# chapter 7 Fibre

**Paul Hamilton,**
Hamilton Research

Africa's total inventory of operational fibre optic network reached the milestone of 1 million kilometres during 2018, increasing the number of people living within reach of a fibre optic node in sub-Saharan Africa to 620 million people. More broadband customers, with more bandwidth per customer, continues to drive Africa's international Internet bandwidth growth along an exponential curve, reaching 15.289 Tbps by December 2019.

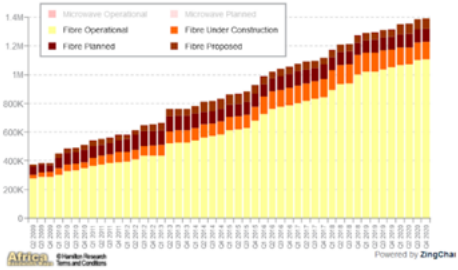
Terrestrial fibre networks reach 1.073 Million Route-Km.

According to the twelfth annual edition of the Africa Telecom Transmission Map published by Hamilton Research for 2020/21, the inventory of operational fibre optic network reached 1,072,649-km by June 2020, compared to 1,025,441-km in 2019, 936,102-km in 2018, 820,397-km in 2017, 762,167-km in 2016, and 622,930-km in 2015. In June 2010, the total fibre inventory was 331,066-km (see chart 1 below).

Since June 2019, an additional 47,208-km of fibre optic network has entered service, an average of 129-km of new fibre optic network entering service per day. In addition, there was in June 2020 a further 119,496-km of fibre optic network under construction, 95,057-km planned, and 69,702-km proposed.

The twelfth edition of the Africa Transmission Map shows the networks which are operational, under construction, planned and proposed for a total of 323 network operators and 72 submarine cable systems. Africa's total inventory of terrestrial transmission networks increased to 1,537,257-km by June 2020, compared to 1,474,983-km by June 2019,

**Chart 1: Route-Kms of Terrestrial Transmission Network, Africa 2009 - 2020**
Subscribers can access the route kilometre datasets by logging in.



1,389,475-km by June 2018, 1,254,413-km in 2017, 1,179,010-km in 2016, and 1,019,649-km in 2015. In June 2010, the total inventory of terrestrial transmission networks was 585,469-km.

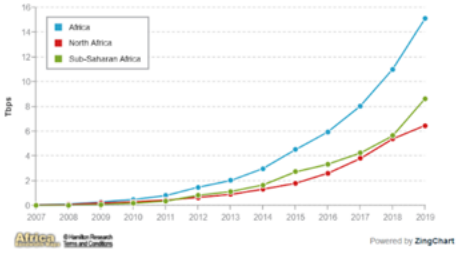
## Fibre Networks Reach Increases To 55.9% Of sub-Saharan Africa

The expansion of terrestrial transmission networks continues to bring additional countries, regions, cities and towns within reach of fibre networks for the first time. In June 2020, 620 million people lived within a 25-km range of an operational fibre optic network node, compared to 584 million in June 2019 and 259 million in June 2010.

In June 2020, 55.9% of the population in sub-Saharan Africa (620 million) lived within a 25-km range of an operational fibre optic network node. This compared to 55.2% (584 million) in 2019, 54.2% (556 million) in 2018, 52.1% (522 million) in 2017, 48.1% (469 million) in 2016, 45.8%, (436 million) in 2015, 44% (410 million) in 2014, 41.8%, (371 million) in 2013, (345 million) in 2012, 36.3% (313 million) in 2011, and 30.8% (259 million) in 2010. Once the fibre network which is currently under construction enters service, the fibre reach of sub-Saharan Africa will increase to 59.6% (631 million), and once the network which is planned or proposed enters service it will increase to 64.1% (679 million).

Since 2010, network expansion has brought more than 361 million more people within access to high capacity national and international backbone networks. In the last year an additional 36 million people were brought within 25-km range of an operational fibre node.

Chart 2: Africa International Internet Bandwidth, 2008 - 2019
Click legend items to show or hide data for each region. Subscribers can access the international bandwidth datasets by logging in.




## Africa's International Bandwidth Reaches 15.289 Tbps

Africa's total inbound international Internet bandwidth reached 15.289 Tbps by December 2019. This compared to 10.996 Tbps in 2018, 8.043 Tbps in 2017, 5.959 Tbps in 2016, and 4.524 Tbps in 2015 (see also Africa: Africa's International Bandwidth Reaches 7.939 Tbps in 2017). In December 2009, Africa's total bandwidth was just 295 Gbps.

The chart below shows that the total international bandwidth of 15.289 Tbps was split between sub-Saharan Africa, which increased by 57% to reach 8.814 Tbps, and North Africa which increased by 20% to reach 6.475 Tbps. Excluding Kenya, which reached 2.720 Tbps in 2019 (source: CA), the total bandwidth for other countries in sub-Saharan Africa increased by 37% to reach 6.094 Tbps in December 2019.

All of Africa's international bandwidth is supplied by submarine cables, terrestrial networks connected to submarine cables, or satellite. Of the total bandwidth of 8.814 Tbps in sub-Saharan Africa by December 2019, 8.126 Tbps (92.2%) was supplied directly by submarine cable, and 678 Gbps (7.7%) was supplied by terrestrial cross-border networks connected to submarine cables. In December 2009, the amount of international bandwidth supplied by submarine cable was 276 Gbps. ■

**Dr Henry Lancaster,**
senior analyst, BuddeComm

Across most countries in Africa the former bottlenecks which had contributed to the low take-up of broadband services are being addressed systematically. The region continues to attract considerable investment in laying additional terrestrial and subsea cable networks, and in providing upgrades to existing systems to increase their capacity.

The key players in these cable systems include existing companies such as Liquid Intelligent Technologies, which have operated in the region for many years, and also the social media giants such as Google and Facebook, which are deploying their own cables in collaboration with local partners. In addition, there are a number of regional schemes, such as the Djoliba fibre network providing connectivity to several countries across West Africa.

At the same time, owners of ICT infrastructure are upgrading their existing networks. Seacom recently announced that it was upgrading its regional network to 100Gb/s.

Many countries in the region have recognised that economic growth is largely dependent on the more intensive use of ICT, thus fostering the development of knowledge-based economic activity. Some countries are working on developing additional terrestrial infrastructure linked to submarine cables in a bid to become regional ICT hubs.

In the wake of the pandemic, it has also been evident that further investment in network infrastructure is required to manage the growth in data traffic. Thus far, most investment has been in mobile networks (principally LTE, and more recently in developing the groundwork for 5G), though there have also been considerable developments with fixed broadband infrastructure, tied to the growing capacity of internet bandwidth.

Nevertheless, it remains true that, depending on the market, between 90% and 98% of all internet connections are via mobile networks. As a result, governments and regulators alike have concentrated on this platform to deliver on their broadband targets in coming years.

## African broadband market overview

The new and upgraded subsea cables which have been built in recent years, as well as a number of new ones due to be lit in 2022, are supporting the numerous national broadband plans in place across the region. Increased bandwidth is paramount for countries in Africa to make effective use of IP-delivered services. These services encompass e-government, tele-education, tele-health, and a broad spectrum of e-commerce platforms which are helping economies to be transformed for the digital age.

Thus far, the limited reach of existing fixed-line infrastructure has inhibited the take-up of fixed broadband services, and as a result in many countries fixed broadband penetration is below 1%. As a consequence of this, the vast majority of data traffic is channelled via mobile networks. In some cases, the investment required to develop fixed telecoms is prohibitive in relation to the potential revenue gained, and thus in practice investment is almost exclusively in the mobile sector.

However, progress is being made to increase backhaul capacity on both the international and national levels. This backhaul is being used to improve fixed-line telecoms, as well as to support growing mobile data traffic. During the last two years several new submarine cables have been completed to provide direct links to southern Europe and Brazil, while terrestrial cables have also been extended to link to telecom infrastructure in the interior landlocked countries.

One of the world's largest submarine cable

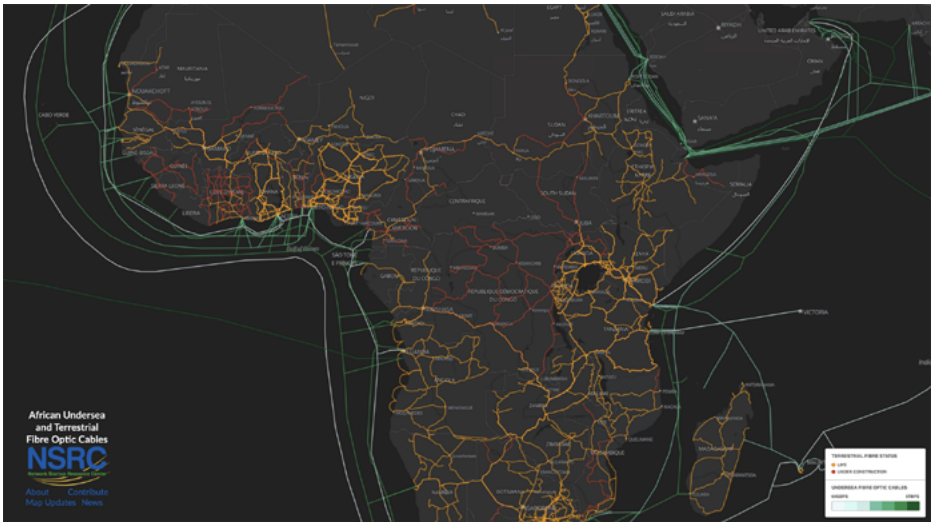
projects, known as Africa2, will serve the MENA region, with connections to Europe. The cable is being developed by a consortium of companies including China Mobile International, Facebook, MTN, GlobalConnect, Orange, STC, Telecom Egypt, Vodafone, and West Indian Ocean Cable Company. With a capacity of 180Tbps, it will have 21 landing stations in 16 countries and is expected to be completed in late 2023.

In September 2021 it was announced that the cable will be extended to the Arabian Gulf, India, and Pakistan, bringing its total length to over 45,000km. This additional section is known as 2Africa PEARLS. Landing stations are planned for Oman, UAE, Qatar, Bahrain, Kuwait, Iraq, Pakistan, India, and Saudi Arabia. A separate cable branch will join extensions to the Canary Islands, the Seychelles, Comoros Islands, Angola, and Nigeria.

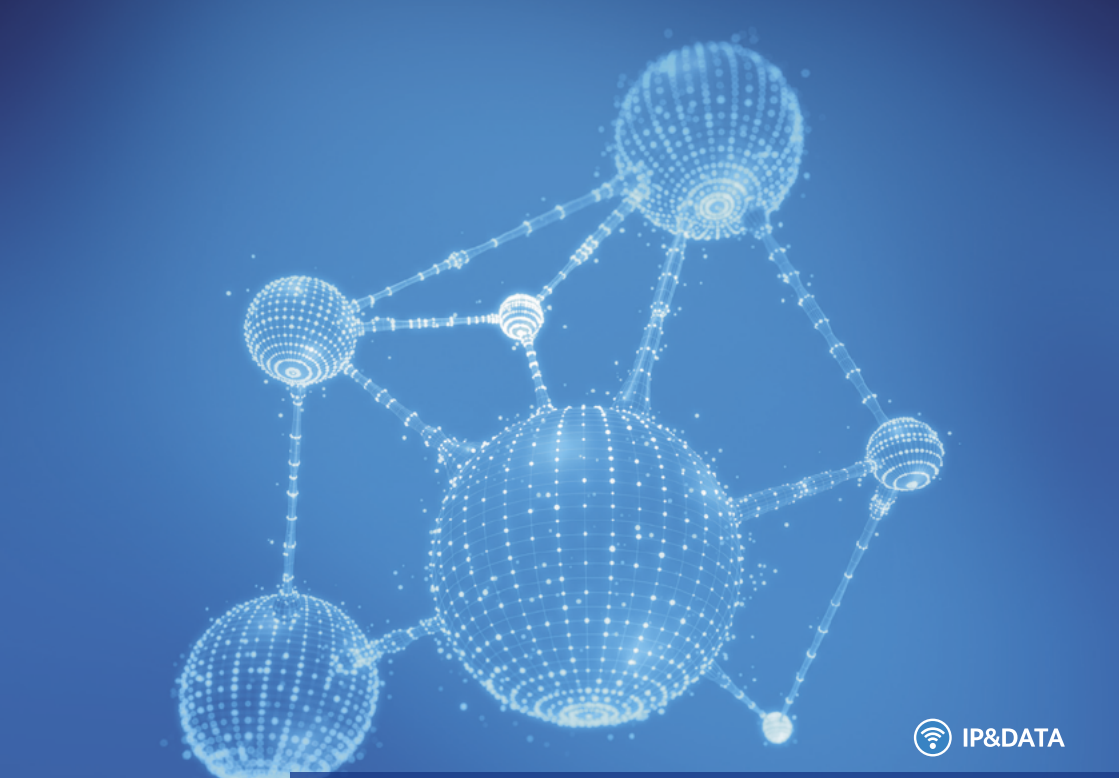
In addition to this fixed-line infrastructure there are ambitious plans to develop satellite broadband to cover remote regions. Beyond leasing capacity with existing satellite operators, some countries also have invested in developing their own fleets. The Ethiopian Institute of Space Technology and Science (ESSTI) launched its first satellite in December 2019 (from China), and its second in December 2020. In Angola, the AngoSat-2 satellite (built as a replacement for the failed AngoSat-1 craft) is expected to be launched in mid-2022.

Considerable efforts are still to be made in domestic telecom infrastructure, where bottlenecks restrict capacity provided by international cables from being distributed effectively, resulting in unnecessarily high local access prices. Bottlenecks have contributed to the take-up of mobile broadband for voice and data services, but mobile networks still need reliable fixed-line infrastructure for backhaul, and cross-border connections to link cities and provinces.

Regional schemes to address capacity restrictions are usually with a view to extending submarine cable access to landlocked countries. Schemes include the East African Backhaul System (EABS), serving Kenya, Tanzania, Uganda, Rwanda, and Burundi which provide landlocked countries with access to submarine cables. Another is the Central African Backbone (CAB), a program funded by the World Bank and the African Development Bank to build fibre-optic infrastructure serving 11 countries in the Central African region. ■




*Credit: Network Startup Resource Centre*



IP&DATA

# You connect and together we evolve

**Sparkle to Build Blue and Raman Submarine Cable Systems in Collaboration with Google**

Sparkle is building, with Google and others, Blue and Raman Submarine Cable Systems connecting Italy to India and, along the path, France, Greece, Israel, Jordan, Saudi Arabia, Djibouti, Oman.
Each equipped with 16 fibre pairs and embracing the innovative concepts of open cable and open landing station, the two systems will provide diversification, scalability and latency for communications between Europe, Africa, the Middle East and South Asia.
Within the Blue System, BlueMed submarine cable is Sparkle's own private domain with four additional fibre pairs and private branches into France, Italy, Algeria, Tunisia, Libya, Turkey and Cyprus. Its flexible design will allow seamless express connections throughout the Mediterranean as well as sophisticated regional subsystems.
Discover Sparkle's IP&Data Platform, an interactive ecosystem based on a global communication network in constant evolution. Its governance ensures the creation of value for customers, suppliers and partners, every day, before they even know they need it. Because we're always looking ahead.

**Sparkle. The world's communication platform.**

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**Leonardo Cerciello,**
VP sales wholesale Asia & Africa, Sparkle

In Africa there is an increase in demand for telecommunications services. The need for internet connectivity and access to content is mainly driven by demographic increase and economic development. At the same time, the rollout of 4G and 5G technologies is enabling new applications which will have a strong social impact in bringing inclusion. Let's think of telemedicine, for example: with 5G, robotics, artificial intelligence and the IoT, it will be possible to bring healthcare to rural and remote places.

All this translates into opportunity and responsibility for a player such as Sparkle to guarantee connectivity and digital services.

Historically, Sparkle has been playing a major role in providing international connectivity services to North African countries, through its Sicily Hub in Palermo, a gateway for Internet traffic to and from Africa to Europe, the Middle East and Asia thanks to the interconnection of 18 submarine cables. However, Sparkle's challenge is to bring connectivity and capacity throughout the continent, opening new PoPs and investing in new pan-African cable systems, in order to satisfy growing demand, which is also shifting geographically: in the past, the main route of internet traffic was between West and East; today demand is growing exponentially from South, where the largest number of the next 'eyeballs', the new users, can be found.

"Our challenge is to bring connectivity and capacity throughout the continent, opening new PoPs and investing in new pan-African cable systems"

The pandemic has confronted us with the importance of ICT infrastructures - networks, clouds and applications - in everyday life: without the network, the lockdown would have been more difficult: we could not watch movies or TV series in streaming, video call relatives and friends and above all, in many cases, we could not work.

During the Covid-19 outbreak, we have experienced unprecedented, accelerated increases in demand on our networks - driven by requirements for critical services, remote working, and home entertainment services – and invested promptly on capacity upgrades to provide constant and stable connectivity.

However, we believe it's vital to assure ICT infrastructure and provision of ICT services are designated as an "essential service" in all jurisdictions to avoid any disruptions to global communications, ensure safety of operational staff in the field and continue customer service to end users.

To this purpose, we have joined the "Keeping the World Connected" advocacy campaign with other global service providers, to call on governments on this matter and call for a better collaboration among ICT infrastructure providers.

In recent years we have been expanding our presence in Africa opening new PoPs such as in Lagos and Casablanca and investing on large scale infrastructural projects to provide advanced connectivity between Africa, the Middle East, Asia and Europe.

Recently, we have announced our collaboration with Google and others to build Blue and Raman Submarine Cable Systems: Blue will cross the Mediterranean Sea connecting Italy with the Middle East, while Raman will connect Jordan, Saudi Arabia, Djibouti, Oman and India.

Each equipped with 16 fibre pairs and

embracing the innovative concepts of open cable, supporting multiple fibre tenants, and open landing station, enabling competitive access to the cable termination points, the two systems set a new reference in terms of diversification, scalability, and latency throughout these geographies.

Blue will be deployed along a new northbound route in the Mediterranean, crossing the Strait of Messina, rather than following traditional route through Sicily Channel. As a result, ISPs, carriers, telecom operators, content providers, enterprises and institutions will benefit from high-speed Internet and state-of-the-art capacity services with unparalleled diversity and performances.

Within the Blue System, BlueMed submarine cable is Sparkle's own private domain sharing its wet components with four additional fibre pairs and an initial design capacity of more than 25 Tbps per fibre pair and is extended up to Jordan with additional private branches in the Mediterranean, including into Algeria, Tunisia and Libya.

BlueMed flexible design gives seamless express connections throughout the Mediterranean Basin, unprecedented latency and spectral efficiency and sophisticated regional subsystems, based on specific customer requirements.

In addition, Sparkle's Genoa Open Landing Platform is set to become the alternative priority access for other upcoming submarine cables looking for a diversified entry to Europe, backhauled to Milan's rich digital marketplace, and thus a new reference gateway between Africa, the Middle East, Asia and Europe.

Blue and Raman are expected to be ready for service in 2024, with the Tyrrhenian part of BlueMed planned to be operational in 2022.

These investments will consolidate Sparkle's positioning in the Mediterranean adding new routes for Africa to Europe and to Asia connectivity. ■

**Looking ahead:** Sparkle sees increase of demand for internet traffic continuing throughout 2022 and beyond and will continue to expand its presence in the continent, opening new PoPs and investing on large-scale infrastructural projects, in partnership with local operators and with hyper-scalers/OTTs.

In terms of internet traffic Sparkle is the second largest network in Africa, thanks to its extensive network running around the continent and direct connection to Europe and to Asia, and thanks to its strategic hubs in Sicily and in Djibouti. However, we continuously expand our network to improve connectivity among African countries, and between Africa and the rest of the world.

In addition to the Blue and Raman Submarine Cable Systems, we are investing on new cables in the Mediterranean, to connect the North African countries to the main European hubs, as well as in new pan-African cables to add capacity and diversity.

In particular, we are investing on the expansion of our global Tier 1 IP backbone "Seabone" – one of the top 5 global IP networks – to increase IP connectivity throughout the continent and in particular to the South.

On top of infrastructure, we are evolving our service portfolio and capabilities to focus more on the provision of connectivity and digital services to multinational customers such as SD-WAN, security services, cloud and IoT solutions, especially in North African countries.

These are the initial steps of Sparkle's expansion plan to support the growing IP connectivity needs in the African continent in the coming years.

**Crisostomo Mbundu,**
senior product developer, Angola Cables

The population of Africa is currently estimated to be 1.36 billion and rising. Of this number, only about 22% are reported as having internet access. That equates to about 1 in 5 citizens on the continent. Although that statistic may be low in comparison to the other continents on the planet, the situation and numbers involved are changing at a rapid pace. This is why the demand for digital content in Africa is on the rise.

At present subsea cables facilitate the transmission of more than 440 terabytes of data – and this number is increasing tenfold · largely due to the high volume of analytic data and content that is now being stored in the cloud. It is estimated that by 2022, IP traffic will reach around 4.8 zettabytes of data. By 2025 the demand for data will skyrocket to 175 zettabytes of data per year. This is an enormous amount of data and the rising demand for data and bandwidth is set to continue.

"These vast amounts of content or data are being stored in the growing data centre ecosystems of Africa and internationally as well as being channelled through a plethora of Points of Presence (PoPs) that intersect and connect people, economies and cultures across the planet"

To carry these increasing amounts of data, additional bandwidth is required. Africa has surpassed other continents in international bandwidth growth for the past four years, largely as a result of new submarine cable builds. Although increasing international capacity is critical to Africa, it is also important to move data to and from Africa as fast as possible via low-latency network designs. This is why leading African service providers, such as Angola Cables, offer a broad low-latency service portfolio.

Driving the insatiable appetite for digital content and the demand for data is the growing requirement by governments, businesses, academic institutions and individual users for this digital content. From documents to streaming to complex Artificial Intelligence (AI) processes and algorithms driving the modern digital economy, data can be viewed as a new currency. These vast amounts of content or data are being stored in the growing data centre ecosystems of Africa and internationally as well as being channelled through a plethora of Points of Presence (PoPs) that intersect and connect people, economies and cultures across the planet.

For an acceptable Quality of Experience (QoE) for end-users, both humans and machines, network performance must reliably deliver scalable capacity at the level of low latency required by the specific use-cases. In short, latency is as important as capacity.

Who cares about this latency and why? Low-latency submarine network connectivity is important, to varying degrees, to Internet Content Providers (ICPs), gaming companies, financial enterprises, cloud service providers, and most end-users. Low latency can be the

difference between a profit or a loss when it comes to the High-Frequency Trading (HFT) world to (virtually) living/dying in a multiplayer online game.

ICPs, who are using most new network bandwidth and building many new submarine cables, covet low-latency end-to-end (E2E) performance to interconnect their data centres and better achieve search index synchronization, distribution of video content nearer to viewers – from Zoom conferencing to AI and machine learning that optimizes cloud services. New submarine cable routes not only provide much needed increased resiliency with improved route diversity, but often shorter paths between endpoints, which in the case of ICPs, is between their ecosystem of interconnected data centre assets.

Not all network operators provide the same latency, since not only are routes and distances different for each submarine cable, but terrestrial backhaul networks at each end of a submarine cable and intra data centre networks are also different. As a result, the pricing for premium routings can also differ.

End-to-end networks can be greatly enhanced through applications such as GeoMesh Extreme. Such programmes significantly simplify E2E network designs, overland and undersea, to provide a broad set of enabled benefits such as: reduced complexity, power, space and an overall reduction in latency.

Angola Cables is an African multinational telecommunications wholesaler network operator offering a broad range of services including leased circuits, IP Transit, Internet Exchange Point (IXP), data centre, and Information and Communication Technologies (ICT) products. The company also offers a broad range of international low-latency connectivity services via our South Atlantic Cable System (SACS), West Africa Cable System (WACS), and Monet submarine cable networks. Angola Cables provides, faster connectivity to and from Africa.

In terms of transoceanic network services, the submarine cable contributes most of the end-to-end latency due to its routed distance over several thousands of kilometers. As light in an optical fiber contributes roughly 5 milliseconds per 1,000 kilometers, latency on a submarine cable adds up quickly. This makes the selected route for a new submarine cable critical when designing low-latency networks, since once the cable is laid upon the seabed, its latency is essentially fixed over its lifespan, typically 25 years or more. Angola Cables has taken this into account when offering a broad range of low-latency services between popular endpoints, connecting Africa to Europe, South America, North America, and to other points in Africa.

Angola Cables understands the importance of a broad and vibrant ecosystem of submarine networks, terrestrial networks, and data centre assets. Subsequently, the company has created an impressive ecosystem of assets and international partnerships, to better serve their customers in Africa, Latin America, and other parts of the world.

Given the dramatic rise in data consumption and the anticipated increase in data usage over the next decade, Angola Cables has a secure and optimised network capable of accommodating this growth. As internet connectivity in Africa grows, so will the population's access to digital content and services grow, opening the door for more businesses and entities in Africa to grow and expand their businesses beyond the continent into other growing markets across the globe. ■

**David Eurin,**
chief strategy officer, Liquid Intelligent Technologies

It has been another busy year for the team at Liquid during which we completed our extensive business transformation from a telecommunications and digital services provider to a full one-stop-shop technology group.

Over the last two decades, Liquid has firmly established itself as a leading pan-African digital infrastructure provider, providing an extensive fibre network on the continent that spans in excess of 100,000km and is complemented by an extensive satellite network. Our rebrand to Liquid Intelligent Technologies reflects more accurately the expansion of our Cloud business, Cyber Security services, Internet of Things, and other technologies that Liquid has added to our existing telecoms and connectivity capability.

Despite these huge changes, at the very core of our business is our long-held belief that every individual on the continent has the right to be connected. We believe that the power of technology will create better and brighter lives for everyone.

"Our rebrand to Liquid Intelligent Technologies reflects more accurately the expansion of our Cloud business, Cyber Security services, Internet of Things, and other technologies that Liquid has added to our existing telecoms and connectivity capability"

As the adoption of cloud technologies progresses rapidly in Africa, such as MS365, Azure, and other cloud-based services, we have invested in building new data centres and fibre links to help OTT operators deploy services and bring more people online. We have succeeded in becoming the largest international DC operator in Africa with facilities in six countries.

To support the growth of international traffic, over 40% this year, we have invested in Equiano with Google, which will land in South Africa, Nigeria and Portugal by the middle of 2022. This is a piece of critical infrastructure for Africa, which should enable a richer digital life and support the development of increased global trade across the world and within Africa.

Across Africa, we have partnered with OTTs including Facebook, to build more fibre routes, such as in the Democratic Republic of Congo where we are busy linking for the first time Kinshasa to Goma. This will bring more affordable and reliable Internet to businesses and to millions of people in one of the largest, but least connected, places in Africa.

The Covid-19 pandemic affected all of us in both our personal and business life and its impact continues to resonate in Africa as it does throughout the world.

We realised the importance of connectivity as we saw it underpin and maintain business activity, enabling Liquid to keep in touch with customers.

For the team at Liquid our biggest challenge has been to keep up the pace of development of our data centre and pace of fibre deployment. In many countries, telecom services were deemed essential services and as such we were able to continue our work. This was not easy, as the health and safety of our employees, customers and contractors are paramount to us. We put in place many new processes and safeguards to ensure our work and services could be continued

in the best possible way, without compromising on safety or quality.

Liquid's stand-out moment in the last 12 months was when Liquid's fibre network reached 100,000km, making us the largest independent network provider not only in Africa but other emerging markets.

This landmark follows more than 13 years of blood, sweat and tears. We now connect more than 100 million people across 643 towns and cities in 14 countries creating new opportunities across the continent and ultimately accelerating the ongoing digital transformation in Africa.

Other highlights include the lighting of multiple East-West fibre routes, in central Africa starting in the DRC and along the coast of South Africa. This is now a reality for Liquid Telecom, while many others are still dreaming of this technological feat.

We also launched our Cyber Security business unit. With the future of network security driven from the cloud, we are focused on protecting our customers' data throughout its lifecycle.

As a Microsoft Gold Partner, we are redefining Network, Cloud and Cyber Security offerings through strategic partnerships with leading global players, bringing innovative business applications, intelligent cloud services and world-class security to consumers on the African continent. ■

**Looking ahead:** 2021 and the start of 2022 will see more dramatic changes in the way we use telecommunication services and how we operate networks, data centres and cloud services. We expect to become more productive and efficient and that our network will continue to expand into new countries to bring affordable and reliable access to the Internet.

Cloud service adoption and the transformation of businesses through the use of digital services (customer relationship, e-commerce, automated operations, cloud-based accounting and billing, etc.) will shoot up in many parts of Africa. However, this will inevitably be followed by more cybersecurity attacks, scams and other dangerous behaviour. We will develop more identity protection and cybersecurity services to help our customers cope with these challenges.

The data centre market should continue its rapid expansion, as more OTT and global software providers "land" more capacity in Africa, expanding outwards from South Africa towards other markets.

Liquid is in a fortunate position having a clear competitive advantage based on aspects such as owning infrastructure across 14 countries that we will draw upon as we continue to invest and build Africa's digital future and roll out new products and services.

Liquid intends to continue along its business path in continuing to provide tailor-made digital solutions for businesses and operations in both the public and private sectors across the African continent. We will expand our Managed Services offerings to drive and ensure successful adoption of tools to re-imagine our customers' businesses and how they work and connect. Whether they are focused on enabling collaboration or they are utilising the most advanced cloud applications available.

Liquid will continue to expand its fibre network across Africa through our own investments (where fibre does not exist or is insufficient quality) or partnerships with leading local fibre operators. We expect to be a truly pan-African fibre operator sometime next year with access to over 40 countries across the Continent, supported by our investments in the new subsea cables.

**Brian Lavallée,**
senior director of solutions marketing, Ciena

When it comes to international bandwidth growth, Africa is far surpassing any other region worldwide. With the fastest growth rate over the last four years and numerous new submarine cables being deployed, this is an emerging market with plenty of opportunity and new infrastructure projects.

A large part of Africa's bandwidth growth comes down to the population size – as the world's second largest continent it covers 20% of our planet's landmass. Africa is also home to 1.4 billion of the youngest people on Earth and it had a median age of just 19.7 years in 2020. A large, young, digital savvy and populous continent means networks play an extremely important role - with clear appetite amongst consumers who have a hunger for the latest content, video streaming and other digital applications. In addition, the networking industry also plays an instrumental role in helping Africa to remain connected to the rest of the world, and in creating a viable and sustainable economy as we continue to progress in the digital world. There is ample opportunity when it comes to connectivity services in Africa and a clear need for the region to remain increasingly connected – so how can the industry support this demand, what is working well, and what are the future developments on the horizon?

"A large part of Africa's bandwidth growth comes down to the population size – as the world's second largest continent it covers 20% of our planet's landmass"

One of the challenges is that network operators not only need to support the world's fastest growing bandwidth demand, but in addition deliver an acceptable Quality of Experience (QoE), as more bandwidth-intensive applications come to market. This means that delivering reliable and secure networks that rapidly scale and offer low latency is just as critical as supporting the capacity needs.

Low-latency connectivity is important for many stakeholders – from Internet Content Providers (ICPs), gaming companies, financial enterprises, and cloud service providers to consumers to varying degrees and for so many different reasons. Low latency can be the difference between winning or losing substantial amounts of money in the High-Frequency Trading (HFT) world or (virtually) surviving in a Massively Multiplayer Online Game.

In general, the lower the latency the better for most use-cases and applications, but as we get lower and lower, special "tricks" and architectures are required, which often lead to higher pricing for ultra-low-latency services, over and above being dependent on supply and demand.

Submarine cables provide massive scalability and relatively low latency using fibre optic cables laid upon seabeds carrying close to 99% of the world's intercontinental electronic communications traffic, so broader access to this undersea

infrastructure is critical for Africa.

In addition, it is not just about tapping into what is already available. Bandwidth demand growth is fuelling the creation of new submarine cables, as African network operators are rapidly evolving from network-centric service providers to fuller digital service providers. This explains the growing number of submarine cable landing points providing access to the massive amounts of undersea bandwidth encircling Africa. And with new submarine cables being deployed around the African continent, such as Equino and 2Africa, the amount of available capacity will massively increase once again. However, once submarine cables make landfall, the onus is then on terrestrial and mobile network expansion to enable Africans to access applications, content, and services flowing over existing and new submarine cable builds.

It is also critical to think about the physical placement when it comes to submarine cables. For transoceanic network services, submarine cables contribute most of the total end-to-end latency due to its routed distance of several thousands of kilometres and the fixed speed of light. This makes the selected route for a new submarine cable critical when designing low-latency networks, since once it's laid upon the seabed, its latency is essentially fixed over its lifespan, typically 25 years or more.

While the development of new cables will help to satisfy the capacity challenges, we are also starting to see a focus on investing in network assets to help manage, scale, and provide the low latency that the region really needs. The importance of a broad and vibrant ecosystem should not be overlooked, and we will start to see greater focus on this in the industry in the future.

There is also mature, field-proven technology available to help with this endeavour. As an example, at Ciena we have GeoMesh Extreme, which significantly simplifies end-to-end network designs – over land, sea, and cloud – providing a broad set of benefits, such as reduced complexity, power, space – and you likely guessed it – reduced overall latency. GeoMesh Extreme is increasingly being deployed, and looking at recent developments, this was something leveraged by Angola Cables, enabling faster connectivity to and from Africa.

At Ciena, we also worked with MainOne, an African submarine cable operator, helping to increase its submarine network capacity utilisation following the significant growth following the global pandemic and as it looked to expand its reach into more countries. It was the combination of a submarine cable network, terrestrial metropolitan fibre infrastructure, data centre assets, and broad interconnect ecosystem that makes MainOne a key enabler of digital transformation across West Africa.

When it comes to the telecoms and networking industry, ensuring connectivity in Africa is critical and it is a region where the opportunities really are plentiful. It is a market that we are certainly going to continue to see a bigger focus on. Although increasing international capacity is critical to Africa, it's also more important to move data reliably and securely to and from Africa as fast as possible via low-latency network designs and this is why innovative African service providers are offering a broad low-latency service portfolio. ■

**Mike Last,**
chief marketing officer and VP international business development, WIOCC

Over the last 12 to 18 months the demand for Bandwidth in Africa has soared, requiring all elements of the connectivity chain – from subsea cable systems and terrestrial fibre backhaul networks, to metropolitan networks and last-mile connectivity provision – to link together and scale seamlessly in delivering to increased demand and these new requirements.

It was only a few years ago that telco and internet service provider (ISP) requirements for international capacity in Africa were measured in multiples of STM1s (155Mbps). However, such has been the increase in uptake of high-speed internet services and bandwidth-hungry applications – including online gaming, music and video streaming, social media networking, etc. – that capacity requirements are now typically measured in multiples of 100Gbps.

Demand has also been exacerbated by the arrival of Covid-19 and the widespread introduction of new working and lifestyle measures designed to combat its spread. The huge increase in remote working brought with it the need for individuals to access services, communications channels and applications in the cloud, and people spending more time at home also ramped up their use of internet-based leisure and entertainment services. During the first six months of the pandemic, these measures collectively contributed to a reported 70% rise in daily Skype usage, a 26 million increase in Netflix subscriptions and a 10% increase in active Facebook users.

"During the first six months of the pandemic, these measures collectively contributed to a reported 70% rise in daily Skype usage, a 26 million increase in Netflix subscriptions and a 10% increase in active Facebook users"

The response to these rapid and very significant increases in demand for connectivity from cloud operators, content providers, ISPs and mobile operators was heavily dependent on working in partnership with an agile, fleet-footed wholesale bandwidth provider with the required network reach and the ability to rapidly scale up clients' capacity provision.

This period has clearly demonstrated that a primary consideration in choosing such providers should be their ability to access and rapidly activate additional capacity where needed, with this capability limited to those with a demonstrable commitment to long-term and ongoing investment in deploying resilient, truly hyperscale network infrastructure across the continent: networks that seamlessly link multiple international submarine cables to tens of thousands of kilometres of terrestrial fibre, metropolitan fibre networks and last-mile connectivity services.

Even for connectivity providers with a well-established policy of long-term network investment, there has still been a need to invest quickly in extra network capacity in specific areas to address anticipated bottlenecks in demand due to the pandemic, and to introduce enhanced measures for sparing and equipment redundancy, given the challenges in moving people and resources

around the continent.

A significant amount of infrastructure investment continues to be made in the continent's main bridgehead markets of South Africa, Nigeria and Kenya, with these representing the most promising initial markets for internet-dependant businesses looking to expand their operations into and within Africa.

For example, established, award-winning capacity wholesaler WIOCC recently completed a multi-billion Rand investment in South Africa, where it built a 16Tbps-ready, Optical Transport Network-enabled extension to its existing international hyperscale network infrastructure. This network extension includes wholly owned metro networks and a further 30 Points of Presence (PoPs) along the 1,700km NLD5 and NLD6 coastal corridors, enabling ISPs to extend more affordable connectivity to consumers' towns along the country's southern coastline.

With many of the older submarine cables at or approaching 100% capacity, there has been a drive to upgrade existing cable systems and build new ones in order to keep pace with Africa's burgeoning demand for international connectivity.

EASSy – serving Africa's eastern seaboard – undertook a major cable upgrade during 2021, and new cables going live over the last 12 months included DARE-1, linking Mombasa to Mogadishu, Bosaso and Djibouti; and METISS, linking the West Indian Ocean islands of Reunion, Mauritius and Madagascar to South Africa. ■

**Looking ahead:** With the rate of increase in demand for capacity in Africa showing no sign of slowing, opportunities for wireless communications companies are set to continue to multiply.

At a submarine cable level, a number of major new international cables are under construction, with more at proposal stage.

Two of the most significant new subsea cable systems are the Facebook-backed 2Africa cable, which will connect Africa to Asia, Europe, the Middle East and the Indian sub-continent, landing at 46 locations in 33 countries; and the Google-led Equiano cable, which will connect Portugal to South Africa and many countries along the west coast of Africa. These will inevitably change the connectivity landscape in Africa, bringing more capacity, alternative routes and cable landing points, and further diversity options for international connectivity within and out of Africa.

Alongside the incremental submarine cable capacity, there are also significant infrastructure investments being made on land to further increase utilisation of the additional international connectivity within Africa. Thousands of kilometres of new terrestrial fibre, additional metropolitan networks and enhanced last-mile connectivity options will all help businesses and individuals take advantage of faster, more affordable, high-quality access to the global internet and all the possibilities that brings.

Facilitated by this improved connectivity and the seemingly insatiable appetite for internet-based applications in particular, the scope for further increases in broadband penetration, internet uptake and access to information, services and improved business and social interaction in Africa is huge.

For companies involved with connectivity-dependent products, applications or services, the business opportunities in Africa look set to become even more attractive and compelling.

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Angola Cables is a multinational operating in the global ICT sector. With a robust transport infrastructure and highly interconnected IP network we offer differentiated solutions to the wholesale and corporate segments. We offer customers access to the largest IXP's, Tier 1 operators and international content providers.

Through SACS, Monet and WACS submarine cable systems the company directly connects the Americas, Africa, and Europe with established partnerships to reach Asia. We manage the Tier III Data Centre AngoNAP Fortaleza (Brazil) and the Data Centre AngoNAP Luanda (Angola), PIX - and Angonix, one of the largest Internet Exchange Points (IXPs) in Africa.
Angola Cables provides digital services and network solutions to multiple industries with customized cloud and gaming resources available to our global customers.

ASN 37468

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