

chapter 8

Fixed Wireless Access



Paul Colmer,
EXCO member of Wireless Access
Providers Association (WAPA)

Those among Africa's poorest must pay exorbitant per gigabyte mobile data costs when there are economically sustainable and under-utilised alternatives.

World Bank data shows that, while Africa's poverty rate decreased from 56% in 1990 to 40% in 2018, the actual number of poor continue to rise due to population growth, which means more than 430 million people now live in extreme poverty compared with 240 million.

Being able to legally use the potential of TV white space (TVWS) for communications is a potential game changer for Africa's unconnected people and Africans who face prohibitive mobile data costs. Data costs in Africa soar well above the world average, for over 600 million people.

TVWS is under-utilised bandwidth that was always reserved for older TV signals,

which needed wide frequency bands to not suffer interference from other signals, but which using modern technology can be repurposed into high-speed Internet at low cost. This is now possible in South Africa, Kenya and could soon be the case in Nigeria, Ghana and Malawi.

One of the big challenges was always being allowed to use the TVWS signals in this way. But another challenge was sourcing affordable kit with which to build the networks. The market was always so small and demand so low that equipment was expensive to manufacture, supply, and maintain.

That is changing.

TVWS regulations exist in the US, UK, Kenya, and Singapore. South Africa has now joined their ranks. Both Ghana and Malawi have TVWS concept projects underway, although the results have not yet been finalised. In January 2020 Nigeria Communications Commission (NCC) released draft guidelines for TVWS for rural broadband.

TVWS has long range and broad coverage but, importantly, has great obstacle and

“The vast majority of these businesses, by combined revenues, fall into the US\$300,000 to US\$650,000 per annum bracket.”

good building penetration characteristics. That makes it an ideal communications technology for much of Africa’s broad, rugged rural regions, as well as for penetrating dense urban environments.

Using TVWS to connect people across the continent could usher in a digital renaissance.

It is particularly poignant as Africa’s population continues to grow, expected to top 2.5 billion by 2050 and represent 39% of the world’s total population by the year 2100. Many Africans are urbanising, trade across the continent is changing, and African national economies are either already transforming or they want to.

If Africans want to participate in the regional, national, continental and global economies, we must connect. TVWS is an ideal opportunity.

The commercial opportunity has never been greater. Media reports in April 2021 reveal that sub-Sahara Africa has six of the 10 most expensive countries worldwide for the cost per gigabyte of mobile data. The average is US\$6.44 in sub-Sahara

Africa, US\$5.25 in South America, versus just US\$1.53 in North Africa, citing a cable.co.uk study.

Kenya comes in at US\$2.25, Nigeria at US\$0.88 while Sudan takes a clear African lead at just US\$0.27, which is still high compared against the world’s cheapest, Israel, at just US\$0.05.

Perhaps tellingly, the average monthly income in South Sudan, according to WorldData, is just US\$38. It is US\$48 in Malawi, US\$147 in Kenya, and US\$167 in Nigeria. In Israel, where the average mobile per gigabyte data cost is just US\$0.05, the average monthly income is US\$3,598.

People in South Africa pay between US\$26 and US\$39 per gigabyte of pay-as-you-go data (bought by the megabyte), compared with just US\$0.13 to US\$0.20 per gigabyte of data (bought in monthly bundled packages) for those who can afford it.

A prolonged study in South Africa demonstrated in an African context that a TVWS network, with each base station having a 10km coverage radius without requiring line of sight, could reach 13 million people currently living in 3.5 million rural dwellings in just two of the country’s nine provinces. Currently, only 35% of these homes have Internet access using a smartphone. While regional regulations differ, the implications for millions of people in many other African countries are significant.

| Exorbitant Mobile Data Costs | |
|------------------------------|--------------------------------|
| Region | Average US\$ Cost per gigabyte |
| Sub-Sahara Africa | 6.44 |
| South America | 5.25 |
| North Africa | 1.53 |

| Paying the Price | |
|------------------|------------------------|
| Country | US\$ Cost per gigabyte |
| Kenya | 2.25 |
| Nigeria | 0.88 |
| Sudan | 0.27 |

The US\$1 million, two-year study in South Africa proves it's possible to connect the unconnected. The Wireless Access Service Provider's Association (WAPA), Microsoft, Project Isizwe, Stadia Capital, Adaptrum, International Data Corporation (IDC), and the United States Trade Development Agency (USTDA) demonstrated the technical, commercial and socio-economic benefits of TVWS.

Each TVWS base station in the 470 to 694MHz bands was connected at 20Mbps with 30 total 2.4 and 5.8GHz Wi-Fi hotspots. The hotspots were within walking distance for each citizen in the trial regions. Subsequent to the project's successful proof of concept, Wireless Internet Service Providers (WISP) in South Africa have the opportunity to deploy as many as 1,600 TVWS base stations, reaching 50 000 hot spots, potentially serving 13 million people in rural areas.

The results of the TVWS project in South Africa, regulatory adoption in Kenya and draft guidelines in Nigeria, with trials

underway in Ghana and Malawi, as well as adoption in other parts of the world, are significant on their own.

But making dynamically allocated TVWS spectrum available could not only stimulate affordable connectivity for digitally divided Africans, it's an opportunity for entrepreneurs to activate small businesses.

Surveyed wireless service providers in South Africa in the 2021 WAPA census reveal that nearly 80 independent and owner operated businesses generate over US\$162 million per annum. The entire industry could be as much as US\$200m. The vast majority of these businesses, by combined revenues, fall into the US\$300,000 to US\$650,000 per annum bracket. By total number of businesses, 63% are micro enterprises. They already employ thousands of people and serve hundreds of thousands of customers.

The most significant hurdle for fixed wireless service providers is the availability of spectrum and affordable equipment to build the networks that use it to provide telecommunication services to the people who need them.

TVWS, trialled at great expense and with deep care around the world, in Africa, and now being used to offer live services on our continent, is a viable commercial prospect to deliver cost-effective broadband Internet and IP telephony services to hundreds of millions of people. ■

“Media reports in April 2021 reveal that sub-Sahara Africa has six of the 10 most expensive countries worldwide for the cost per gigabyte of mobile data”

The biannual Ericsson Mobility Report provides projections and analyses of the latest trends in the mobile industry, including subscription, mobile data traffic and population coverage worldwide. The following is from the June 2021 report.

5G commercial launches drive FWA offerings

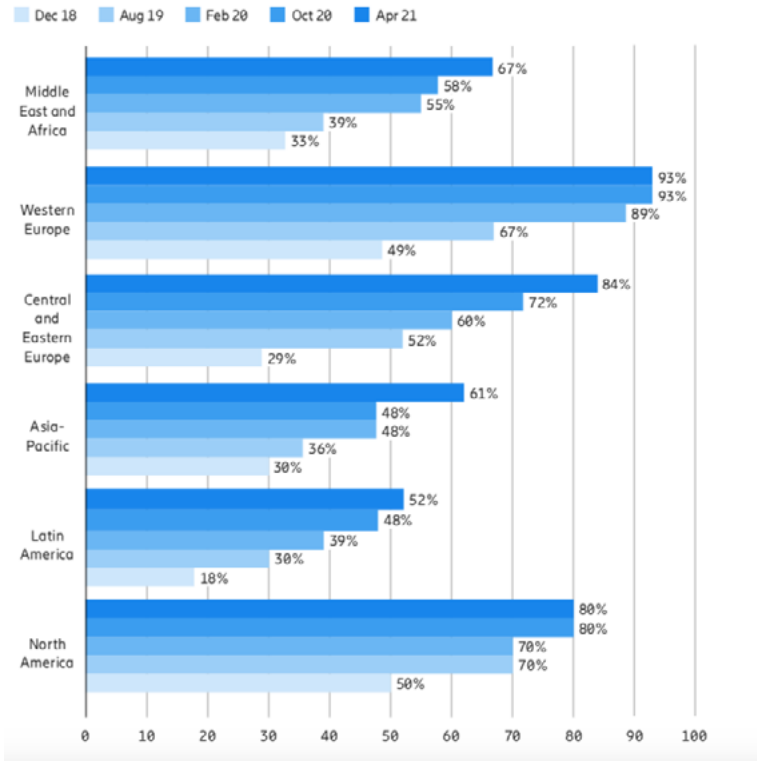
Over 70% of all service providers are now offering fixed wireless access (FWA) services. Connections are forecast to exceed 180 million by the end of 2026, accounting for more than 20% of total mobile network data traffic globally.

Over half of service providers in every

region now offer FWA

According to the regional breakdowns, more than 50% of service providers in every region are offering FWA. The highest growth during the last six months has been in regions with the lowest fixed broadband penetration – that is, Middle East and Africa, Central and eastern Europe, Asia-Pacific and Central and Latin America. These regions grew between 4–13 percentage points. Central and eastern Europe has had a growth of almost 25 percentage points since the start of the pandemic in February 2020. Globally, they now have the second highest adoption at 84%, while western Europe have the highest FWA adoption at 93%. ■

Figure 6: Regional percentage of service providers offering FWA





Andrey Koynov,
CTO, Infinet Wireless

Infinet Wireless has adopted a positive business outlook for the future, in relation to the ever developing and growing African market. Infinet Wireless has based this view on key criteria and the indicators for growth. Today Africa is an emerging, yet ever more prominent marketplace for telecoms, technology, and telecommunication services. The continent of Africa is one of opportunities, with an ever-growing entrepreneurial class and a middle class with increasing disposable income.

As an indication of our own belief in the economic future of the continent we opened in 2020 a new regional office located in Cameroon to help address our customer's needs in one of the world's fastest growing economic regions. This presence has been led by Kamal Mokrani, Global Vice President at Infinet Wireless, and this investment has already brought some promising results. Mr. Mokrani has responsibility for and supervises setting up technological programs and qualifications in the sub-Saharan region, while actively promoting the interests of Infinet Wireless and its brand.

Currently Infinet Wireless is progressing, at pace, with its strategic plans to benefit our customers and fulfill their business requirements. The company is fortunate in that our customers are well aware of the benefits and advantages in working with us and as a company we appreciate this commitment and confidence, especially as the world experiences the severe impact of the Covid-19 pandemic. Like many

enterprises worldwide Infinet Wireless has had to adapt and change to a new way of working. The pandemic has slowed down the speed at which we would be normally moving forward as a business, but we have risen with our employees to the challenges of the pandemic and the needs of the market.

As part of this adoption of new ways, Infinet Wireless moved forward and instigated its first virtual event, the IW Tech Day 2021 West Africa. In what was a successful event the company set out and significantly achieved the aims of introducing Infinet Wireless and showcasing its solutions to connectivity companies and professionals across the whole of sub-Saharan Africa.

We feel this event had a positive impact with our customers and prospective customers and stimulated an increased interest in what we do and the solutions we provide to the market.

We are pushing forward as a company in these continuing challenging times and our plan for next year is to continue to grow Infinet Wireless's presence in other regions of the continent.

We see the challenges ahead, and in relation to moving into new regions we see how some regions have more of a tendency to having a bond with the Middle Eastern market, but this is a market that Infinet Wireless already has a history with. As a company we feel a level of excitement, although well aware of the challenges we face, in dealing with this expanding area and we are confident that as a company, working positively with our employees, partners and customers we will rise to the challenges ahead and become a stronger company in the future to service our customers' requirements. ■



Justin Farnell,
founder, WiFiontheMove

WiFiontheMove has been offering a fully managed, cloud-based WiFi solution to market leading (bus, coach and train) transport companies across Southern Africa for over 3 years.

My anchor client is Irizar, the Spanish maker of luxury class coaches. Irizar have a regional headquarters and transport depot located in Centurion, Gauteng. Whenever they supply a customer with one of their i6s 60-seater luxury coaches, I then go on to supply a fully configured Teltonika router, which is enabled with Global Positioning System (GPS) tracking, a custom branded captive portal on the Linkyfi platform for Wi-Fi passenger analytics, and a hard capped daily LTE data allowance, to control usage costs.

The Teltonika also has the advantage of being a dual SIM router, this allows, when needed the ability to provide and support cross border connectivity too.

In the past twelve months. I have also

“Although Covid has caused many negative affects both socially and economically, because of lockdowns, it has re-emphasised one of life’s fundamental laws which is, one has to adapt to survive and those that do adapt, can and will prosper”

started connecting the Teltonika to a Poynting PUCK-5 antenna. It is a 5 in 1 (LTE MIMO x 2, dual WiFi and GPS) antenna which can significantly improve signal stability and throughput. This can be particularly important for optimising Long Term Evolution (LTE) on the move, and when a coach leaves the connectivity of the city. I have for the past 2 years also used Vodacom as they are a network that fulfils the needs of our system and product well for LTE coverage on the main highways in and around South Africa.

It goes without saying that reliability and quality of service is crucial for a positive passenger experience and is critical to delivering WiFiontheMove. We are receiving from our customers approval ratings between 80 and 90% based on information we gather via the Linkyfi feedback form when passengers log back into the onboard WiFi.

So, it is a complete end to end solution. There could be hundreds of WiFi routers installed on buses operating within South Africa, that are literally gathering dust across South Africa, as a consequence of not being supported and managed, resulting in a lost opportunity to monetise capabilities. This is the value proposition of WiFiontheMove. I’m not just shifting tin.

Two reasons: firstly, as a consequence of a trip I was taking to see family back in the United Kingdom, I decided to use the National Express coach service going from the capital city, London to a major city in the north of the country, Leeds. I was excited to discover that Wi-Fi was advertised onboard. Unfortunately, on this occasion, what was my first experience, as a customer, of onboard Wi-Fi turned out to be very disappointing. I couldn’t connect! But on the return trip,

my customer experience was better as I was able to browse and message on WhatsApp to my then future wife Phiwe back home in South Africa. She asked where I was (because my LTE roaming was disabled to save money) and when I said I was on the coach using Wi-Fi she replied "Wow!"

That is the point in time when WiFiontheMove was born because I realised that what many take for granted in developed countries such as the UK, is still a novelty in a developing country such as South Africa.

Which leads me on to the second reason for founding the business. I made contact with all of the major coach operators and found there was little or no Wi-Fi being offered to passengers on coach and bus services across South Africa.

Well, I'd be lying if I said it's been anything other than horrendous for the passenger transport industry in general. International travel restrictions due to the Covid pandemic have particularly hit the tourism sector in South Africa - Greyhound was forced to close after 37 years of service. Inter provincial travel bans and social distancing restrictions on coach and bus capacity have also hit the long haul and city commuter buses.

WiFiontheMove was pre pandemic in a

"Yes, business is picking up! I've just had my best month in two years, with Irizar starting to place orders again, primarily with Zambian and Zimbabwean customers."

position to commence trials on Gautrain Buses and with a host of other operators, but the lockdown has put paid to all of that.

To be blunt, I am thankful to be staying in business, fortunately, I am a service orientated company and my cost base is low, as I work with partners rather than employing my own staff directly. To make ends meet, I also took on a digital consultancy contract to see me through.

Yes, business is picking up! I've just had my best month in two years, with Irizar starting to place orders again, primarily with Zambian and Zimbabwean customers. South Africa is going to take longer but I am now seeing the commuter market waking up, with Municipalities putting out tenders for enabling Wi-Fi on their Metro buses. ■

Looking ahead: I am bullish in my outlook for 2022. There has been, in my view, a noticeable positive shift in business sentiment, combined with a distinct pick up in business procurement activity. People are also starting to travel again as travel restrictions both locally and nationally are being removed, this obviously helps a great deal.

Although Covid has caused many negative affects both socially and economically, because of lockdowns, it has re-emphasised one of life's

fundamental laws which is, one has to adapt to survive and those that do adapt, can and will prosper.

For WiFiontheMove I see a huge potential for growth in emergent markets such as southern Africa, because just as these days you wouldn't buy a car, if it didn't come with Bluetooth as a standard, so are coach and bus travelling passengers coming to expect WiFiontheMove as a standard, as part of their travel experience, not just as a nice to have.



Lux Maharaj,
director of sales, Africa, Parallel
Wireless

With the worldwide impact of the Covid-19 pandemic it has been very difficult to meet customers and stakeholders from across the globe in person, as safety and health for everyone is our top priority. People want and need to stay connected for social and economic wellbeing. Our Parallel Wireless vision is to reimagine wireless networks, so all people are connected whenever, wherever, and however they choose. Our mission is to deliver innovative products that unlock value and disrupt the economics of wireless networks through intelligence and openness. Our customer's success is our success, as we have a Customer First mindset.

During the pandemic Parallel Wireless sales team members, project management, engineers and other customer support staff continued to develop strong relationships with our Mobile Network Operator (MNO) customers from across the globe by utilizing MS Teams video and audio and other platforms to continue the dialog and strengthen relationships. We were able to

“The federal government of Nigeria is committed to facilitating the achievement of its’ national policy goals for universal service and access to information and communications in Nigeria”

activate networks remotely, without sending people there – showing the ease of deployment of Open RAN networks.

Our MNO customers are searching for wireless network providers who will be around for the long term and those who have significant market share in Open RAN. Operators want suppliers who have high powered solutions with features and KPI performance and ease of management which match those of legacy vendors. In addition, they want turnkey solutions which include hardware, software, and professional services. Wireless networks are more important than ever as voice and data communications are commonplace and often required due to the pandemic instead of in person communications. Advanced applications such as Internet of Things (IoT), autonomous driving, robotics, remote surgeries will all require robust, reliable, and secure wireless networks.

Despite the pandemic throughout 2020 and 2021, working closely with our sales teams, product management, engineering and other key stakeholders across the company we have clinched customer wins such as; Axiata Group, Millicom, Etisalat, Vodafone Ireland and IPT in Peru to name a few.

We have also won numerous contracts with major operators in the African continent. In subSaharan Africa,, according to the GSMA, a quarter of the population still live outside of mobile broadband coverage compared to 7% globally. The federal government of Nigeria is committed to facilitating the achievement of its’ national policy goals for universal service and access to information and communications in Nigeria. In December of 2020, Parallel Wireless and Hotspot Network Limited, a Network as a Service (NaaS) provider, announced plans to deliver on Nigeria’s connectivity vision, helping to build and expand wireless networks across Nigeria, providing next-generation digital services

to local communities.

In July of 2020, Parallel Wireless and Orange announced a partnership to deliver open, software-based, and virtualized Open RAN network architectures to deliver scalable 2G and 3G, broadband services in the Central African Republic (CAR). In Africa, Orange is implementing a program called IDEAL – Include Digital in Every African Life. This program aims to provide digital services to their customers who do not have any connectivity today. The Central African Republic is a digitally divided country with only 48% unique mobile connections and limited network infrastructure.

In April of 2020, Parallel Wireless and the Ghana Investment Fund for Electronic Communications (GIFEC) announced a partnership to provide All G, cloud-native, O-RAN compliant, Open RAN networks enabling telecommunications and Information and Communications Technology (ICT) to unserved, underserved, and deprived groups and communities in the country of Ghana. Africa is the most digitally divided continent with only 44% unique mobile users. Though

Ghana has one of the more competitive telecom markets in the region, there are approximately 1,020 communities without mobile signals.

During the Covid-19 pandemic there were and continue to be challenges in many areas of the world, however our employees have persevered utilizing digital tools and resources to their full extent to continue developing thorough leadership and strengthening communications with our valued customers. As examples of our successes during the Covid-19 pandemic we can include the creation of; Open RAN explainer videos, webinars, case studies, whitepapers, blogs, solution briefs, FAQs, over 45 plus OpEds in industry publications and educational materials such as the Open RAN e-book. In addition, we have developed an extensive social media following by creating the #OpenRANdailyfact on LinkedIn which has attracted a significant number of followers. And at the end of June 2021, we exhibited our leading edge All G, O-RAN compliant, Open RAN networks at MWC21 – Barcelona under strict Covid-19 precautions to protect the safety of those attending. ■

Looking ahead: We are extremely optimistic about the future of telecommunications especially wireless networks for 2022 and beyond. With Open RAN solutions which are cost effective and easy and efficient to deploy, rural and urban environments are quickly enabled with ALL G – 2G, 3G, 4G, and 5G connectivity. Parallel Wireless was recently named by Appledore research in their ‘Who’s winning in Open RAN report’ as the most deployed vendor with many O-RAN compliant, Open RAN successes over the last year with Mobile Network Operators from across the globe such as, Axiata Group, Millicom in Columbia, Etisalat in Afghanistan, Indosat Ooredoo in Indonesia, Hotspot in Nigeria, Orange in the Central African Republic (CAR) to name a few.

In Africa, according to the GSMA Mobile Economy Report 2021 there are 800 million people in the sub-Saharan Africa region still not connected to the mobile internet. However, most of the broadband growth in the African continent from 2021-2025 will happen in 4G. Open RAN networks will help to bring 4G connectivity and capacity to enable voice and data communications.

We are excited about the potential to connect the unconnected in Africa and around the world, providing leading edge services such as digital banking, e-learning, digital health, Internet of Things (IoT), Industry 4.0, autonomous driving, and so much more. The future is bright for telecommunications, bridging the digital divide and empowering economies across the globe.



Paul Fick,
managing director, Webb Industries

Over the last 18 months, dramatic changes due to Covid-19 occurred, business operations changed, and billions worked from home to create profit.

This shift in societal and industrial interaction prompted an increased need for high-quality, reliable, and fast connectivity. Investment followed to cope with the demand for services and commodities required by the new generation of remote workers.

Quality digital communication has never been in such demand. Service providers scrambled to deploy additional services and infrastructure; enablement of radio access networks (RAN), fibre optic services such as FTTH and FTTB, LTE WIFI routers and WIFI mesh networks.

If such services hadn't been available, the world and African economy would have taken a bigger hit.

At a software level, giant companies like Google, Microsoft, Apple, and Zoom pushed hard to improve the stability of their virtual meeting platforms. We all now have access to virtual meetings.

Webb Industries played a critical role in providing Mobile Network Operators with vital components and services during the pandemic. Webb provided everything from cables to Antennas to project services such as In-Building Solutions (IBS), active integrated Distributed Antenna Systems (iDAS) and Cellular Enhancement Systems.

One aspect still hampering the communications industry is the unavailability of the required spectrum to roll out additional

services and capacity. The Independent Communications Authority of South Africa (ICASA) and Mobile Network Operators (MNOs) routinely argue in the courts and expend money on fees. Meanwhile, South Africans are waiting for opportunities to expand their businesses. Without access to the RF spectrum, the country loses economic benefits.

Would it not be better to regulate how the Tier 1 providers share the spectrum usage under their control, thus making it possible for Tier 2 Innovators to use the network at a fair price? This way, more South Africans can innovate at the Tier 2 level.

Webb has consistently, over the years, been at the forefront of innovations in our market niche. Recent examples include designing and developing a surge and lightning protection device for telecoms power supply systems and the manufacturing and supply of tinned copper cable to reduce outdoor cable theft.

The African continent has the highest lightning incidence in the world. Webb provides World Class Surge Protection Device components from our partner agent Dehn Africa. Webb deploys these SPDs into a range of Webb designed DC Distribution Panels, especially for the RAN Telecommunications Industries.

We expect the superpowers to start flexing their muscles to get their territories operating and growing again. African countries may feel left behind as countries in the Northern hemisphere are in flux and attempting to overcome the Covid recovery delay.

This short- to medium-term supply chain gap will impact Africa's power and communication needs. Hazardous cargo, which includes all types of batteries, is likewise subject to severe restrictions by shipping companies.

Perhaps this is a good time for Africa to become more protective of its raw

minerals. We should better negotiate the supply-demand balance.

How will 5G be used? The most general applications will be in Critical Communications, Large scale IoT, and enhancing current smartphone innovation and applications.

Critical Communications: 5G will enable rapid traffic control, intelligent vehicles, remote medical operations and critical security reaction components.

Large Scale IoT: white goods will have the ability to self-report status to manufacturers and owners, controlling and monitoring items at home and in business, monitoring frail relatives or patients, and monitoring security status at home and on company premises.

Just like all its predecessors (2G, 2.5G, 3G, and 4G), 5G will stimulate innovation beyond our current imagination. To recall history:

after GSM, we had 2G, and quickly 2.5G followed by 3G and 4G. Back in the 2G/2.5G era, “smartphones” were not all that smart, but hardware and software Innovators were all saying, “give me more bandwidth and data speed and watch this space!”

Sure enough, 3G did the trick, bandwidth and speed as never before were seen on Radio Access Networks (RAN), but what will we do with all this capacity? Well, big and small Innovators came from every direction, and smartphones suddenly had a “name”. Then the software Innovators, from Operating Systems (OS) to every possible application the human mind could conceive. The demand was so high that RAN manufacturers and MNOs now had to play catch-up with the Innovators. 4G and aggregation of frequencies was the answer, but not for long. ■

Looking ahead: The Innovators are hungry for more, so now it’s 5G. Already, there is talk of 6G. Sadly, in SA, we still have to drive 5G to its maximum! So let the “Big RF Carriers” do what they do best to enable the Innovators to drive the economy! Please, ICASA?

The promises of 5G capabilities are monumental and yet not an easy task for Mobile Operators to implement. For one, the capital investment required is massive, and two, will consumers or businesses be willing to pay more? That remains to be seen!

What are the benefits?

- Next-level connectivity,
- Up to 20 times faster mobile speeds than the current 4G network,
- Better exchange of information,

- Longer battery life of mobile devices,
- Low latency in communication and
- Connecting a vast number of different devices simultaneously.

Still, the question remains: is 5G an immediate requirement?

A study done by PWC confirmed that only a third of consumers are willing to pay more for 5G, even with higher data speeds. Most consumers are not in a hurry to get the new technology if it requires purchasing a new mobile device. Only 26% said they would rush out to buy a new device if they were not yet eligible for an upgrade.

Will 5G take off in our country? Will South Africa have 11 million subscribers by 2025, or how far away are we from mass adoption?

We are living in exciting times indeed!



Ted de Boer,
regional sales director for southern
Africa, Siklu

The 2021, sub-Sahara Spectrum Management Conference (SSMC), covered developments in millimeter wave (mmWave) frequencies and implementations helping to close African digital divide.

ITU's WRC-19 meeting, identified spectrum for IMT in mmWave bands resulting in potential mmWave-based applications, covering private and public networks, taking shape worldwide. In Africa, most countries across sub-Sahara haven't started to explore these frequency options, except South Africa, which was in first 'wave' of countries launching commercial 5G mmWave networks.

It's important to distinguish 5G "NR" (New Radio) and 5G fixed wireless access (FWA) services, such as those represented by Terragraph ecosystem (within 60 GHz V-band) and other applications operating in 70/80 GHz bands (E-band).

In Africa, 2021 marked exploration of topics such as mmWave 5G spectrum licensing, network deployment, specific 5G use cases for mmWave frequencies and resulting socio-economic benefits. 2021 also saw progress in real mmWave network deployments in terms of Terragraph trials and backhaul deployments for private network services.

Nigeria for example. Delta State University (known as DELSU), in Abraka city, started with one campus at Abraka and one at Anwai, Asaba. It expanded in 1995 at Oleh. DELSU operates multi-campus systems serving 22,000 students (2019/2020 roll). Having 22,000 students and growing catalogue of courses, programs and distance learning initiatives, DELSU needed to boost its networking bandwidth available to students and staff.

To improve learning environments and productivity, implementation of 802.11ac Wi-Fi networks across campuses, featuring multiple access points

occurred. Intercampus backhaul links were required, topologically connecting locations "A and B" 1.2 km apart and B to C 2 km apart. Given numerous access points and backhaul traffic, only Gigabit-level solutions would suffice. Complicating matters, in terms of provision of bandwidth, campuses had no fiber PoP, nearest being 5 km away.

Nigeria has a history of wireless network development, particularly 5 GHz band and the campus locations proved no exception. DELSU's installer surveyed the area determining interference and noise levels, limiting capacity of another 5 GHz DELSU network.

Addressing the interference problem, provider and DELSU decided to move higher in the frequency spectrum to wide-open E-band (70/80 GHz), allowing 10 GHz availability and virtually zero interference.

Compared to provisioning fiber for DELSU's requirements, involving prohibitive costs and time, the installer needed three days to establish three Full Duplex links carrying a combined 1 Gigabit traffic linking all campuses. They serve as backbone for enhanced network, integrating hundreds of Wi-Fi access points and point-to-multipoint radios deployed for intra-campus connectivity.

Like E-band, V-band has available spectrum and the Terragraph system proves it can offer fiber-like connectivity speeds cheaper than fiber. Numerous trials are underway in Africa, that prove benefits as envisioned years ago when Facebook started the Terragraph project.

Terragraph doesn't bridge rural digital divides, given propagation range is typically 300m, but the majority African population live in urban and sub-urban areas, it shows tremendous promise providing Gigabit-speed alternative to mobile phones for Internet connectivity.

The nature of 60 GHz signals and use in Terragraph equipment means band won't be saturated and little real interference. With 14 GHz available spectrum worldwide, service providers can use it without interference.

Further, concept behind Terragraph is mesh topology. For mesh networks in urban digital divide environments, or anywhere in city or suburb, 300m is adequate range. Suburban areas, typically single-family homes are well within 300m of each other. In cities, the technology is deployable on street furniture, with links less than 300m.

A mesh network with limited propagation means higher frequency reuse and in a mesh environment is a critical factor. Previously, mesh networks operating 5 GHz band reputationally were “RF polluters” due to a technique known as “listen before talk.” Resulting in operators having many devices trying to talk at the same time, creating interference.

With Terragraph, Project OEMs made changes that increase capacity, making mesh products fundamentally different from past ones. For instance, Terragraph uses time-division multiple access (TDMA) technology, each device taking its turn to talk. Process unfolds cleanly, nobody stepping on top of each other from a device access perspective. Combined with capacity from 60 GHz band, the scheduled access Terragraph provides with TDMA means operators have mesh networks providing high quality of service.

Another Terragraph advantage is deployment speed. Deploying wireless network versus wired one saves time, especially when wireless network offers same Gigabit speeds as fiber, it becomes a game changer. Terragraph time advantage increased by beam steering technique.

Urban mesh networks with thousands of nodes becomes prohibitive to manually design each node location. Beam steering solves issue as it’s fundamental to the concept of “auto-connecting” devices. Providing each is within sight of the other, devices will locate and connect.

This feature and software dynamically monitor thousands of nodes for RF health, automatically rerouting connections around obstructions or link outages, making Terragraph installation easy. Network installation doesn’t require an experienced RF installer but similar skills to home satellite dish installation, “out of the box” simplicity, means end users can fix terminal unit to wall, plug in, it automatically scans area, locating next node in network and connecting while network provides access permissions.

Having multiple OEMs participating in Terragraph ecosystem, 2022 should see significant Africa Terragraph network growth. ■

Looking ahead: What’s happening or expected to happen next year in South Africa may serve as a useful illustration for Africa.

Discussed SSMC, many Africa Terragraph trials are in the works, while in South Africa, plans are underway with 100% black-owned ISPs establishing “proof of concept” networks. This government initiative called B-BBEE, broad-based black economic empowerment, provides preference to companies wholly black- and female-owned, or a combination. These efforts seek to prove Terragraph viability in delivering low-cost Internet to areas with significant populations lacking connectivity, thus bridging long existing digital divides, while providing and publicizing projects on social media platforms, via hashtag #mmwaveforthemasses.

An emerging trend concerns a new technique to

expand reach of high-capacity, multi-Gigabit mmWave links. As above, the E-band (70/80 GHz) frequencies are becoming more popular and now it’s possible to combine those radios with those operating in microwave bands to creating dual-radio systems that effectively creates multi-gigabit connections up to 10km plus in length, fiber-equivalent reliability of 99.999%, even in bad weather.

Establishment of mmWave networks will be buttressed by regulatory activities, as multiple filings (e.g., on 60 GHz for point-to-multipoint networks) are submitted to Independent Communications Authority of South Africa as part of the 2021 Draft National Radio Frequency Spectrum Plan, for submission to the Minister of Communications and Digital Technologies for final review and approval in 2022.



Mark Goosen,
sales director sub-Saharan Africa,
Cambium Networks

The world's reliance on digital technology is increasing, particularly in relation to access to information and critical services such as education, banking and healthcare. Research from The Borgen Project, March 2021 cites approximately 80% sub-Saharan Africa's population don't have basic internet access connection, highlighting the Africa digital divide. Working towards closing the gap, the African Union, supported by World Bank Group, set a goal of connecting all individuals, business, and governments to wireless access by 2030. Africa has been faced with a lack of spending on infrastructure which is needed for network access, leading to gaps in coverage across the region.

Cambium Networks has been able to work alongside and support regional internet service providers to deploy technologies needed for more accessible and reliable connectivity. Facilitated through local partnerships, such as with local wireless provider Tizeti Network Ltd. to improve connection in Nigeria and expanding to Ghana and with First Direct to improve connectivity for small and medium enterprise locations and governments.

We worked with Facebook to develop a 60 GHz fixed wireless solution to expand access to affordable and multi-gigabit broadband. This was done through leveraging Facebook's Terragraph meshing technology to provide fibre-like connectivity, at a lower cost to more people faster, without the need to trench new infrastructure. In doing so, mobile and

satellite operators, and internet service providers are supported to build, grow, manage, and operate their Wi-Fi networks and services. The aim is to provide a wider area with broadband, connecting businesses and residents in urban and rural environments. Focus has been placed on providing wireless connectivity in a sustainable and scalable way.

Subsequently, Cambium Networks partnered with Tizeti Network Ltd. to deploy and accelerate the use of Express Wi-Fi within Africa. This has been used to expand and increase connectivity in public areas, within the education sector, and for small and medium enterprises. By leveraging Cambium's fixed wireless access technology, Tizeti has been able to connect 2 million users in Nigeria with Express Wi-Fi. Previously, approximately, 200 million people had poor broadband access. Yet, this partnership has provided over 70,000 GB of speed per day to subscribers in Nigeria. Due to its successes, Cambium Networks and Tizeti expanded their wireless solutions to Ghana, resulting in wireless access becoming increasingly available to more people in West Africa.

This is possible through fixed wireless applications where Tizeti owns and operates over 100 towers across Nigeria and Ghana. These wireless deployments are being run on solar power, which means costs associated with installation and maintenance of necessary equipment is reduced. The reduced operating costs help address the issue of affordability, which prevents many across Africa from being able to benefit from broadband access. Tizeti is passing these benefits onto consumers via lower prices, allowing more people a means to access wireless connections.

Despite low levels of investment in wireless infrastructure, and challenging conditions, Tizeti has been able to deploy resilient networks throughout Nigeria and Ghana. This is because, without the requirement to install generators and underground cables, the fixed wireless solution has been far cheaper to deploy. Furthermore, fixed wireless solution used has been found to provide a more reliable and efficient connection than 2G, 3G and 4G.

These connectivity increases are crucial when bridging the gap between access in various parts of Africa. Even so, this new technology is affordable and can be resilient without any pre-built infrastructure, meaning more communities will have an improved wireless connection with better reliability at lower cost to customers. Tizeti has also passed these cost savings onto their customers, allowing more people to be able to afford this wireless access.

Cambium Networks also played a role in assisting the deployment of improved wireless connectivity with purpose-built networks in enterprise spaces. With more enterprises and government agencies in Africa choosing fixed wireless and Wi-Fi technologies to deliver improved broadband speeds and, for some of them, even connect

some to the internet for the first time.

First Direct is a value-added IT distributor focused on small and medium enterprises and is a distribution partner of Cambium Networks in South Africa. Additionally, these solutions have been delivered throughout several countries in Africa, including Angola, Botswana, Union of Comoros, Democratic Republic of Congo (DRC), Eswatini, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, Tanzania, Zambia, and Zimbabwe.

This relationship has helped improve wireless and Wi-Fi connectivity for small and medium enterprises, industrial locations, and governments in urban, suburban, and rural environments. Cambium Networks and First Direct have been able to increase the availability of connectivity without the time consuming and expensive process of building new infrastructure or placing cables underground in challenging environments.

We worked with service provider Tizeti and channel partner First Direct to continue to improve network infrastructure and give more people a stake in digital opportunities. The need for wireless connectivity will always continue to grow as it becomes more and more necessary for life. ■

Looking ahead: As the continent continues to develop, wireless needs and connectivity will become even more important and should continue to be improved for more people to benefit. With unpredictable changes, wireless and Wi-Fi should be resilient to continue to support those in all parts of Africa. The pandemic has shown just how important an internet connection is. As such, the demand for these technologies is there but has not been met yet. Next year and beyond, through our partnerships, wireless technologies will continue to be developed with access becoming reliable and

secure at a cheaper cost.

As wireless access could become easier to access and more readily available, an increased number of devices will be connected to these networks. Therefore, rises in mobile needs will be the push for an expansion of wireless access. Currently, 2G, 3G and 4G networks have been rolled out around Africa, but the future may see a widespread 5G rollout, with more spending on wireless infrastructure. This could also lead to more hotspots around the continent which may be deployed by broadband providers or other external partners.

Mobile Mark Europe Ltd

8 Miras Business Park,
Keys Park Rd.
Hednesford, Staffs.
WS12 2FS, United Kingdom
enquiries@mobilemarkeurope.co.uk
www.mobilemark.com
Tel: (+44) 1543 459 555
Fax: (+44) 1543 459 545

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Rajant Corporation

200 Chesterfield Parkway,
Malvern, PA 19355
P: +1 484.595.0233
F: +1 484.595.0244
www.rajant.com

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26 Spartan Road, Kempton Park, 1619 | Tel: +2711 974-0006 | email: sales2@Stratosat.co.za

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www.cerillion.com
info@cerillion.com
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