Rajant network. "We're hoping to be able to publicise this activity soon but in summary, this could only have been achieved with the ability of the Rajant network to support high-bandwidth and more importantly low-latency to guarantee safety of operations."

As in many other regions across the world, Mason says users in Africa are increasingly requiring highly reliable, resilient wireless networks. "It can't be underestimated how mission critical sophisticated applications are becoming more essential to the management and survival of industrial organisations. The growth in the use of data from operations to drive efficiencies, prevent downtime and derive insights into business processes needs both high bandwidth and low-latency.

"Furthermore, automation and associated video imagery requires increasing amounts of bandwidth, adaptable to the demand and locations of operational use. This automation trend is across all industries and is essential to take personnel out of harm's way, and to drive efficiencies."

According to Rajant, global organisations face several challenges across their territories, not least of which is a legacy of multiple systems in different locations and the number of personnel required for support. Mason says this becomes a problem when the drive for efficiencies seeks to centralise and standardise on technologies such as wireless networks.

"We've seen an increasing requirement across organisations for a single wireless standard technology – one that, when an upgrade or expansion is required, doesn't require the disposal of previous generation equipment. Rajant can seamlessly integrate with Wi-Fi or any Ethernet connected device. This integration is becoming increasingly more important as network operators look to add more functionality and mobility to their existing infrastructures."

Mason reckons Rajant is "uniquely positioned" to support this growth or adaptation. So what obstacles need to be overcome on the continent in order for the company to achieve such objectives?

"Africa's 12 month challenges are a subset of its longer term challenges. These include a growing population and the need to feed, house, educate and find work for that population. Added to this escalating growth is the need to ensure appropriate stewardship of natural resources, and to assure the economy can develop and utilise those resources responsibly for future generations as well as to generate non-natural resource opportunities.

"Urbanisation of the population and an expanding middle class are two additional drivers creating unprecedented demand to manage transport, infrastructure and government services ever more efficiently."

As a result, Mason says the potential for significant growth of technology adoption across the continent is "immense". He believes the exploitation of data from within organisations' operations is stretching from the consumer and enterprise sectors into industrial environments.

"The Industrial Internet of Things (IIoT) is extending into every industry and further underlining the requirement for all assets, devices and people to be connected. Organisations that fail to make use of their own data are wasting an asset they already own and which can directly contribute to making them a more efficient and therefore resilient business.

"There are challenges indeed in infrastructure, investment and not least commodity pricing, but with increasing political stability, national and international collaboration, Africa's growth potential shouldn't be underestimated."

When it comes to dealing with such obstacles, Rajant's view is to 'bring it on'. Mason says: "Rajant's challenges in Africa are those we welcome: how to ensure we satisfy the increasing demand for our networks and associated management software."

He adds that in 2017, the company is also aiming to consolidate and expand its existing networks, expand its sub-Saharan Africa

footprint and penetrate new markets. "Whilst we have a strong user base in South Africa, our aspirations extend into countries such as Botswana, Ghana, Mozambique, Namibia, Swaziland, Tanzania and Zambia, so we'll be working with our partners to target these areas.

"For Rajant to continue to grow across Africa, we need to secure partners addressing the new geographies and markets identified. We'll be concentrating on the tasks of identifying the key markets and recruiting and training a strong set of channel partners in each country and supporting them in the associated processes of homologations and import permissions.

"There are also a number of key product developments in the pipeline which will be announced in due course that will add to the appeal of Rajant capabilities across multiple markets."

One of the company's recent development areas is the deployment of its wireless network capabilities on unmanned aerial systems or drones. Mason says this provides a "third dimension" to the *Kinetic Mesh Network*, extending coverage into otherwise difficult to reach coverage areas, longer distances and for longer durations.

"Rajant enables organisations to build private wireless networks that support the industrial IoT," he says. "We refer to those as 'Living Networks' because they thrive in dynamic network environments where everything in the network can move and evolve as connectivity demands change. With our *Kinetic Mesh* technology, network infrastructures can be built with the ruggedness, mobility, and autonomous application support required in today's demanding business environments."

Lux Maharaj, Strategic account manager, Intracom Telecom

Intracom Telecom is a global telecom systems and solutions vendor and has been present in Africa since 2010, as strategic account manager Lux Maharaj explains.

"The Intracom Telecom Group has enhanced its presence in Africa with the establishment of subsidiaries in South Africa and Morocco. The company started its expansion plan from the South African market. It is now the supplier of choice for large WISPs and telcos in several countries, such as Nigeria, Ghana, Ivory Coast, Liberia and Morocco, especially with *WiBAS*, its broadband point-to-multipoint radio product line.

According to Maharaj, Intracom saw "significant" demand for *WiBAS* in

2016 with new deployments in Liberia, Ghana, Nigeria, Ivory Coast, Mali, Egypt, Equatorial Guinea, South Africa, and others.

WiBAS represents the firm's flagship product range. Maharaj claims it delivers "state of-the-art" IP connectivity, backhaul of hetnets, and premium broadband and legacy access networks at an aggregate rate reaching 1Gbps per carrier at the hub site. "It also enables a wide range of profitable business plans providing a key differentiator to operator success," he says.

Intracom has also introduced *WiBAS-Connect*, a CPE terminal for residential and SMB subscriber access. "It operates in the 10.5, 26 and 28GHz bands, and provides broadband connectivity, featuring leading capacity up to 500Mbps per carrier, to subscribers who presently are constrained by the digital divide. This product enables access to information and entertainment services for subscribers on the continent, and enhances the competitiveness for the operators against legacy fibre/copper technologies due to faster rollout rates with high QoS."

Maharaj continues by saying that the company has now established new local and global partnerships, and has grown its base of skilled and trained engineers as well as trainers across Africa. In terms of the region's technical trends, he says there has been sudden uptake of the ITU PMP spectrum, particularly at 10.5GHz, 28GHz and 26GHz.

Maharaj also points out that mobile and fixed operators continue to migrate enterprise customers on wireless networks from unlicensed bands to licensed bands. He says Intracom has been engaging various operators in Southern, Central and Western Africa, and has helped them to build strong business cases for addressing the enterprise segment within their markets.

"Operators who previously focused on the mobile voice and data markets have now increased their focus on the strong enterprise market – typically served by the ISPs or incumbent fixed line providers.

"Some operators have attempted to target the enterprise market using their existing LTE investments. However, following their concerted efforts, these operators tend to come to the same conclusion that LTE architecture is primarily designed around mobile users, and creating a fixed user service tends to be complex and prone to operational challenges.

"In particular, as LTE is a L3 network, turning LTE into a L2 network for metro Ethernet type services was found to be doable but extremely complicated. The promise of a lower cost LTE CPE is often thwarted by the fact that an indoor CPE often tends to require an external antenna and the operator is faced

with challenges in obtaining the link statistics and matching the subscriber IDs at EPC, eNodeB and the customer CPE."

Throughout this year, Maharaj says Intracom expects to significantly grow its PMP business throughout the continent in order to address the constantly increasing bandwidth demand, frequency spectrum congestion, and what he describes as the "failure" of currently used unlicensed technology to meet the required quality of service.

"The company is now a familiar brand for the region's Tier-1 operators and WISPs, and this will be used as the foundation of the promotion strategy for the new generation of ultra broadband products, such as the new series of E-band *Ultralink* radios.

"The company has also developed a unique, self-aligning, aesthetically-appealing, microwave and millimetre wave solutions ideal for deployment in municipalities and high traffic areas for the backhaul of small-cells or Wi-Fi hotspots.

"A developing need by governments is for solutions to help alleviate road traffic congestion and improve security and surveillance monitoring, and the company is looking forward to meeting this need with its unique *StreetNode* offering.

"Furthermore, in line with the latest technology trends and specifically the smart city concept, Intracom Telecom has developed a comprehensive portfolio of smart solutions including smart parking, smart lighting, surveillance, traffic management and monitoring, waste management, smart metering and energy management, and unparalleled integration capabilities with any IoT device."

Maharaj reckons these offerings offer the "best fit" for municipalities, gated communities, universities/campuses, business parks, shopping malls, etc. At the same time, he claims Intracom's innovations, successful track record and expertise can contribute towards the modernisation of network, IT and public infrastructure.

// There comes a time in all technologies when they take a giant leap beyond what was originally envisioned," declares Christian Jonsson, MEA sales director for Aptilo Networks. "You can recognise the leap when you look back and say, wow, of course that's where this was going all along."

Christian Jonsson, Sales director Middle East/Africa, Aptilo Networks

According to Jonsson, Wi-Fi reached that turning point in Africa in 2016. "The focus has rapidly moved from providing simple public hotspot services with vouchers to a more holistic Wi-Fi services approach. We can see that from all our operator customers and prospects in Africa. Operators are now looking to utilise Wi-Fi in a much broader way and to squeeze every penny out of it, both directly and indirectly."

To illustrate the point he starts by talking about indirect monetisation: "In the industrial world, the largest source of Wi-Fi monetisation is customer retention – offer Wi-Fi and keep your subscribers.

Mobile operators typically spend 15-20 per cent of their revenues just to have the same number of subscribers on 31 December as they had on 1 January. Reducing this spending just a few percentage points can reap hundreds of millions from indirect monetisation of Wi-Fi.

"But, this retention effect is not as relevant in Africa with the vast majority of connections being pre-paid, right? Wrong! Most people have multiple pre-paid cards and they use the one that is offering the most attractive data deals at any given moment.

"The best way for you to ensure that the user has your SIM card in their phones most of the time is to offer attractive and affordable Wi-Fi services. So, the indirect monetisation of Wi-Fi in the form of 'customer retention' is just as relevant in Africa, even if it may be more difficult to measure."

Jonsson says Aptilo has also seen an increasing interest among operators to do automatic Wi-Fi offload with secure and seamless authentication of the users through SIM authentication. He believes this is another huge opportunity for indirect monetisation of Wi-Fi.

"Generally, the cost (TCO per bit) of producing data in Wi-Fi is eight per cent of doing so in 3G macro cells and 32 per cent of 4G macro cells[5]. In Aptilo's experience, we find that it is possible to offload 30 per cent of the data traffic to Wi-Fi with the right Wi-Fi deployment strategy. No wonder that Wi-Fi offload is a highly interesting value proposition in Africa where a lot of networks are still on 3G – just do the maths. In fact, many networks may use Wi-Fi as a bridge between 3G and 5G, and not deploy 4G at all."

Operators in Africa are also becoming increasingly creative when it comes to direct monetisation of their Wi-Fi services. Jonsson says that the continent's MNOs, along with those elsewhere in the world, have identified the "huge potential" in selling Wi-Fi as B2B and B2B2C services.

"Providing managed guest Wi-Fi services to businesses such as hotels, healthcare providers, enterprises, stadiums and retailers is a growth opportunity. At the same time, operators gain important indoor Wi-Fi coverage and Wi-Fi offload footprint.

"If they play this right, operators have a competitive edge over the many cloud players offering guest Wi-Fi services on top of the existing Wi-Fi infrastructure at the different businesses. Operators with a systems integrator arm can move in and replace the often-times mediocre Wi-Fi infrastructure with a carrier-class one. They can also sell a more complete solution to the businesses, as this solution can include internet backhaul and even end-user support.

"Best of all, they can take a more holistic view when calculating the profitability of each individual project. If the operator factors in upsell effects of other products and services and the possibility of reserving their own SSID for Wi-Fi offload, then they can offer a very competitive price.

"There are many possibilities in the African market that go beyond the traditional public Wi-Fi hotspots. But, to realise this potential, operators need the right tools. To scale their B2B Wi-Fi services they need a flexible and scalable Wi-Fi service management platform built for the task. It must offer a multi-tenancy architecture which allows hundreds of businesses to share the same platform while remaining totally separated from one another. Operators must also allow these business customers to modify parts of the captive portals themselves even down to a single location.

"Operators must offer tools that enable the businesses to get analytics from the Wi-Fi service in a hierarchical fashion. The management of a large hotel chain may be more interested in general trends while the manager at one of the local hotels may want actionable insight about his/her visitors. This is one reason why insights about the users through, for example, Facebook login to the Wi-Fi service, has become as important as the Wi-Fi service itself. Managers may also want to engage directly with their visitors through the portal, mail and SMS."

Jonsson says flexibility in the systems and being able to support many business models is key. But he pointed out that even more important is robustness and proven interoperability with all leading Wi-Fi vendors. "The operator that can provide a managed guest Wi-Fi service that is always up and running and that works with everything will be the true winner."

[5] *The economics of small cells and Wi-Fi offload,* by analyst Monica Paolini of SenzaFili