chapter 8 Fixed Wireless Access

Paul Colmer,
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Bridging the digital divide with WiFi for South Africa's future

It's no secret that South Africa is one of the most unequal societies on Earth, certainly when it comes to internet access.

According to StatsSA, 89.6% of South African households don't have WiFi internet access at home. That means the same 89.6% of South Africans are charged 50 times more for mobile data than the privileged 10.4% who do have WiFi, the equivalent to paying R1500 for a cup of coffee.

That's purely because our infrastructure is skewed in favour of a handful of large operators, and thus they can charge poor communities an extortionist premium for their data compared to wealthy urban clientele. Also, because broadband WiFi infrastructure – the only viable alternative for affordable internet access – lags significantly behind, our future is perilously stuck in limbo.

Make no mistake, the digital divide is one of the biggest threats to our society today. Inequality stems from many different sources, but one of the surest ways to fight inequality is education. Based on the numbers in the 2030 Reading Panel Report, only an estimated 18% of grade four learners can read for meaning. At the same time, most schools in South Africa's underprivileged and rural areas lack any sort of connectivity, let alone internet access for learners.

Without internet access, how are we ever going to turn this systemic tide of inequality?

The mobile data conundrum

Ironically, the Cisco Visual Networking Index suggests that, if we normalise data usage per citizen, the average African uses the same amount of mobile data as the average European. However, looking closer at the numbers, it also tells us the average African has 1/20th the access to broadband internet data compared to his European counterpart.

Sadly, in South Africa, mobile data is the only perceived option for reliable data access,

and that's because, currently, it is. We simply don't have the installed base of fixed broadband wireless alternatives to challenge the mobile cabal, even though mobile customers in poorer communities, who can only afford to buy small rations of prepaid mobile data each month, are fleeced by the exorbitant cost of this data.

One of the key reasons for this lopsided distribution of data infrastructure is, quite simply, profit. The first 10 years of fibre to the home (FTTH) in South Africa saw deployments to the wealthiest 10% of homes, because the returns on investment were based around the potential revenue of a home.

However, if we switch the equation and focus on the potential revenue per hectare as opposed to household, a very different picture starts to emerge. Take two different communities for example: Westville in Ethekwini, and Kayamandi in Stellenbosch. Based on historical census data, Westville has an average annual household income of R230,700 while Kayamandi's average household income is merely R14,600.

The data also tells us the connectivity revenue potential per household is R460 for Westville, and only R30 for Kayamandi. However, the potential revenue per hectare is only R1,852 in Westville, compared to R3,141 in Kayamandi.

Why is this important, and how does it address the mobile (and subsequently FTTH) data conundrum? Because, across the country, there are over 9.3 million homes that fall into an ISP revenue potential of greater than R1,000 per month per hectare. Moreover, of the 2.6 million homes that are in an ISP revenue potential area of more than R5,000 per month per hectare, 80% have household incomes of R10,000 a month or less.

These are the homes – and schools – that have historically been neglected by the fibre and fixed wireless providers, and this is where things can and must change for us to turn the ship of inequality around.

Bridging the gap

We've been working with Wireless Internet Service Providers (WISPs) and other stakeholders like Project Isizwe, a non-profit organisation that partners with funders and ISPs, to find effective solutions to the data access crisis in rural and underprivileged areas.

However, if we're going to succeed, the most critical requirement is commercial viability, especially for commercial operators like WISPs. But identifying the sites where revenue per hectare makes infrastructure deployment commercially viable is just the start. Project Isizwe, for instance, has already developed a connectivity revenue potential per hectare map of South Africa based on 2011 and 2022 census data.

The next, more difficult step, is to give WISPs the tools and know-how they need to make it work. Interestingly, that's where schools come in, again. I already mentioned how important internet connectivity is to ensuring schools have the resources they need to give learners a proper education, thus narrowing the digital divide.

As it happens, in many of the underprivileged areas we surveyed, schools are the centre of the community, providing among other things a convenient location for housing the critical network equipment needed to supply the community with fixed broadband services. We've shown that providing these communities with affordable WiFi services is not only commercially viable, but because WISPs can make use of school facilities to house the transmission equipment, they'd otherwise be paying operators thousands per month to host, the schools themselves can be subsidised for free internet access.

As such, together with Project Isizwe, we have

already started to empower WISPs to connect 20,000 schools with free wireless internet access by the end of 2024. While 20,000 sounds like a high number, remember that we have a national network of 200-plus WISPs, so the target is very achievable.

A wireless future

This is not pie in the sky talk, by the way. In 2021, a two-year, $1 million study by WAPA, Microsoft, Project Isizwe, Stadia Capital, Adaptrum, IDC, and the United States Trade Development Agency, demonstrated the commercial viability of using TV whitespace (TVWS) in South Africa to deliver broadband internet access to 13 million people living in 3.5 million rural dwellings via WiFi hotspots in just three of the country's nine provinces.

For context, TVWS is under-utilised bandwidth reserved for older TV signals that can now be repurposed for delivering internet services at low cost. The point here is that we have multiple connectivity technologies we need at our disposal to reach the communities we need to reach, and we also know exactly which communities we need to reach.

In the years we spent conducting the TVWS study, we also learned how to build the necessary networks, how to make data access uncapped, how to fine-tune the network hotspot model, and how to implement the token payment and voucherless systems and to make revenue collection seamless.

Now comes the next stage, taking those lessons learned, and moving forward, using all the means of transport in our purview to generate enough money to get all these schools connected. This is not just a social responsibility project, it's commercially viable, with a huge pre-existing market that we can tap into, a market that's been fleeced by the mobile operators for years.

So, my message to WISPs is this: join us. This is not the time to compete with each other, but rather to stand together and take the fight to the data bullies that currently hold the upper hand. We need to do this. It's not optional. Our future depends on it. ■

Erman Tanin,
head of FWA, market area Middle East and Africa, Ericsson

Current status of connectivity

What is the current status of the global digital divide? According to Ericsson's analysis (Ericsson Mobility Report, July 2023), it is anticipated that even by 2028, about 30% of households worldwide will still be missing broadband connectivity. Additionally, 3GPP technologies are forecast to provide extensive coverage to both individual subscribers and households. For instance, LTE is projected to reach over 95% of the global population and households, while 5G is expected to cover approximately 85% of the world's population by 2028. This huge potential for household coverage presents a great opportunity for communication service providers (CSPs) to offer fixed wireless access (FWA) services alongside their existing mobile broadband (MBB) offerings.

We anticipate that these numbers will be significantly lower in Africa, primarily because of its relatively limited broadband connectivity compared to other global regions. This raises a critical question: how can we effectively and

quickly provide connectivity to these households and businesses to bridge the digital divide? The solutions for home broadband can be categorized into three main segments: fixed-dedicated line solutions like fibre or DSL, satellite-based solutions, and finally fixed wireless access (FWA).

Different methods for household connectivity

The three main fixed broadband technologies are xDSL, cable, and fibre. xDSL and cable offer cost advantage with a relatively low investment requirement if existing copper or cable TV equipment is available. Fibre stands out for its exceptionally high speeds. However, both xDSL and cable are speed-restricted and distance-dependent with limited futureproofing. A further disadvantage of cable is that it lacks the capability to separate connectivity from services, which limits competition.

Fibre presents many obstacles, including very high upfront investments in civil engineering and ducting projects. Deployment challenges such as obtaining permits often result in slow time to market. According to Fierce Wireless, FWA providers can enter rural and urban markets at about one-tenth the cost of physical fibre deployment (Fierce Wireless, 2018).

Governments are driving connectivity and broadband rollouts through various programs and subsidies, recognizing the link between increased broadband penetration and economic growth (Ericsson and Imperial College London, 2017).

On the other hand, FWA offers clear advantages over fixed connectivity options. Time to market is a clear winner. FWA eliminates the need for cumbersome civil works. It also provides flexibility by using the same resources for both mobile and fixed broadband, improving economies of scale.

The adoption of 4G FWA represents an initial step in providing FWA services. As it transitions to 5G, it is anticipated to provide ultra-fast speeds comparable to fibre optics, enhancing the overall fixed broadband landscape. A

number of markets including Angola, South Africa, Nigeria, and Zimbabwe, have already started offering 5G FWA services. When looking at why FWA is favoured over fixed services in certain scenarios, we see the obvious advantages such as lower CAPEX, faster time to market, increased monetization opportunities, and greater flexibility.

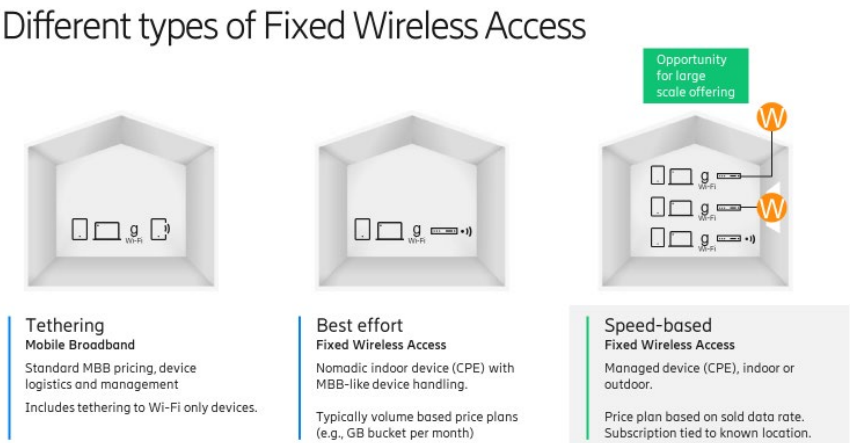
While fixed broadband services are limited to providing home connectivity, FWA can serve multiple use cases including mobile broadband and Internet of Things (IoT). This allows a single radio network infrastructure to support various use cases. Therefore, in a hypothetical scenario, 3GPP mobile resources can be used for MBB cases in case FWA adoption is limited.

Three types of FWA deployments

FWA mainly involves using 'wireless' access for the last mile of connectivity. While it sounds simple, there are three distinct deployment approaches for FWA: tethering; best-effort; and speed-tiered.

Tethering: in this approach, one or more mobile phones are used to establish communication with a household, including tethering to WiFi only devices. It operates under standard mobile operator pricing schemes, following standard retail, provisioning, and fault handling procedures.

Best-effort: in this approach, households acquire an indoor wireless router with wide-area wireless (such as 3GPP) capabilities for connectivity to and from the household. WiFi (or LAN cabling) is used within the house, between the router and other local devices. The device and subscription are nomadic, allowing the family to take and use the router anywhere, within the validity period of the subscription. The subscription reuses MBB paradigms, possibly with higher data allowances to cater to the whole household's needs. Device handling is also inherited from MBB, in terms of retail setup, provisioning, and fault management. It is like a mobile phone without a screen. Despite its nomadic nature, it resembles FWA from the household's perspective, and is labeled 'best-



effort' since it is a challenge to provide very high-grade guaranteed offerings when the customer premises equipment (CPE) is nomadic, and the subscription terms need to be valid everywhere.

Speed-based FWA: This is where we believe the industry needs to focus more. This approach focuses on provisioning households with a wide-area wireless-capable (such as 3GPP) device, such as an outdoor unit mounted on a roof or wall, or an indoor unit, either fully integrated like a standard router or with a more advanced antenna arrangement to improve performance. It follows the fixed broadband paradigm, enabling remote configuration and fault management from a customer service center over standard protocols. Pricing plans are specially designed for the service, emphasizing the sold data rate from fixed broadband offerings. In terms of pricing positioning, speed-based offerings typically have higher ARPU than best-effort offerings given the superior performance, with pricing levels similar to fixed broadband offerings. On top of it, service providers can use a mix of offerings with different price and speed tiers to target different segments.

Finally, the subscription agreements are typically location-specific, ensuring the service only works in the subscribed location. This is ensured either inherently through the fixed-mounted CPEs, or logically so that if the CPE is moved, the unit does not work, or the subscription is modified. Many service providers are already using this kind of location awareness for their subscribers, enabling a more surgical approach to delivering FWA services.

Last but not least, it is important to note that there are multiple levels of maturity for FWA deployments. The chart below shows how these different deployment options are adapted in different markets based on their needs (Ericsson Mobility Report, July – 2023).

Can FWA help close the digital divide in Africa?

FWA offers significant advantages over fixed technologies, particularly in terms of flexibility and time to market. And we are already seeing these implementations.

A recent initiative between FREE Senegal and Ericsson aims to connect several schools in Senegal with FWA technology, along with providing laptops, learning content, and teacher training to support the development of the ecosystem.

The project will run as part of Ericsson's Connect to Learn program, a global education initiative to improve educational opportunities through technology. For many schools around the globe, especially those in remote areas, connecting to the internet, and accessing online education relies heavily on mobile networks.

Originally designed as a solution for homes and businesses, the trial demonstrates FWA's potential to close the digital divide between urban and rural areas. Using the existing mobile network infrastructure is a cost-effective and efficient solution to connect schools, promoting equitable access to education and information across Africa. Imagine the time and cost associated with providing connectivity to remote areas with fibre or DSL!

Summary

In summary, FWA has emerged as the second most prominent 5G use case, following mobile broadband. Leading service providers are actively expanding and capitalizing on the potential of 5G FWA, driven by three primary scale advantages:

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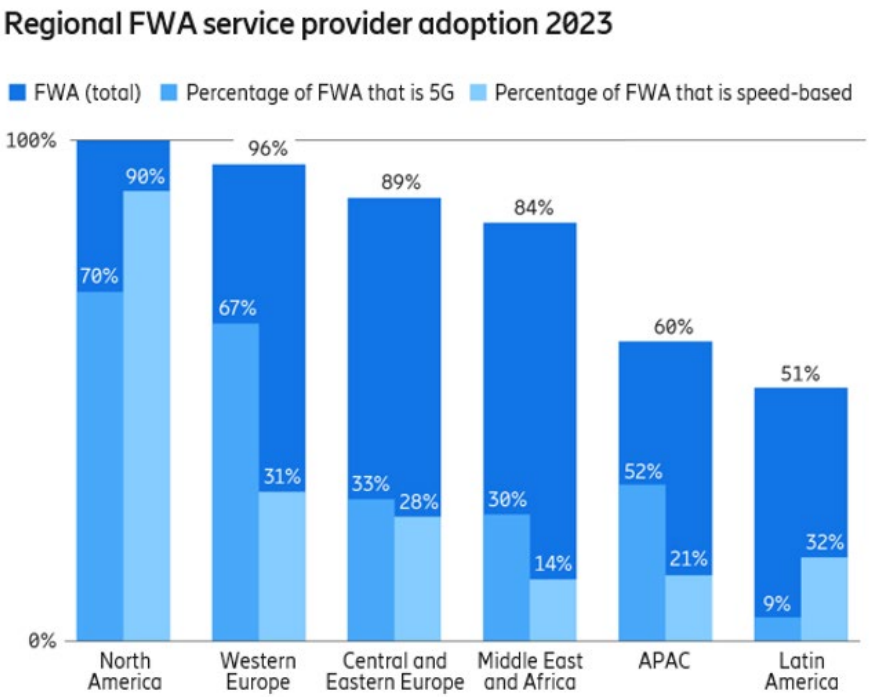


1. **Leveraging 5G's multi-use case network scale:** FWA enables CSPs to make shared investments, generating revenue from multiple use cases, which in the long run spreads risks and lowers initial upfront investments for new use cases.
2. **Harnessing the global 5G device ecosystem:** The scale of the global 5G device ecosystem is humungous, reaching 1 billion connections by 2022 (two years faster than the growth of 4G from the day of its launch). This rapid expansion enables the availability of affordable devices and a broad device ecosystem (Ericsson Mobility Report, July 2023).
3. **Leveraging the 3GPP innovation ecosystem:** 5G FWA attracts billions of dollars in R&D investment and a new spectrum, which contributes to the development of higher capacity and higher performance devices and networks.

To highlight a recent development, the 3GPP standard has extended the reach of millimeter wave technology, allowing for FWA connectivity at gigabit speeds over distances of up to 11km. FWA service providers are strategically positioned to address the connectivity needs of over a billion locations currently lacking access to high-speed and reliable broadband.

This positions FWA as a critical enabling technology in narrowing the digital divide and empowering both consumers and businesses across the entire African continent. ■

FIXED WIRELESS ACCESS: INTRODUCTION

Dobek Pater, Hloni Mokenela, Pieter Grootes, Ritu Sarmah, and Roald Kvevli – Africa Analysis

The need for 'meaningful connectivity'

Broadband connectivity is becoming increasingly important as a means of socioeconomic advancement. Several studies illustrated a positive relationship between broadband connectivity and higher GDP growth rates. COVID-19 related restrictions expedited the trend of increasing reliance on broadband for social and economic activities, including across Africa.

The minimum specification of broadband is often insufficient for an individual to be a full participant in society, even in Africa. Thus, the concept of 'meaningful connectivity' has been developed to identify the minimum requirements a good quality broadband service needs to meet to allow households/individuals not to be digitally marginalised.

The World Economic Forum (WEF) differentiates between two types of broadband connectivity:

- Internet to enrich day-to-day life requiring 2-3Mbps download, 512Kbps upload, and 500Mb monthly use
- Internet as a vital part of most activities requiring 25Mbps download, 10Mbps upload, and 50Gb monthly use

While the Alliance for Affordable Internet (A4AI) provides four components to define 'meaningful connectivity:'

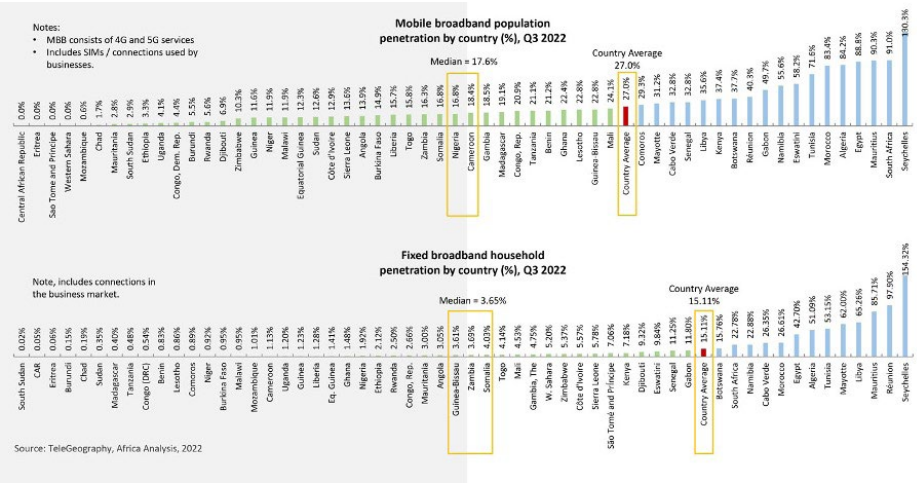
- The right speed: users need sufficient speeds to access multimedia and other applications
- An adequate device: users must be able to both produce and consume content online
- Enough data: lack of data should not stand in the way of individuals fully using internet-based applications
- Frequent connection: if users can only connect to the internet every so often, it is less likely to be a meaningful tool

Broadband growth in Africa

In Africa, most of the continent's adult population uses mobile technologies to access the internet. However, true broadband quality connectivity on mobile networks is still quite limited in its availability. It is also often considerably more expensive than fixed connectivity on a per-Gb basis. This results in constrained use, especially in sub-Saharan Africa (SSA).

Historically, fixed connectivity has been used predominantly by businesses, government and other (non-residential) organisations. This has begun to change with extensive deployment of FTTH in some countries (e.g., South Africa) and the use of various fixed wireless access (FWA) technologies.

Despite many countries in Africa liberalising their telecommunications markets and developing broadband policies to expedite the



deployment of broadband infrastructure and adoption of broadband services, progress to date has been slow.

Countries with the highest levels of broadband penetration are mainly the North African countries and some of the small island states. Fixed broadband penetration remains at very low levels in most SSA countries. Moreover, broadband penetration, particularly fixed broadband, is skewed in favour of households and individuals with higher income levels and those in the urban areas where the broadband infrastructure footprint is higher. The gap between urban and rural use of the internet in Africa is more than threefold – the highest disparity among all regions globally.

Africa significantly lags other regions globally in internet usage. Within the continent, there are stark differences between more advanced countries and those that are part of the Least Developed Countries (LDC) group. Only 12% of the population has access to meaningful broadband (and only 6% in SSA). DSL is the main fixed wired connection technology, but mainly in North Africa. This is a legacy technology and in decline across practically all markets. It is being replaced by fibre and FWA technologies, mainly fixed 4G/LTE. Thus far, fixed 5G is available only in several countries and to a limited extent.

Many countries have formulated broadband policies and developed roadmaps to achieve wider broadband connectivity across all socio-economic segments. Examples of connectivity targets are provided below. However, many are already outdated in terms of timelines and required connectivity speeds.

FWA evolution

FWA technologies are gaining momentum due to their ease of deployment and ability to function where fibre or other connectivity solutions are not feasible. In Africa, FWA is seeing strong uptake due to expanding wireless network coverage, a growing range of services and tariffs, lower service prices relative to fibre services, and ease of adoption.

The initial FWA internet connectivity

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The digital divide in Africa is a complex issue that has been attributed to the lack of access to affordable and reliable Internet connectivity, inadequate infrastructure, and limited digital literacy. To bridge this gap, a mix of different technologies can be used. Leveraging unused TV channels , TV White Space (TVWS) technology can assist in optimizing the available wireless spectrum to reach the underserved communities.

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Kenya

The National Broadband Strategy 2018-2023

Timeline	Consumers	Schools
Medium term	90% at 3Mbps 50% at 100Mbps	100% at 10Mbps 80% at 100Mbps
Long term	100% at 10Mbps 80% at 100Mbps	100% at 1Gbps

Nigeria

National Broadband Plan (NBP) (2020-2025)

Timeline	Consumers	Schools
Medium term	70% at 5Mbps for rural 70% at 15Mbps for urban	Fibre connectivity to 70% tertiary, 30% secondary and 15% primary schools
Long term	90% at 10 Mbps for rural 90% at 25Mbps for urban	Fibre connectivity to 100% tertiary, 50% secondary and 25% primary schools

South Africa

SA Connect Broadband Policy (2013-2030)

Timeline	Consumers	Schools
Medium term	90% at 5Mbps 50% at 100Mbps	100% at 10Mbps 80% at 100Mbps
Long term	100% at 10Mbps 80% at 100Mbps	100% at 1Gbps

Ghana

National Broadband Strategy 2012

Timeline	Consumers
Medium Term	• 2Mbps speed for heavy users • Speed of over 2Mbps for communities, groups etc. • 1Mbps speed for domestic users

was delivered using WCDMA (3G) and WiMAX technologies. Newer generations of wireless technologies, such as 4G/LTE, have improved FWA and expanded coverage, driven by mobile networks.

Advancements in 5G network technologies have significantly improved the download, upload, and latency capabilities of FWA services. Some of the new FWA technologies can deliver performance similar to that of fibre and cable. Fixed 5G can offer 10x to 100x more capacity than 4G, allowing for increasingly higher and potentially symmetrical download and upload speeds. It also provides lower latencies (under 10ms) which is critical to many emerging 5G use cases.

FWA relies to a large extent on the mid-band spectrum to provide broadband services. Enhanced Mobile Broadband (eMBB) services are the most common and most extensive initial use case when operators launch 5G networks.

The use of mid-band spectrum (1.6GHz to 7.125GHz) for 4G and 5G services is becoming increasingly popular, as it provides a very good combination of network coverage and capacity for these technologies.

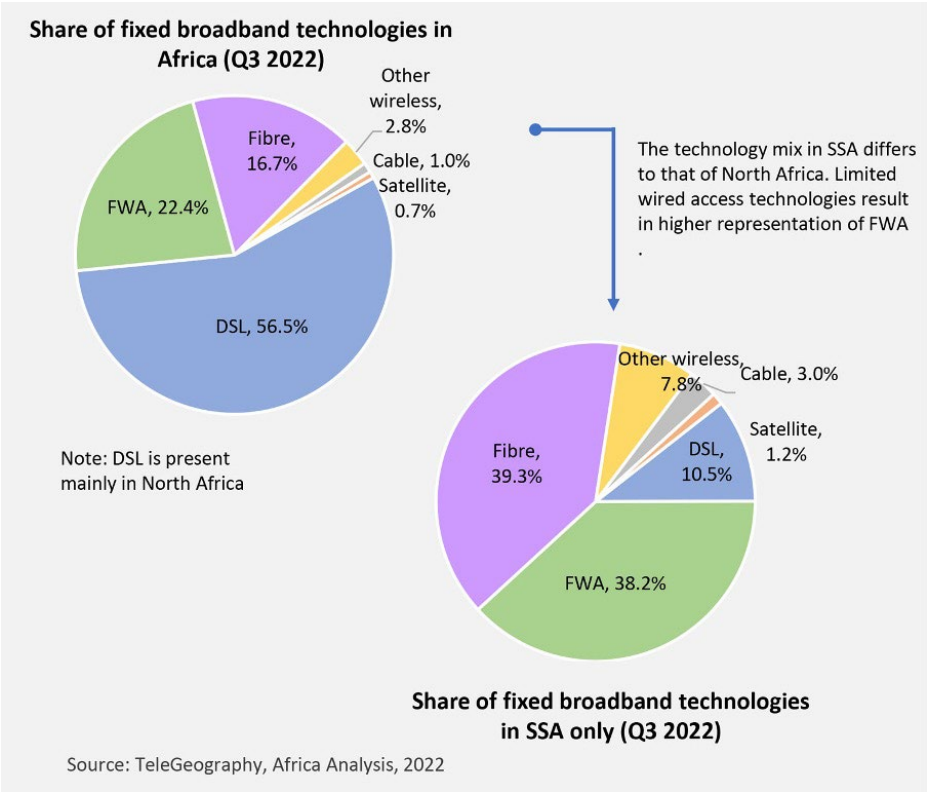
The 6GHz band will become more important for 5G deployments in the future. As the demand for bandwidth in both

4G and 5G networks increases, national telecommunications regulatory authorities around the world have been working on making more spectrum available for the provision of services. Spectrum that is under-utilised for the provision of mobile broadband services – particularly in peri-urban and rural areas – can be used for FWA services.

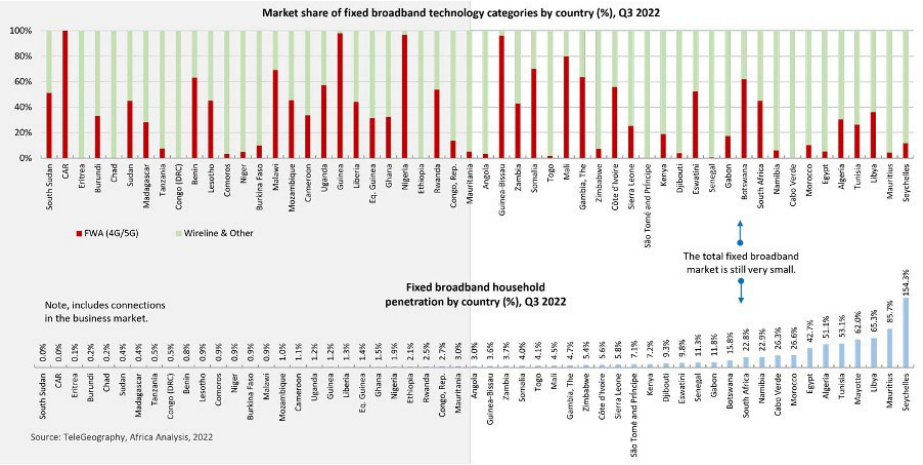
FWA adoption in Africa

In Africa, FWA technologies are seeing increasing deployment and service uptake due to quicker and less costly network build than wired technologies. Deployment capex and operator pricing strategies make the provision of FTTx services unfeasible in many areas, while satellite broadband services remain expensive.

The resultant expanding wireless coverage and a growing choice of services and tariffs is resulting in a stronger uptake of FWA services, particularly in SSA. As of September 2022, there were 7.07 million FWA connections in Africa; 58% of these in SSA. FWA connectivity represented over 22% of all fixed broadband connections on the continent and over 38% in SSA. In 2021, 58% of the SSA population lived in rural areas, where FWA can be deployed faster, with more comprehensive coverage, and with lower total cost of ownership (TCO) than wireline solutions.



Source: TeleGeography, Africa Analysis, 2022



Fixed 4G, and more recently fixed 5G in some countries, are being used by operators for the deployment of FWA to compete with and complement wireline technologies. By the fourth quarter of 2022, almost all countries in Africa had 4G networks and 13 countries and territories had begun to offer commercial 5G services - all of them in SSA. Operators in ten other countries were piloting 5G networks and preparing to launch commercial operations.

Apart from the small island states/territories, 5G infrastructure is still extremely limited. Even 4G networks have been deployed to date mainly in the urban environment. The opportunity for the build-out of 4G infrastructure remains high, while 5G network build-outs are only in their early deployment phase (in the countries where they do exist).

African deployments

Currently, mid-band spectrum is mainly used to provide FWA services in Africa. Operators require enough spectrum to provide good quality fixed 4G and 5G services, ranging from contiguous 20MHz to tens of MHz spectrum frequencies. Several IMT spectrum bands are useful for the provision of FWA services, which normally include the 2.6GHz and the 3.5GHz bands. To be useful, spectrum bands need to be part of the broadband ecosystem, including critically the availability of requisite and affordable CPEs (e.g. WiFi routers).

When deploying FWA, operators usually follow a 'push' strategy, building out FWA infrastructure and making services available in areas where there is an expectation that such services are required. Geographic areas are identified mainly based on population density and sometimes also on the existing use of mobile broadband services. FWA products are sold predominantly on data volumes, although they are differentiated on speed in terms of marketing. Some operators sell fixed 4G products on data volumes, but fixed 5G on speed.

Access to requisite spectrum and efficient use of the spectrum are one of the main challenges faced by operators. To mitigate

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this, some operators have been refarming spectrum, as well as acquiring new spectrum licences where possible. Spectrum sharing is one potential solution to more efficient use of available spectrum.

Affordability of CPEs and FWA services by consumers is another challenge. Operators are actively trying to source lower cost CPEs and offer a wide range of service options to suit various levels of affordability. Additionally, customer education is undertaken to drive awareness and demand for broadband services.

Key takeaways

Good quality broadband connectivity is becoming increasingly important as a means of socio-economic upliftment. As digitisation of societies progresses, quality broadband will be critical to avoid marginalisation.

The addressable market for fixed broadband connectivity in Africa is expected to increase from 56 million households in 2022 to 82 million in 2035. Fixed 4G and 5G connections in Africa are projected to grow from 4.3 in 2023 to 17.7 million in 2035, at a CAGR of 12.6% (the base case).

This growth depends on the availability of spectrum. Various forms of government intervention to support broadband adoption will result in higher broadband penetration among households. Such measures could increase the growth of Fixed 4G and 5G connections to over 21 million, or an additional 14% growth. The adoption of these connectivity services will likely be much higher if retail prices of CPE and services decline substantially over the long-term future from the current prices. Allocation of 6GHz spectrum frequencies to FWA is critical for available capacity expansion to continue providing high quality broadband services. The more spectrum is available, the better the broadband services. To this extent, it is critical for governments and regulatory authorities to make the requisite spectrum available to the FWA operators in sufficient quantities – the 2.3GHz, 2.6GHz, 3.5GHz, 6GHz and 26GHz spectrum bands. This will allow them to provide wider coverage on a nation-wide basis and operate their networks most efficiently.

However, several constraints currently limit growth, including the rate or urbanisation across different countries in Africa; household income levels vs. prices of good quality broadband services; and the rate of fixed broadband networks deployment.

Apart from making the spectrum available, governments and regulatory authorities can leverage various other intervention measures to expedite network deployment and drive broadband adoption, by reducing input costs for the network operators, including reduction or complete removal of import duties and excise taxes on imported network equipment; cutting the cost to deploy network infrastructure through infrastructure sharing regulations and the use of Universal Service funds to cover the high cost of backhaul network deployment; and enhancing demand for broadband services through the introduction of government demand-side incentives to make the adoption of broadband services more affordable. For example, introducing subsidies for monthly service subscription and/or data consumption, as well as CPE and/or connection activation, and incentivising the network operators to offer discounts on services provided to public institutions such as institutions of learning or to low-income households. ■

John Tenidis,
marketing director, wireless solutions portfolio, Intracom Telecom

Over the past year, our company has witnessed a period of restart and gradual return to normalcy following disruptions caused by the pandemic.

We've been supporting and maintaining networks and are now observing new investments in network expansion. Our portfolio includes supplying fixed wireless access (FWA) networks to ISPs and telcos, wireless transmission networks to mobile operators, control and management networks for electricity companies, as well as private networks for armed forces, police forces, and the mining industry. Our clients are proactively considering network capacity, scalability, and the growing demand for remote interaction in both business and private settings. These trends have positively impacted our booked business over the past year, and we anticipate continued growth in the future.

The continent faces significant challenges in the realm of ICT, including limited infrastructure, affordability issues, and the digital divide. The lack of network coverage, inadequate broadband infrastructure, and unreliable electricity supply hinder the expansion of ICT services. Affordability remains a major hurdle, with high data costs and limited access to affordable devices inhibiting widespread adoption. Moreover, the digital divide persists, with disparities in access to ICT services across urban and rural areas and among different socio-economic groups.

However, Africa also holds promising opportunities. The mobile revolution has created avenues for mobile-based services and innovative solutions tailored to the mobile-centric market. Initiatives aimed at improving internet connectivity offer prospects for enhanced access and higher speeds. Additionally, the continent has seen a surge in digital innovation and entrepreneurship, fostering economic growth, job creation, and localized solutions.

The ICT trends in Africa include mobile technology dominance, improving internet connectivity, growth of e-commerce and digital platforms, thriving digital innovation hubs and start-up ecosystems, adoption of artificial intelligence and data analytics, and efforts to promote digital skills development. The rural and sparsely populated areas have historically posed challenges to progress, creating a divide that needed to be bridged. Previously referred to as the digital divide, the advent of 5G technology has revealed that communication is as crucial to human life as water and energy. Therefore, ensuring equal access to communication is fundamental for the prosperity of communities. It is no longer acceptable for communication facilities to be prioritized for desk workers over farmers toiling in the fields. Africa faces a unique challenge stemming from its cultural and lifestyle diversity. Recognizing the potential brought by achieving equal access to communication is key.

The African telecom and ICT market differs from global markets due to infrastructure challenges, a mobile-centric focus, affordability concerns, rural connectivity needs, localization and adaptation requirements, and the emergence of innovative payment solutions. Africa faces significant obstacles in terms of limited network coverage, inadequate broadband infrastructure, and access to electricity. The market heavily relies on mobile technology, with mobile phones being the primary means of internet access. Affordability plays a crucial role,

leading to the provision of affordable options and data pricing considerations. Extending wireless connectivity to remote areas is a unique challenge due to the large rural population and geographical constraints. Localization and adaptation are necessary.

Despite Africa's wealth in natural resources, the second most populous continent struggles to achieve the living standards of other regions. The implementation of ultra-fast broadband technology holds promise for improving quality of life and increasing prosperity. The new 5G FWA technology can impact various areas such as the economy, politics, social dynamics, industry, academia, and professional life. To fully leverage its benefits, local skills must be developed to cater to specific regional needs.

South Africa, Kenya, Nigeria, Egypt, Ghana, and Libya are among the most vibrant countries in Africa. South Africa boasts an advanced telecom infrastructure with widespread coverage and high-speed broadband. Kenya is known for its leadership in mobile technology and digital innovation, while Nigeria has the largest telecom market in Africa, with significant investments in network expansion and digital transformation. Egypt has a well-established telecom infrastructure and serves as a regional hub for telecom operations. Ghana has made strides in expanding broadband connectivity and promoting digital services. In Libya, there is a fascinating initiative aimed at enhancing governmental services nationwide, leading to pivotal projects focused on modernizing operators FWA networks. These countries will continue leading the way; however, other African nations like Uganda, Morocco, Senegal, Ethiopia, Ivory Coast, etc. have also pockets of progress in their telecom development.

We have supplied one of the largest mines in sub-Saharan Africa with our WiBAS™ Point-to-MultiPoint (PtMP) Wireless Systems, and supply our technologies to one of the leading MNOs for the deployment of a network funded by government to connect officials, civic facilities, and civilian serving sites.

The problem with doing business in Africa is the fragmentation of the regulatory framework in so many countries, with different pace of progress. For example, in Nigeria the 26GHz band was allocated to 5G, in Ghana the same band is reserved for 5G and was taken away from FWA, and in South Africa the same frequency band is available for FWA without plans for 5G yet. To address this diversity of regulatory frameworks a broad portfolio of products is required, and an intensive plan of country-specific homologation is in place. We take into consideration this diversity and we adjust and expand our product portfolio accordingly to be able to satisfy customer demands as soon as they appear. The diversity of regulatory framework has a negative impact on keeping up business expansion at the same pace across the continent. ■

Looking ahead: We firmly believe in Africa's huge potential to invest in modernizing and expanding telecommunication infrastructures. The vastness of the land, the diversity of the populations and the magnitude of nations on the continent has no similar on our planet, yet with one distinct characteristic; the wide gap between those who have connection and those who do not.

We see a tremendous opportunity for our solutions enabling access communication networks, ones that provide real broadband and uncompromised quality to citizens, no matter where they are. Our industry has previously focused on improving connectivity on the move and neglected fixed locations. As opportunities arise, we are eager to participate in projects focused on implementing ultra-broadband wireless access.

Yisrael Nov,
VP global sales, Parallel Wireless

Parallel Wireless' presence in Africa started when we decided to address 'connecting the unconnected.' In the last few years, we have established a footprint in Africa for solutions including 2G, 3G, 4G and now 5G which meet the continent's special requirements such as support for transmission over satellite and equipment powered by standalone power sources (e.g. solar).

In this past year we have expanded our deployments with our existing customers by starting our journey to deploy urban solutions with our next generation ORAN-based technology. These solutions support multi-band, multi-layer, and multi-RAT networks.

Africa is characterized by a unique cultural, environmental, and commercial landscape. Due to the generally low ARPU, in comparison with other markets, operators have limited resources for investment in infrastructure, whether for maintenance or for upgrades. The sheer size and wild expanse also result in fewer access roads, which make physical installations trickier. On top of that, power supply is inconsistent and very expensive in proportion to the ARPU. This can hamper network rollout and forces us to use innovative approaches to ensure smooth, continuous operation.

Operators have fewer inhouse resources available for developing and upgrading the network, so 5G adoption is still sparse and even 4G is limited to densely populated areas. On average there is less familiarity with technical aspects, which makes it harder to communicate advanced concepts like ORAN and RAN Centralization. As a result, many operators develop a strong reliance on their vendors, which leads to little appetite for ORAN, though it could help them improve the cost-efficiency of their networks.

There is a growing realization that connectivity and broadband are not a luxury, but a necessity to enjoy the fruits of a global economy. The cost of satellite communication (multi-beam and LEO satellites) is decreasing and is therefore more accessible, improving the business case for connecting additional sites to a satellite backhaul.

5G will be a key technological driver in the next few years. Apart from the technological boom surrounding the deployment of the network itself, the increased broadband capacity, and the support for new capabilities (such as massive IoT deployments) that 5G brings will transform the African market. With true broadband access reaching so many new consumers and businesses, the whole region will be able to participate more actively in the global economy.

We're seeing new opportunities due to the rises in energy unit costs and cell-site power consumption, and a surge in interest in 5G, both the technological capabilities and in finding the right path to implementation. There is a global debate in terms of how best to roll out 5G. Operators are deliberating how far they can afford to go in the short term; embrace 5G completely with RAN and core network equipment (5G SA) or just purchase new 5G RAN equipment to give customers a partial 5G experience (5G NSA).

As a subset of this process, operators are showing a growing wariness about the power consumption of the network. The concerns are both for the ability to reliably supply all this power across the network and how they can afford to pay for it. That is why the demand

for power efficient solutions has ascended in priority. In countries where energy is relatively expensive, the ability to optimize 5G network power consumption is critical. We expect that the ability to deliver power savings will be a major factor in the selection of vendors.

We have also noticed more interest in the power of AI to impact the industry by making networks smarter, more reactive, and more efficient. The fact that mobile networks are relatively new in Africa may allow them to embrace smarter network components faster. ■

Looking ahead: We expect 2024 and 2025 to be exciting across the continent.

South Africa stands out as it is one of the most advanced countries when it comes to mobile networks. Due to the relatively high ARPU, we see more competition among mobile networks which leads to more pressure on each operator to innovate with better technology and better services.

Nigeria has a relatively dense population and is fortunate to enjoy a good supply of valuable natural resources. This means that even if the market can't bear a high ARPU, the operator has the financial capability to invest in the mobile network. And if that isn't motivation enough, the fact that there is a new entrant in the telecommunications space means that we will probably see a race to win over consumers.

The third country to watch out for is Ethiopia. While there is no expectation of high ARPU, the fact that there are two new entrants will keep competition fierce, for service, for coverage and for subscribers.

We are very active in East Africa, where we have worked closely with an operator who required a complete solution. They asked us to supply the full end-to-end solution, including RAN equipment, transmission, power, infrastructure, delivery, and deployment. We expect to see additional operators who will seek to deploy ORAN technology and will need similar assistance.

We are happy to say that we see more awareness on the part of the regulators of the challenges and difficulties that stand before MNOs as they attempt to provide consumers with good quality service. With everything that they are facing, there is growing appreciation of just how big an engineering feat it is to roll out and maintain a mobile telecom network. Regulators seem to grasp that they can also be part of the solution. Thanks to this, there is increasing evidence of network sharing between two or more operators, a practice that is aided, sometimes even made possible, by the regulator.

In parallel, there seems to be a much more proactive push by the regulators and governments to encourage rural service and coverage. Given the boost this can give to local communities, this is indeed great news. There is no doubt that giving everyone the right to access broadband is increasingly becoming a priority.

Next year we expect interest in ORAN to continue to strengthen as more and more MNOs realize that the best way for them to optimize their investments in mobile connectivity is to break their reliance on proprietary hardware. The ORAN ecosystem has grown and is now fully capable of providing MNOs with opportunities to upgrade their networks without being locked-in to a single vendor.

The dual challenges of adding capacity and reach to their networks will also lead operators to consider RAN Centralization. This will disrupt the industry and more operators in Africa will adopt Open RAN.

Danny Ben-Simhon,
regional sales director - ME and Africa, Siklu

Our years of experience in Africa have highlighted the inadequacies of the electrical grid, which are severely hampering the spread of broadband connections and the closure of the digital divide. This makes it difficult to utilise street light infrastructure and other site acquisition projects for the deployment of wireless networks. In addition, to use South Africa as an example, power is not available 24/7 due to load shedding, which sometimes lasts 10-12 hours a day.

The lack of a steady supply of electricity from the grid leads one to consider back-up power solutions, which will require installation in a secure estate or area; otherwise batteries and solar panels get stolen. Therefore, back-up power solutions apply to both metropolitan and rural areas, and more so in the latter as the grid does not even extend to certain regions.

The assets at stake range from the fixed broadband wireless infrastructure, to the cables and other wired infrastructure and the CPE installed at the home. You need the community to protect the infrastructure by making them part of the roll-out - as sales people and local community representatives, and also when it comes to the skills transfer necessary to operate and manage the local network. A combination of technologies, and a combined effort with involvement from local and overseas governments in terms of investment, are required.

"Another interesting technological achievement concerns the use of dual-band wireless systems that dramatically extend the range of highcapacity wireless systems."

Another interesting technological achievement concerns the use of dual-band wireless systems that dramatically extend the range of high-capacity wireless systems. A long range wireless link is almost always less expensive to deploy than an equivalent length fibre line, but the long range PtP wireless networks deployed in Africa are usually 'sub-6' systems, which have capacity limits and other limitations. However, there is a relatively new technique that uses software to combine the high-capacity capabilities of E-band radios (70/80GHz) with long distance transmission capabilities of the lower band radios (e.g., 5GHz) to deliver an astounding 10Gb at distances of >10km. Deployments to date have shown that this is a very cost-effective solution.

Previous approaches to accomplish such a feat meant sacrificing up time availability or adding parallel links, resulting in significant additional costs and complexity. The software also removes the need for an external switch or router to further reduce CAPEX. Field testing and the many operational deployments of this unique technology have also proven that it is a vendor agnostic solution that can help overcome supply chain issues and get projects up and running sooner.

Furthermore, as accounting for rain events is a must in most parts of the continent, the software enables an adaptive modulation and advanced QoS operation for the E-band and lower-band radio combination. This means that when a significant rain event occurs, the adaptive capabilities will kick in to lower the capacity of the E-band link and improve the link budget.

Or, if the capacity reaches a user-defined low threshold, then the traffic is routed to the lower band radio to maintain the availability of high-priority traffic. All of this can be done in less than 10 microseconds, which conforms to the highest public network operational standards. This is a cost-effective technique that could be very useful in many areas in South Africa and elsewhere, and, as a result, we expect it to gain further traction. ■

Looking ahead: In 2024, we see things ramping up for license-exempt 60GHz band mesh terragraph deployments and increasing demand for 10Gbps backhaul in the 80GHz domain, as the congested 5.x GHz deployments cannot provide the interference-free, fibre-like, fixed wireless broadband that demanded by both residential and business customers. The combination of the 60GHz massive-mesh terragraph, which has a 1km diameter coverage area for each node and works well in densely-populated areas, and the 10Gbps 80GHz extended range backhaul is proving to be a much less expensive and time-consuming solution than the equivalent wireline options for gigabit-level connectivity.

This illustrates a single user success story that stood out for us and our partner in South Africa, Skywire, in 2023, regarding the Innibos music and cultural festival. The Innibos event organizers were anticipating 40,000 attendees each day. Based on their previous experiences, public cellular networks would not be able to handle the high demand for connectivity in such a crowded area. After a quick calculation, it became evident that Innibos would require massive bandwidth, reaching multi-gigabit levels. The event would need multiple gigabits to account for the expected amount of video content that would be transmitted wirelessly from performance stages and other areas to a central production studio located on the premises.

To provide multi-gigabit bandwidth, many operators and solutions providers would typically consider using a fibre link, but laying fibre for a temporary event is expensive and time-consuming. On the other hand, the scalable fixed-wireless combination of backhauling over extended-range 80GHz and meshing over the 60GHz band for onsite applications, has increasingly become the preferred connectivity option around the world, and especially here in the typically congested urban Africa areas, as it offers both interference-free operation as well as a faster deployment time. To meet the backhaul requirement, Skywire looked for their nearest fibre POP with a clear line-of-sight to the event's arena. A path analysis to the nearest fibre POP, some 3.8km away, revealed a marginal line-of-sight and this type of connection could only be accomplished with a fixed wireless system featuring a very narrow beam capability – and the solution was a Siklu multi-Gigabit 80GHz radio.

For onsite connectivity, Skywire needed to backhaul a dozen high-end WiFi 6, dual-band access points operating at the highest-rate. After reviewing the project's wide area and the available equipment options, Skywire selected the Siklu's MultiHaul™ TG mesh solution, as it operates in the ultra-wide, interference-free and license-exempt 60GHz band, and the MultiHaul T280 terminal units. These terminal units feature an integrated switch and power-over-Ethernet capability, which enabled a simplified connection directly to the served WiFi access point, while eliminating the expense of adding another power adapter, longer cable runs and an external switch.

The end result was fibre-like backhaul private connectivity to all WiFi APs and other devices throughout the venue and even higher capacity performance from the venue to the fibre POP, with no need to use public cellular networks.

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6Harmonics

6H New GSW-5500

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6Harmonics, a Canadian Company, has its roots in developing long-range broadband. In late 2021, the company assembled a new management team to develop a new product strategy.

The New GWS 5500 Delivers more TVWS broadband capacity at greater distances.

6H has just announced its new GWS-5500, the industry's highest performance, furthest distance, PTP/PMP broadband wireless connectivity solution. The lower-priced IP-67 industrial-grade product delivers lower TCO, both onshore and offshore.

6H is also developing an IP-67 Rugged Edge Compute and Communications (RECC), delivering real-time computing for people and things at the very edge of the network.

The new 6H edge intelligent systems comprise H/W with edge S/W, either on-prem or cloud-based 6Harmonics controller S/W. Communication port options will include 4G/5G, WIFI6, TVWS, LORA, Etc. The new platform offers high value to digital divide solution providers and resource extraction operators such as: O&G, mining, forestry, fisheries, farming, and utility companies.

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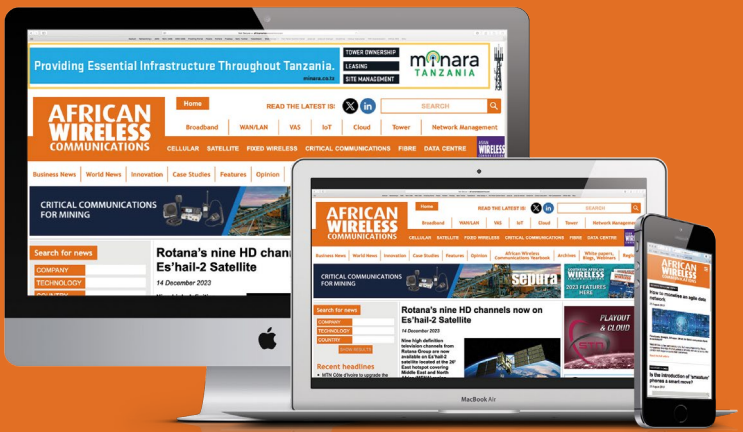

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