

UbuntuNet Alliance: A Collaborative Research Platform for Sharing of Technological Tools for Eradication of Brain Drain

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Abstract

In this paper, we envisage UbuntuNet Alliance as a continental association that enables tertiary education and research institutions collectively to strengthen research that will expand new technological tools, increase the industrial base and facilitate interaction with the African academic and research diaspora worldwide. An increase in technological tools and in the industrial base will enhance production, engender more job opportunities for sub-Saharan African society to maximise benefits from relocated brains or even help eradicate the brain drain which has taken so many excellent intellectuals to the developed world.

The UbuntuNet Alliance for Research and Education Networking is a non-profit association that gives legal and operational substance to the collaboration between National Research and Education Networks (NRENs) in the sub-Saharan region in the securing of broadband connectivity.

The Alliance acts as a consortium for the acquisition of bandwidth for education and research institutions. The Alliance works primarily with established and emerging National Research and Education Networks (NRENs) in Africa, seeking to interconnect them with NRENs outside the continent, via a pan-African high speed research and education backbone network. The Alliance's vision is to secure gigabits per second bandwidth connections at affordable prices for the NRENs throughout Africa.

The Alliance aims to acquire significant bandwidth on optical fibre cables at low cost within sub-Saharan Africa. The Alliance has a connectivity backbone development strategy that, initially, envisages two clusters: the UbuntuNet East and South Backbone Development Clusters. The UbuntuNet East Backbone Development Cluster (UEBDC) is conceived as those countries that have potential terrestrial links and access to the proposed EASSy or other submarine cable with landings on the East African coast. The UEBDC includes the following countries: Kenya, Tanzania, Sudan, Rwanda, Ethiopia, Uganda and Zambia. The UEBDC has potential options for broadband terrestrial connectivity to Europe via submarine cable landing points in Mombasa and Dar-es-Salaam, or through the Sudan and Egypt.

The UbuntuNet South Backbone Development Cluster (USBDC) comprises those states that have or soon will have broadband connectivity to the SAT-3 submarine cable landing point at Melkbosstrand, near Cape Town, South Africa. Initially, the USBDC includes the following countries: Botswana, Mozambique, Namibia, South Africa, Lesotho, Swaziland, Zambia, Malawi, Zimbabwe and Tanzania. The USBDC will also enjoy

broadband connectivity to the rest of the world through Mtunzini, north of Durban, via the South Africa Far East (SAFE) submarine cable, to Penang, Malasia, and hence, across the Pacific Ocean to the west coast of the United State of America. Further options may be available if and when the proposed EASSy cable, which is planned to have landing points in Mtunzini, South Africa and Maputo, Mozambique, and then northwards via Dar es Salaam, Mombassa and other ports all the way Port Sudan, where it will connect to existing northern hemisphere cable systems.

In this paper we stress the importance of modern, Internet-based communications nationally and regionally, and especially of “research and education networking”, as practiced in Europe and North America, in enabling the staff and students at the universities and research centres of Sub-Saharan Africa to participate as peers of and collaborators with researchers everywhere in the academic and research life. There can be no doubt that if African academics could interact remotely with other academics, with educational and research datasets and with research instruments world-wide as readily as most academics at European and American universities can, then many more African academics would elect to stay at or return to their home institutions and take pride in playing the dual role of teacher and active researcher. There can also be no doubt that such improvements in the national and regional electronic communications infrastructure, and of staffing and activities within the universities, would dramatically enable economic development and raise the demand for professionals and skilled labour generally.

Keywords: UbuntuNet, NREN, tertiary institutions, collaboration, consortium, bandwidth, Africa, development

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1. Introduction

The UbuntuNet Alliance for Research and Education Networking is an association of African Research and Education Networks (RENs). Its developmental vision of a collective research and education backbone, of acting as a consortium for bargaining for very high speed - gigabits (Gb/s) connectivity, provision of auxiliary services, access to optical fibre, establishment of clusters, and thrust to connect Africa NRENs to Géant stand as a high chance of addressing the issue of Brain Drain in Africa.

1.1. Related Work

Much has been written by many scholars about the brain drain from Africa, giving statistical figures of educated people who have left the continent for Western World in search of improved career and life-style opportunities. However, very little about the retention of the professional workforce has been discussed. Claude-Velentin Marie (2004) points out that the International Organisation for Migration estimates the number of teachers, engineers and doctors leaving Africa every year at twenty thousand. He further states that although the continent needs one million engineers and scientists for its development, even Nigeria, the richest country, has not been able to prevent the exodus of about forty thousand graduates. John Salt (2006) gives a comparison by national origin of the immigrants accepted for settlement in Britain as: from Africa and from Asia other than the Indian sub-continent, 30% each; from the Indian sub-continent, 16%; from Europe, 12%; and from the Americas, 8%. From this sampled statistical comparison, Africa shows high rate of immigrants considering that Asia has a very much higher population. In this way, Africa has paid dearly to attract expatriates to take up strategic positions. According to a US Congressional Research Service report, it can be extrapolated that between 1985 and 1990, for the sixty thousand (60,000) professionals who emigrated, the continent of Africa spent USD1.2 billion in that time period alone. This sum excludes any valuation of the further loss of intellectual capacity during the period.

In this paper we focus on a particular set of initiatives that focus on the power of dramatically improved electronic communications to help reduce and even reverse the brain drain from Africa.

1.2. Statement of the Problem

In the Western World, the research done in universities has fuelled economic development. Atkinson (1997) points out that the American science advisor of 50 years ago, Mr. Vannevar Bush, in his report entitled “Science: The Endless Frontier”, which is one of the great documents in American history, viewed science as a vast frontier of opportunity to serve virtually every aspect of the national welfare. Atkinson also cites a report of President Clinton’s Council of Economic Advisers called “New Growth Theory” which states that 50% of the growth in the American economy in the last 40 years has been due to investments in research and development. Atkinson emphasises that the United States relies more than ever on Universities for the basic research that will ultimately fuel its economy. He summarises recent statistics as showing that 73% of the papers cited by U.S., industry patents are based on publicly supported science, authored principally by academic scientists; with the remaining 27 percent being authored by scientists employed outside academe. This shows how the research carried out in

American universities and research institutions enhanced the growth of industries in USA and created more job opportunities for both citizens and foreigners.

By contrast, in sub-Saharan Africa, throughout the post-independence period, industries have remained largely static due to lack of both innovation and invention of new technological tools for production.

Few African universities are in position to spearhead the research that is required to provide the tools to drive these industries. While student numbers may have increased, investment in institutional infrastructure has been very limited, especially as concerns the laboratories, equipment and campus networks required by science and science-based faculties like engineering and medicine. In addition, research and education networks do not yet exist in the vast majority of sub-Saharan African countries. Few African universities have Internet connections of more than two or three megabits per second, which is completely inadequate to allow staff or students to participate in today's data-intensive scientific research milieu.

The upshot is that African academics in such disciplines face a fundamental and dramatic choice. To participate at the cutting edge of research and scholarship; to be able to attract students and to work with colleagues at the frontiers of knowledge, the African academic has to try to leave Africa and find a position at a university or research centre in a developed country elsewhere. To stay at a university in Africa is to accept a role that is primarily educational and developmental and to recognise that participation in open scholarly and research activity will be a tough struggle against unfair odds. While many academics do remain and perform valuable services in their universities, many others feel that they have no option but to become part of the brain drain from Africa.

2. Reversing the Brain Drain

Many different interventions by many different parties are needed to slow down and eventually reverse the brain drain from Africa. This paper focuses on infrastructural interventions that help to nullify the effects of geographic isolation of Sub-Saharan universities and research centres from each other and from other centres worldwide.

Specifically, we stress the importance of modern, Internet-based communications nationally and regionally, and especially of "research and education networking", as practiced in Europe and North America, in enabling the staff and students at the universities and research centres of Sub-Saharan Africa to participate as peers of and collaborators with researchers everywhere in the academic and research life. There can be no doubt that if African academics could interact remotely with other academics, with educational and research datasets and with research instruments world-wide as readily as most academics at European and American universities can, then many more African academics would elect to stay at or return to their home institutions and take pride in playing the dual role of teacher and active researcher. There can also be no doubt that such improvements in the national and regional electronic communications infrastructure, and of staffing and activities within the universities, would dramatically enable economic development and raise the demand for professionals and skilled labour generally.

3. General Remarks on Communications Industry Development

The pace of development of the communications infrastructure is accelerating in many countries of Sub-Saharan Africa. The extraordinary growth of mobile telephony shows that the African giant has awoken, and in several countries mobile operators have grown to become effective alternatives and serious challenges to the established and over-protected incumbent telecommunications operators. New optical fibre cables are being deployed; not only by telecommunications operators but also by electricity companies along their power lines, by gas companies along gas pipelines and by railways along railway lines.

There is also accelerating development of communications services to end customers – services that depend upon the aforementioned infrastructure. In particular commercial Internet service providers compete with each other in many countries. National Associations of Internet Service Providers have been formed in several countries as well as a regional association of African Internet Service Provider Associations, known as AfrISPA¹. With support from DFID, IDRC and OSI, AfrISPA has successfully fostered the creation of operational Internet Exchange Points as well as fostering the formation of national Internet Service Provider Associations. A key role of each national association is to actively lobby for and foster the levelling of the playing field as regards telecommunications regulations and curtailing unfair competition from incumbent telecommunications operators².

It is of the greatest importance for economic development and for reversing the brain drain that African governments should move away from nurturing the market power and financial interests of incumbent telecommunications operators and instead, should promote the growth of efficient electronic communications industries. This should be done at all levels from the deployment and operation of infrastructure, including cross-border international connectivity, to the provision of communications services to end-customers.

4. Research and Education Networking

4.1 General Remarks

“Research and education networking” refers to the organised inter-connection, at very high bandwidths, of campus networks of universities and research institutions, nationally, regionally and globally. Most countries of the World have a National Research and Education Network (NREN). At the continental level, NRENs in Europe, North America, Canada, Latin America and the Far East have formed so-called regional research and education networks: Géant in Europe, Abilene and NLR in the USA, CANARIE in Canada, RedClara in Latin America and TEIN2 in the Far East. These regional RENs, inter-connect with each other to form a single inter-connected global research and education network.

¹ See <http://www.afrispa.org>

² Anticompetitive behaviour by incumbents is not limited to Africa. On 4 July 2007, the European Commission fined Spain’s Telfónica €152 million for unfairly narrowing the margin between its wholesale prices for infrastructural services to competing Internet service providers and the price at which Telfónica itself sold Internet access to retail customers. Telfónica was reported as having said that it had not applied prices that the Spanish regulator had not approved.

The policies and practices of research and education networking are very well established in most countries and regions of the World. A key element is compliance with and respect for each others' Acceptable Use Policies (AUPs) that delineate what kinds of institutions may connect and for what purposes. Commonly, use of the network or services for commercial purposes is prohibited.

Organisationally, research and education networking is controlled and managed at the institutional campus network level; at the national level where responsibility and initiative lies with the NREN, and at the regional and global level, where responsibility and initiative lies with regional RENs to establish regional backbones that inter-connect the NRENs of the region, and to inter-connect regional backbones to each-other as part of the global REN.

4.2 NRENs in Sub-Saharan Africa

When it comes to research and education networking, Sub-Saharan Africa is dramatically under-represented, but the region has started moving decisively to remedy this position. In doing so, it has many friends and supporters, and the REN community worldwide will welcome Africa's rise to parity as regards connectivity for its universities and research institutions.

In Sub-Saharan Africa only four NRENs are operational in the sense that they are delivering services to their member institutions³. But there is a flurry of activity to form NRENs in many other countries. At a workshop for emerging NRENs held on 22 February 2007 in Nairobi, fourteen countries of Central, Eastern and Southern Africa were represented. This activity is spurred on by the accelerating deployment of optical fibre networks and the prospect of new submarine cables being laid along the eastern seaboard of African, including the so-called EASSy cable system and others. In some countries, the NREN is being formed through a project run by a government department, and in others, as a non-governmental association of universities and research institutions.

4.3 Formation of the UbuntuNet Alliance

Established and emerging NRENs in Kenya, Malawi, Mozambique, Rwanda and South Africa⁴ came together in the latter half of 2005 to found a new regional research and education network: the UbuntuNet Alliance for Research and Education Networking. The UbuntuNet Alliance is driven by a vision of securing high bandwidth connections - gigabits instead of the current kilobits per second – at affordable prices, that connect African NRENs to each other, to other NRENs worldwide, and to the Internet generally⁵.

The UbuntuNet Alliance will not normally be involved in development of specific campus networks. At the national level, the Alliance promotes the establishment of

³ These are Kenya Education Network (KENET), Malawi Research and Education Network (MAREN), Sudan Universities Information Network (SUIN) and Tertiary Education Network (TENET) in South Africa.

⁴ The Alliance currently comprises six Participating NRENs: KENET (Kenya), MAREN (Malawi), MoRENet (Mozambique), RwEdNet (Rwanda), SUIN (Sudan) and TENET (South Africa). The Directors of the UbuntuNet Alliance are Prof Zimani Kadzamira (Chairperson, Malawi), Victor Kyalo (Kenya), Duncan Martin (South Africa), Jameson Mbale (Zambia), Américo Muchanga (Mozambique), Margaret Ngwira (Malawi), Albert Nsengiyumva (Rwanda), F F (Tusu) Tsubira (Uganda).

⁵ See <http://www.ubuntunet.net>.

NRENs as organisational entities and collaborates with NRENs in securing access to optical fibre infrastructure.

At the regional level, the Alliance will deploy cross-border links to inter-connect member NRENs, recognising that each NREN may have to transit traffic to and from other NRENs as part of the collaborative enterprise. The Alliance's strategy for gaining access to optical fibre infrastructure is opportunistic. At present development is focussed on eastern and southern "clusters" of NRENs. The Alliance has invited the West African university and research community to propose a west "cluster" project.

Finally, at the global level, the UbuntuNet Alliance will provide connectivity for its member NRENs to global REN via the best means available. For the eastern cluster, this entails VSAT links for the immediate future, but with the prospect of submarine connectivity via one of several projects that envisage laying a cable along the east coast of Africa. The southern cluster will use the existing SAT-3 submarine cable, and also, potentially, have access to future east coast and west coast submarine cable systems. These strategies are discussed further below and in Martin (2007).

Of course, this simple hierarchical picture is simplistic, especially as it ignores the reality that many campus networks cannot connect to any other campus, let alone to an NREN, because of a lack of available communications infrastructure. Such institutions have little choice but to procure Internet connectivity from a satellite provider, and to accept that all traffic that passes between the campus and any other network, will traverse an expensive, high-latency satellite circuit and pass through the provider's teleport in Europe or elsewhere outside Africa. The UbuntuNet Alliance will attempt to provide useful services to such institutions, in collaboration with whatever NREN to which they will eventually be able to connect. The "Thrust to connect to Géant", which is described below, is one such service.

4.4. Terrestrial Inter-Connectivity Between NRENs

Many if not most tertiary institutions depend on VSAT communications, which is very expensive. It is with this view that the UbuntuNet Alliance will secure terrestrially-based communications through the NRENs of the Sub-Saharan, by establishing at least two initial sub-regional backbones, which the Alliance calls "clusters". These are the UbuntuNet East Backbone Development Cluster (UEBDC), which is conceived as those countries that have potential terrestrial links and access to the proposed EASSy or other submarine cable with landings on the East African coast. The UEBDC includes the following countries: Burundi, Kenya, Tanzania, Sudan, Rwanda, Ethiopia, Uganda and Zambia. The UEBDC has potential options for broadband terrestrial connectivity to Europe via submarine cable landing points in Mombasa and Dar-es-Salaam, or through the Sudan and Egypt. Such a project would definitely create jobs for engineers who would lay the terrestrial cable across the named countries. This would create global employment for the Sub-Saharan nationals.

The UbuntuNet South Backbone Development Cluster (USBDC) is considered to comprise those states that would have broadband access through the SAT-3 submarine cable landing point at Melkbosstrand, near Cape Town, South Africa. The USBDC may include the following countries: Botswana, Mozambique, Namibia, South Africa,

Lesotho, Swaziland, Zambia, Malawi, Zimbabwe and Tanzania. The USBDC would also be considered for broadband connectivity to the rest of the world through Mtunzini, north of Durban, via the South Africa Far East (SAFE) submarine cable, to Penang, Malasia, and hence, across the Pacific Ocean to the west coast of the United State of America. A further option would be the EASSy cable which has landing points in Mtunzini of South Africa and Maputo of Mozambique.

4.5. Thrust to Connect the NRENs of Africa to Géant in Europe

The UbuntuNet consider establishing connectivity to Géant using existing service contracts and infrastructures, including both terrestrial and satellite-based infrastructures, as a service that the Alliance can offer almost immediately to participating RENs. This thrust focuses on IP routing arrangements, and establishes institutions' connectivity to UbuntuNet and via UbuntuNet to Géant without waiting for broadband transport infrastructures to become affordable or available. The bandwidth of the connectivity is determined by the institutions' and NRENs' existing infrastructure, and, in many cases, would not be at broadband speeds. The Alliance will establish a single connection to Géant from an UbuntuNet Hub that the Alliance will establish and operate at or near Géant's PoP in London. The NRENs will connect to the UbuntuNet Hub either directly or using GRE tunnels through the networks of the NRENs' current Internet Service Providers. However, for many NRENs, the long-haul connectivity from Africa involves transmission segments via satellites.

4.6. UbuntuNet Provision of Auxiliary Services

The UbuntuNet Alliance intends to provide auxiliary services to its member NRENs Institutions. For instance, the inter training programmes, such as Network Administration, Network Cabling, Network Trouble-Shooting, e-learning Content or Resource development, and bandwidth management among Sub-Saharan institutions. Having carried such training, the Alliance would be in better position to deploy the skilled personnel to the NREN states that lacks particular skilled experts.

5. Conclusions and Future Work

In this paper we have stressed the importance of modern, Internet-based communications nationally and regionally, for economic development and to help to reverse the brain drain. In particular, Africa must evolve research and education networking, as practiced in Europe and North America, and in local versions, to enable the staff and students at the universities and research centres to participate as peers of and collaborators with researchers everywhere in their academic and research life.

The UbuntuNet Alliance forms a Sub-Saharan continental bandwidth consortium. Such a consortium bargains for cheaper or affordable bandwidth for the institutions. The acquisition of adequate bandwidth facilitates efficiency communication in an industry or institution. Once there is an efficiency communication, production is increased as well. An increase in production may improve the wages of the employees who will be encouraged to work locally.

The USBDC, and USBDC massive terrestrial connectivity would create more jobs for the nationals along the areas where the cable is laid. Apart from that this terrestrial connectivity would improve continental connectivity which would improve the efficiency

of communication and facilitate high productivity. This would definitely enable various countries expand their industries, as such more job opportunities are established.

The success to connect the NRENs of Africa