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Unlocking Affordable Access in Sub-Saharan Africa

Steve Song

UNLOCKING AFFORDABLE ACCESS IN SUB-SAHARAN AFRICA

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The Global Commission on Internet Governance was established in January 2014 to articulate and advance a strategic vision for the future of Internet governance. The two-year project conducts and supports independent research on Internet-related dimensions of global public policy, culminating in an official commission report that will articulate concrete policy recommendations for the future of Internet governance. These recommendations will address concerns about the stability, interoperability, security and resilience of the Internet ecosystem.

Launched by two independent global think tanks, the Centre for International Governance Innovation (CIGI) and Chatham House, the Global Commission on Internet Governance will help educate the wider public on the most effective ways to promote Internet access, while simultaneously championing the principles of freedom of expression and the free flow of ideas over the Internet.

The Global Commission on Internet Governance will focus on four key themes:

- enhancing governance legitimacy — including regulatory approaches and standards;
- stimulating economic innovation and growth — including critical Internet resources, infrastructure and competition policy;
- ensuring human rights online — including establishing the principle of technological neutrality for human rights, privacy and free expression; and
- avoiding systemic risk — including establishing norms regarding state conduct, cybercrime cooperation and non-proliferation, confidence-building measures and disarmament issues.

The goal of the Global Commission on Internet Governance is two-fold. First, it will encourage globally inclusive public discussions on the future of Internet governance. Second, through its comprehensive policy-oriented report, and the subsequent promotion of this final report, the Global Commission on Internet Governance will communicate its findings with senior stakeholders at key Internet governance events.

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ABOUT THE AUTHOR

Steve Song is a wireless researcher with the Network Startup Resource Center, where he works to develop strategies for expanding the utilization of wireless technologies through shared-spectrum strategies to enable greater Internet access in Africa and other emerging-market regions. Previously, Steve worked at the International Development Research Centre, where he led the organization's information and communication technology for development program in Africa, funding research into the transformational potential of information and communication technologies across the continent.

EXECUTIVE SUMMARY

A digital urban-rural divide is growing in Sub-Saharan Africa. While national governments embrace strategies calling for universal telecommunications service, telecommunications operators are challenged to deliver affordable access into more sparsely populated rural areas where incomes are lower. In order to achieve affordable, ubiquitous access for all, new access models that complement existing telecommunications networks will be required. Historically, the deployment of a communications network required millions of dollars of investment to create the international connections, national backhaul and last-mile infrastructure to deliver access. However, the access landscape is changing. Fibre optic networks have brought high-capacity, high-speed networks to African cities, and new low-cost wireless technologies are putting last-mile networks within the reach of start-ups and communities alike. Enabling this access will require making changes to spectrum management so that it encourages bottom-up development of wireless access in underserved areas. Policy makers and regulators need to encourage wireless innovation from new market entrants and allow alternative business models to flourish.

INTRODUCTION

It is hard to overstate the transformation in access to communications that mobile phone networks have brought to African countries. In 1995, in a speech to the Group of Seven, Deputy President of South Africa Thabo Mbeki pointed out that there were more phone lines in Manhattan (New York) than in all of Sub-Saharan Africa (M'Bayo 1997). Today, about two-thirds of the population in Sub-Saharan Africa has mobile phone reception (although not necessarily phones) and about one-quarter have access to 3G or better mobile data services (Ericsson 2015). There is a common perception that a linear increase in mobile access networks will eventually connect everyone on the planet. Yet, the reality is that a digital urban-rural divide is growing (International Telecommunication Union 2014). Mobile network subscriber growth in Africa is slowing, as is revenue growth for mobile network operators (GSMA Intelligence 2016). This slowdown is linked to the fact that a significant percentage of newer users come from lower income brackets living in regions that present challenges to operators, ranging from sparser population distributions to lack of effective power infrastructure. Meanwhile, operators are experiencing pressures in their existing markets, from increased competition, erosion of revenue from over-the-top (OTT) voice and data services such as WhatsApp, Skype, and so on, and insistence from regulators on network quality improvements (Locke et al. 2016). In terms of how to affordably connect everyone on the planet to communication networks, mobile networks will continue to play the dominant role, but new complementary strategies will also be required. Historically, the deployment of a communication network required millions of dollars of investment to create the international connections, national backhaul (long-distance, high-capacity infrastructure with massive data-carrying capacity) and last-mile infrastructure to deliver access; today, the access landscape is changing. Fibre optic networks have brought high-capacity, high-speed networks to the shores of African countries, and new low-cost wireless technologies are putting last-mile networks within the reach of start-ups and communities alike.

FUELLED BY FIBRE

The real impact of technological innovation is often not felt until long after market introduction — in particular in emerging markets. Consider the launch of the first mobile networks in Sub-Saharan Africa in 1994, for example: the impact of affordable access granted by mobile technology was not felt until more than 10 years later (*The Economist* 2005). Fibre optic technology is at a similar juncture today. The first high-capacity open-access[1] undersea cable to reach countries in Sub-Saharan Africa was launched in July 2009 with little fanfare (Sinico 2009). In 2016, more than a dozen undersea cables encircle the continent, offering many terabits of digital capacity (see Figure 1). The arrival of high-capacity fibre on the shores of African countries, combined with market reforms and regulatory reforms, has triggered a wave of investment in terrestrial fibre optic infrastructure, to the point that virtually every African nation has at least one fibre optic backbone — and many have several — connected to those undersea cables.

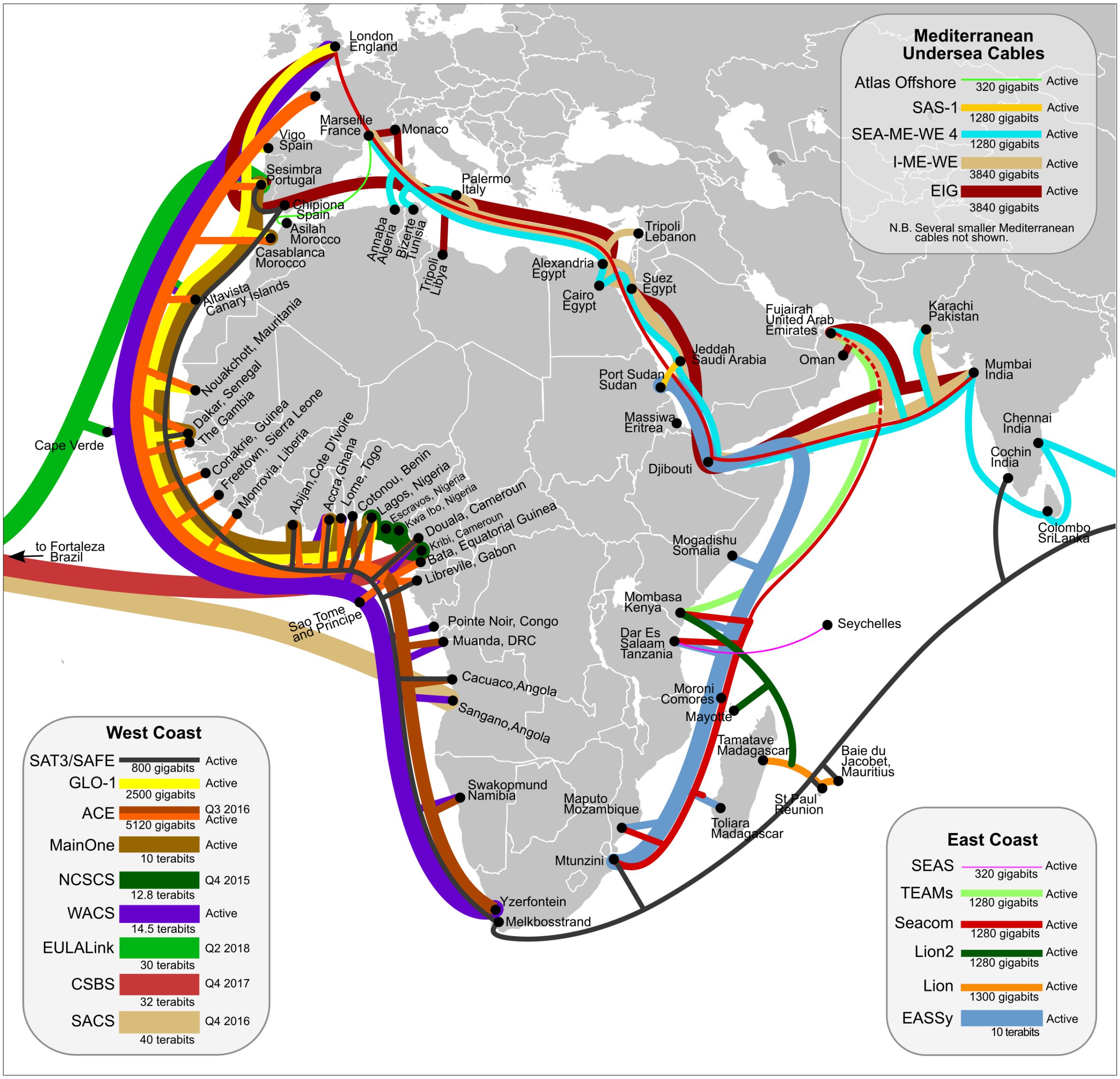
Although much of the investment in fibre optic infrastructure has been spurred by the need to provide better, faster and cheaper backhaul for mobile networks, it has also created an enabling environment for complementary last-mile solutions — a positive side effect for all. Previously, the cost of building a communication access network involved solving an array of expensive problems — from international backhaul, to national network access, to middle- and last-mile challenges and the diffusion and maintenance of access devices. Now, with the advent of locally available open-access fibre networks in primary and secondary cities in Sub-Saharan Africa, new opportunities have opened up for access providers.

SPECTRUM ROADBLOCK

While fibre optic infrastructure is transforming the underlying fabric of access models in Sub-Saharan Africa, wireless networks remain the dominant means of delivering access to the last mile. The traditional means for telecommunications operators to make wireless

1 Open-access policies ensure that access to essential communication infrastructure is available to all licensed operators on fair and reasonable terms and in a manner that is transparent and non-discriminatory.

Figure 1: African Undersea Cables



Source: Steve Song, African Undersea Cables, https://manypossibilities.net/african-undersea-cables/.

spectrum space available is through an exclusive licence for a particular frequency, usually over a period of 10 to 20 years. As demand for wireless spectrum has increased and begun to exceed its immediate availability, regulators have been challenged to find effective means of making frequencies available to operators in a timely and efficient manner.

An apt illustration of this is the transition from analog to digital terrestrial broadcasting in Africa, referred to as the digital switchover (DSO), which is intended to free up spectrum in the ultra-high frequency (UHF) bands. Digital broadcasting needs only a fraction of the amount of wireless spectrum required by analog broadcasting. In 2006, African countries agreed to participate in a DSO transition process that would, among other things, free up hundreds of megahertz of spectrum for telecommunications access (International Telecommunication Union 2006). The completion date was set for nine years into the future: 2015.

As of July 2016, few African countries have completed the transition, with economic leaders such as Nigeria and Ghana only committing to complete by 2017 (Ogundeji 2016). The reasons for this lag are bound up in a combination of technological and standards challenges, financing problems and power politics. As spectrum regulation goes, it is not unusual for deadlines like this to slip by. Traditional spectrum re-farming, which typically involves moving existing spectrum licence holders into new frequencies, can take years, with millions of consumers being affected by these changes.

What is different about the DSO decision in Africa is what has happened in the meantime. When the decision was made in 2006, many technologies that are taken for granted in 2016 did not exist. The first Apple iPhone, herald of the modern smartphone era, was only introduced in January 2007. Other technologies, such as tablets, arrived in 2010. Smartphones and tablets were key enablers of media services streamed over the Internet, such as the music service Spotify, which launched in 2008. Ironically, although movie distribution company Netflix did exist in 2006, its distribution platform was sending digital video discs via the US Postal Service. Netflix began streaming movies over the Internet in 2007. By 2014, a host of OTT video distribution companies had emerged in Nigeria, South Africa, Kenya and beyond, challenging the traditional distribution channels (Kabweza 2014). In the meantime, terrestrial television is facing growing competition in satellite television services in African countries (Eutelstat 2016). It is conceivable that digital terrestrial broadcasting could be largely overtaken by OTT and satellite services before the DSO is fully complete on the continent.

The challenge that policy makers and regulators face with the DSO is symptomatic of a more general problem: the inability to make spectrum available in a manner that can possibly account for the many inevitable yet unforeseeable changes in media and communication technologies to come.

This problem is not the only challenge that regulators in emerging markets face. Spectrum auctions have become the default mechanism for assigning spectrum in markets where demand exceeds the availability of spectrum. However, spectrum auctions are notoriously difficult to run well from the point of view of ensuring fair play and even more so from the point of view of ensuring the growth of competition (Jochum and Leonhard 2015). For modestly resourced regulators, spectrum auctions can present a significant design and execution challenge. Even those countries with considerable experience, such as Nigeria, experience challenges in their execution (Azeez 2016).

GROWTH OF ALTERNATIVES

Technological change has not only improved the communication technologies in use; it has also created new possibilities for how spectrum might be managed.

WI-FI

The most successful alternative to traditional spectrum management has been that of the unlicensed spectrum frequencies originally dedicated for industrial, scientific and medical (ISM) purposes. ISM bands are probably best known for enabling the success of Wi-Fi communication. Wi-Fi has changed from being a niche technology for geeks and experimenters, ignored by telecommunications companies, to one of the most pervasive communication technologies on the planet. Some industry analysts predict that, for consumers, 90 percent of Internet data will be carried over Wi-Fi by 2020 (Kinney 2016). This prediction highlights the importance of unlicensed spectrum as a last-mile technology. The popular perception that Wi-Fi spectrum is unregulated, and successful for that reason, is mistaken. Unlicensed spectrum *is* regulated — but it is the devices that use it that are regulated, not the spectrum. Wi-Fi devices are designed to have low power outputs that limit their ability to interfere with other devices. They are also designed to “play nicely” with each other, listening for other devices before transmitting. This design allows for a rich ecosystem to evolve without the necessity of offering exclusive rights to the spectrum to any particular user.

The integration of Wi-Fi into virtually every modern smartphone has opened up new possibilities for access. Network operators in Africa deploying metropolitan fibre networks have discovered that offering Wi-Fi networks wherever they deploy fibre offers effective consumer-access infrastructure at very low marginal cost, thanks to the comparatively infinite capacity of fibre backhaul (Dikuelo and Dichabe 2015; Beres 2015; Malakata 2015). This new opportunity is not limited to wealthy urban networks. Argon Networks in Kenya is rolling out a Wi-Fi network in Kibera, outside of Nairobi (Southwood 2015), and Mawingu Networks is delivering affordable Wi-Fi networks in rural Kenya (*Daily Nation* 2015).

DYNAMIC SPECTRUM

The success of Wi-Fi brought pressure to make more spectrum available on an unlicensed basis. More than 10 years ago, researchers began to see the potential of serendipitously making use of unused television channels in the UHF spectrum band. These buffer channels were initially referred to as Television White Space spectrum but have now come to be more generically known as dynamic spectrum. Serendipitous re-use of spectrum occupies a middle ground between traditional spectrum licensing and unlicensed spectrum. Dynamic spectrum management does not confer exclusivity in the way that licensed spectrum does, yet it offers the regulator some control over the use of the spectrum through a database approach to validating dynamic spectrum devices. Having a degree of control allows the regulator to move forward in making this spectrum available without the high risks entailed by completely re-allocating frequencies, as in the DSO.

Dynamic spectrum in the television bands has particular application in Sub-Saharan Africa because most countries in the region have few existing terrestrial broadcast channels. This means there are many channels in television broadcast frequencies currently lying fallow. Sub-Saharan Africa has more dynamic spectrum pilots under way than any other region in the world, with 11 pilots going on in eight African countries (Dynamic Spectrum Alliance 2016). These pilots have built a convincing evidence base that dynamic spectrum technologies can co-exist with broadcasters without interference. While regulation to formally permit dynamic spectrum use is under development in South Africa and Malawi, regulators seem reluctant to take the final step in gazetting regulations.

RURAL GLOBAL SYSTEMS FOR MOBILE (GSM) COMMUNICATIONS

Low-cost alternative GSM technologies have existed for a number of years, leading a variety of start-ups to build mobile technologies on low-cost hardware and open-source platforms. Such companies include Range Networks, Vanu, ViRural, Africa Mobile Networks, and Fairwaves. The result is that it is possible for anyone to erect a functioning GSM base station for a few thousand dollars. What holds these start-ups back, however, is the fact that the popular GSM spectrum bands have largely been assigned to existing mobile network operators. Low-cost GSM start-ups are left with the option of trying to sell their technology to incumbents, whose supply chains are often closely tied to large equipment suppliers.

In 2015, the Mexican communications regulator, Instituto Federal de Telecomunicaciones (IFETEL), published its new frequency plan (IFETEL 2015). IFETEL has set aside mobile spectrum in the 800MHz band to serve social good. The criteria for using this spectrum is that the population of communities being served must be less than 2,500 or the community must be designated as an indigenous region or priority zone. This regulatory decision builds on the success of a non-governmental organization that has been delivering GSM access to rural areas for several years. Rhizomatica is a non-profit organization that has been providing GSM services to indigenous communities around Oaxaca since 2012 (Salazar 2016). Until 2015, it operated under a special dispensation from IFETEL, but the allocation of spectrum to this purpose has now been made official and any organization may apply for access to this spectrum under the conditions specified. The amount of allocated spectrum is not large compared to what the big operators access, but it is more than enough for smaller communities.

Currently, Mexico remains unique in this ground-breaking regulation. Regulators in Sub-Saharan Africa could use the same strategy to ensure that sparsely populated rural areas have the potential to solve their own access challenges.

CONCLUSION

Mobile networks are the most important last-mile access technology in Sub-Saharan Africa and that fact is unlikely to change in the near future. However, evidence is mounting that existing mobile network economic models may not lead to affordable access for all, especially in poorer regions outside of urban areas. Fibre optic networks in Africa, both undersea and terrestrial, combined with lower-cost wireless access technologies, offer new models for delivering affordable access. What is needed are policy makers and regulators who embrace the strategic importance of unlicensed and dynamic spectrum and lower the barriers to access innovation. Combined with open-access policies that democratize access to fibre optic backbones, the modernization of spectrum regulation to encourage unlicensed and dynamic spectrum regulation can not only encourage competition via new forms of access but also help to develop more resilient networks through technological and economic diversity in the last mile.

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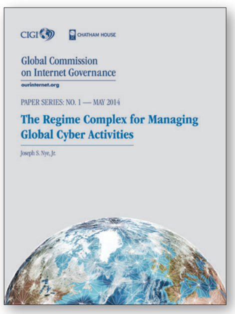

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