

## The emerging Research and Education Networks of sub-Saharan Africa

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### Summary

The two most important developments for securing improved Internet access for universities in sub-Saharan Africa in the future are

- (a) the increased tempo at which national operators, cellular operators, multinational consortia of operators, and electrical power companies are **deploying optical fibre networks** that offer the prospect of much greater connectivity via optical fibre networks; and
- (b) the rapid emergence of **national and regional Research and Education Networks (RENs)** as the organisational vehicles for inter-institutional collaboration.

EASSy<sup>1</sup> is a submarine cable system that will run along the east coast of Africa and is scheduled to come into service in late 2007. This is a major development, as are associated projects to connect metropolitan areas in the "EASSy hinterland", which includes land-locked countries of Central and East Africa.

National RENs (NRENs) already exist in Kenya and in South Africa. Active projects to establish NRENs are underway in Mozambique, Malawi, Rwanda, Tanzania, Uganda and Zimbabwe. The first sub-Saharan regional REN is in the process of being formed under the name of "The UbuntuNet Alliance".

The emerging national and regional RENs of Africa need the support of all parties that wish to see the universities and research institutions of sub-Saharan Africa as well connected to the Internet as are their counterparts in Europe and America. High speed connectivity to each other and to Research and Education Networks world-wide is especially important.

### Optical fibre deployments

**Terrestrial connectivity** using optical fibre cables is vastly preferable, in terms of capacity, communications effectiveness and cost, to connectivity that involves space segments, as is case with VSAT<sup>2</sup> connectivity. While many Universities in sub-Saharan Africa are still dependent upon satellite-based connectivity to the Internet, the picture is changing quite rapidly, especially as regards institutions located in or near major metropolitan areas.

Major drivers of new fibre deployments include

- the amazing uptake of mobile telephony and the needs of the mobile operators for backbone connectivity;
- the deployment of optical fibre by electrical power companies as they upgrade and extend the power grid;
- in many countries, removal of the restrictive regulations that enforced the monopoly of the historical incumbent operator (notably, this applies to most East African countries, but much less so to those of Southern Africa);
- the prospect of the East Africa Submarine System (EASSy); a submarine cable system that will run along the east coast of Africa from Mtunzini on the South African

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<sup>1</sup> East Africa Submarine System

<sup>2</sup> Very Small Aperture Terminal

Coast to Port Sudan in the Sudan, with landing points at Maputo, Toliary (Madagascar), Dar es Salaam, Mombasa, Mogadishu, Djibouti and Mitsiwa (Eritrea), and will connect via existing cable systems to Europe and the World. EASSy is expected to come into operation in late 2007. Plans provide for the "EASSy hinterland" - the region that is connected via optical fibre to an EASSy landing point, to include all the countries of East Africa, including the land-locked ones such as Rwanda, Uganda and Zambia.

The maps below are taken from the EASSy Consortium's web site <http://eassy.org>. Map 1 shows the planned routing and landing points, while Map 2 depicts the envisaged hinterland backhaul network.



Map 1



Map 2

Of course, time will tell whether the EASSy cable system and its associated hinterland connections will be a great enabler, or, like the SAT-3 system, will be mainly a wealth generator for its share-holders. There are signs that governments in the region have learned the lessons of the SAT-3 experience.

## National Research and Education Networks (NRENs)

The NRENs of Europe are the prototypes for collaborative networking between and for universities and research institutions. Most of them receive substantial funding from their national governments. Some are governmental bodies staffed by civil servants, but many are structured as non-governmental associations of member institutions, with government officials participating in, but not controlling the governance processes.

National Research and Education Networks (NRENs) are not-for-profit organizations characterised by:

- their national character;
- their *inclusiveness* - i.e. their acceptance of all universities and research institutions in the country (other than perhaps, for-profit and/or foreign-owned institutions) as members; and
- their primary purpose of taking responsibility for organizing inter-institutional connectivity for their member institutions and providing shared connectivity for these institutions with other NRENs world-wide.

Many NRENs also take responsibility for providing general Internet access (as opposed to inter-NREN connectivity) for their member institutions. Some NRENs also organize inter-institutional collaborations on capacity development, library matters and even academic matters.

NRENs already exist in Kenya (KENET<sup>3</sup>) and in South Africa (TENET<sup>4</sup>). Active projects to establish NRENs are underway in Mozambique, Malawi, Rwanda, Tanzania, Uganda and Zimbabwe. Such projects have been mooted in Senegal and Zambia. In Nigeria a small group of universities has formed a "Bandwidth Forum", but it is unclear at this stage whether this grouping intends to become sufficiently inclusive to be regarded as an NREN.

## Regional Research and Education Networks

Regional Research and Education Networks are consortia of NRENs. The European Commission's famous Géant network is the prototype Regional REN that inter-connects 35 NRENs in Europe via a very high-speed pan-European backbone network, and has high-speed links with RENs in the Americas, Eastern Europe, the Middle East, North Africa and the Far East. In essence, the role of the Regional REN is to provide *international connectivity* to its member NRENs.

The first African Regional REN was the EUMEDCONNECT network that inter-connects NRENs of Algeria, Egypt, Morocco and Tunisia, and provides a shared fast connection to Géant.

The first sub-Saharan Regional REN is in the process of being formed under the name of "**The UbuntuNet Alliance**". It envisages:

- having all NRENs in East and Southern Africa as its members;
- developing a regional backbone network that will inter-connect the NRENs, using optical fibre links wherever possible and microwave links otherwise, from a range of operators; and
- providing the NRENs with high-speed connectivity to Géant and other RENs of the World via the EASSy submarine cable that will become operational in late 2007.

The UbuntuNet Alliance is trying to become a member, in some suitable sense, of the EASSy consortium, so as to secure access at wholesale prices to bandwidth on the cable. In November 2005 this strategy was aired in Tunis at the World Summit on the Information Society, and received some publicity. So far the consortium has declined to enter into any dialogue with the Alliance. It is important to note that the purpose of the Alliance is not thwarted if it fails to become a member of the consortium. The purpose is to be an effective regional REN for its member NRENs, as stated in the above bullet points. Becoming a member of the consortium is one possible means to this end, but it is not the sole means, and it is not the end itself.

A key challenge facing the UbuntuNet Alliance in building out its regional backbone is that of overcoming the common practice by incumbent operators of charging exorbitant prices for cross-border half-circuits.

The idea of a West African Regional REN was mooted at a very recent conference in Dakar, Senegal. This will provide connectivity to Europe via the SAT-3 WASC cable when its use

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<sup>3</sup> Kenya Education Network. *The Kenyan NREN.*

<sup>4</sup> Tertiary Education Network. *TENET is the de-facto South African REN. The writer is its CEO. TENET is controlled by Higher Education South Africa (HESA), the association of vice-chancellors of South African universities. TENET may be subsumed within or replaced by the South African National Research Network, SANReN, which the South African Department of Science and Technology intends to establish.*

becomes more affordable. In this regard, it is important that the "exclusivity period" granted by the SAT-3 consortium to national incumbent operators ends on 18 April 2007.

## **Conclusions**

From the beginning of 2008, growing numbers of universities and research institutions in East and Southern Africa will be able to enjoy fast, terrestrial connectivity to each other, to RENs in other parts of the World, and to the Internet generally. This will apply soonest to institutions in or near to major cities, which means that *from early 2008, many if not most of the region's major universities and research institutions will be finished with VSAT connectivity*. Some institutions will not benefit as early as others, and institutions in remote areas may well be dependent on VSAT connections for several years longer.

This means that each NREN will be running a growing terrestrial backbone, to which an increasing proportion of its member sites connect. Clearly the NREN is well placed to assist its member sites to plan and prepare for their eventual connection to the NREN's terrestrial backbone, and the concomitant termination of VSAT services. *NRENs that include all of their countries' universities and research institutions and provide VSAT services to those member sites that still need them will be especially well positioned to manage the migration to terrestrial connectivity for their country's institutions collectively.*

The emerging national and regional RENs of Africa need the support of all parties that wish to see the universities and research institutions of sub-Saharan Africa as well connected to the Internet as their counterparts in Europe and America are. In particular, funding agencies that sponsor and support connectivity development for the benefit of education and research are encouraged to shift their focus from the level of selected individual institutions to that of the NRENs and the regional RENs. Agencies should establish primary developmental relationships with the NRENs, and should encourage NRENs to welcome all bona fide universities and research institutions in their countries as members. Wherever possible, agencies should leave the management of connectivity relationships with the institutions to the NRENs irrespective of whether the institution requires terrestrial or VSAT connectivity.

The approach described above has many advantages. One is that it promotes the inclusiveness of the NRENs by providing a direct incentive for institutions to join the NRENs even while they still require VSAT connectivity. The advantages of scale are immediate – NRENs as "bandwidth consortia" will negotiate on behalf of all institutions in their countries. Better still, when regional RENs negotiate with network operators, including VSAT providers, they will be representing most of the universities and research institutions in sub-Saharan Africa.

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