

UbuntuNet-Connect 2010

Rolling out the Regional Infrastructure: from Dreams to Achievements

"Infrastructure...Applications....Content...Innovation...Regulation"



Proceedings and Report of the 3rd UbuntuNet Alliance Annual Conference

17 - 18 November 2010

Kopanong Hotel, Johannesburg, South Africa

ISSN 2223-7062

Proceedings Editors:

Tiwonge Msulira Banda, Margaret E Ngwira and Eng Dr F F Tusubira

UbuntuNet Alliance Secretariat

Lilongwe, Malawi

Lilongwe: UbuntuNet Alliance, 2011

www.ubuntunet.net

ISSN 2223-7062

ISSN 2223-7062

Key title: Proceedings and report of the ... UbuntuNet Alliance annual conference

Abbreviated key title: Proc. rep. UbuntuNet Alliance annu. conf.

IDRC CORENA Project [105717](#) provided funding in support of this event.

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1. INTRODUCTION

Academic and Research Networking is an extremely dynamic field and never more so than in Africa today. UbuntuNet-Connect is the series of annual conferences organized by UbuntuNet Alliance that track the progress in the area. The first was held in Lilongwe, Malawi in November 2008, the second in Kampala, Uganda in 2009. The third conference, UbuntuNet-Connect 2010, was held at 17 - 18 November 2010 at Kopanong Hotel, Johannesburg, South Africa.

The theme was

Rolling out the Regional Infrastructure: from Dreams to Achievements "Infrastructure...Applications....Content...Innovation...Regulation"

The conference attendance grows each year. This year it was attended by presenters and delegates from Africa, Europe and the America, bringing together, researchers, policy makers, ICT business representative, connectivity providers, academicians and a pool of expertise in research and education networking. Of particular significance was the high level delegation from the Africa Union Commission led by the Director of Human Resources, Science and Technology, Vera Brenda Ngosi. In her opening remarks she reminded us that the vision of the African Union is a peaceful, integrated, prosperous Africa, driven by its own citizens to take up its rightful place in the global community and that . Infrastructure development including e-infrastructures continues to play an important role to attaining this Vision

In addition to the core funding from IDRC, several prominent companies provided sponsorship: CISCO Systems, SEACOM, Dimension Data and MWeb, There was also an accompanying exhibition. For the first time, papers were peer reviewed and presented and these are included in this volume. Thanks are extended to the CEOs of MAREN, RENU, TERNET and XNET for ably rapporteuring the sessions

The main conference was preceded by an exciting series of capacity building activities, details of which are contained in Annexe 1.

Fuller details can be found on the UbuntuNet Alliance website:

http://www.ubuntunet.net/uc2010_program

2. CONFERENCE PROGRAMME

The presentations are posted on the Conference page of the UbuntuNet Alliance website http://www.ubuntunet.net/uc2010_program

PROGRAMME

Day 1, 18th November 2010	
<i>Time</i>	<i>Activity</i>
0730 - 0830	Registration: Ms Beatrice Ng'ambi
<i>Opening Session, Chair: Dr. Iman Abdelrahman, CEO of SUIN and Vice Chair of UbuntuNet Alliance</i>	
0830 - 0900	Introductions (by country) <i>Dr. F.F Tsubira, CEO of UbuntuNet Alliance</i>
0900 - 0905	Welcome remarks from the Chair of the UbuntuNet Alliance <i>Prof Zimani Kadzamira, Chair UbuntuNet Alliance</i>
0905 - 0910	Welcome remarks from TENET, the host Dr Duncan Martin, CEO of TENET
0910 - 0920	Remarks from the Research and Education Networking Unit of the Association of African Universities <i>Dr Pascal Hoba, AAU</i>
0920 - 0930	Remarks from the African Union Commission <i>Mrs Vera Brenda Ngosi, Director, Human Resources, Science and Technology, AUC</i>
0930 - 0950	Keynote Address and Opening by the Guest of Honour <i>Prof. Loyiso Nongxa, Chair of TENET</i>
0950 - 1000	Vote of Thanks and Announcements <i>Ms Ludmila Maguni, CEO of MoRENet</i>
1000 - 1030	<i>Group photograph and Health Break</i> <i>Geoff Hoy</i>
<i>Sub-theme 1: Content, Applications, Innovations, and Collaboration, Chair: Dr. Patrick Mangheni, CEO, RENU</i>	
1015 - 1045	Co-ordination and Harmonisation of Advanced e-Infrastructures (CHAIN) <i>Tiwonge Banda, UbuntuNet Alliance and Dr Bruce Becker, SAGrid</i>
1045 - 1100	Discussion
1100 - 1115	The role of broadband networks for the social and economic development of

	the countries <i>Alireza Khosrow, e-Government and e-education Director, Alcatel-Lucent</i>
1115 - 1135	New Models for Education Access and Innovations for NRENs in Africa <i>Ashraf Patel, SAFIPA</i>
1135 - 1145	Discussion
1145 - 1205	The UbuntuNet Research Index for Information Sharing Model <i>Dr Nora Mulira, Director, Directorate for ICT Support, Makerere University</i>
1205 - 1215	Discussion
1215 - 1235	Enhancing ICT Development in Africa: a framework for collaboration between NEPAD and African Research and Educational Institutions <i>Dr Towela Nyirenda-Jere, Programmes Manager, NEPAD e-Africa Programme</i>
1235 - 1245	Discussion
1245 - 1345	Lunch break
<i>Sub-theme 2: Infrastructure, Chair: Moses Bayingana, ICT Expert, AUC</i>	
1345 - 1405	Adding Academic Networks as an external KML map layer to the web version of the Africa Transmission Network Map <i>Paul Hamilton, Independent Consultant</i>
1405 - 1420	Discussion
1420 - 1440	Emerging NRENs in Western and Central Africa and WACREN <i>Dr Ousmane Moussa, University of Moumouni, Niger, WACREN Representative</i>
1440 - 1455	Discussion
1455 - 1525	Health Break
1525 - 1700	Moderated Panel discussion (with audience input and questions): The Direction of Further evolution of fibre to and within Africa <i>Chair: Steve Song with J.L Parmentier (SEACOM), Axel Cleaberg (SISCO), Pierre vd Merwe (XON- Juniper) and Erik Osiakwan (afrISPA)</i>
<i>1900 - 2200</i>	<i>Social Event</i>
Day 2, 19th November 2010	
<i>Subtheme 3: Sharing Experiences and Innovation, and Initiative into Africa, Chair: Prof. Zimani Kadzamira, Chair UbuntuNet Alliance</i>	
0830 - 0850	What kinds of organisations may NRENs serve? <i>Dr Duncan Martin, CEO of TENET</i>

0850 - 0900	Discussion
0900 - 0920	Internet2, USA <i>Dr. Louis Fox, Internet2</i>
0920 - 0930	Discussion
0930 - 0950	GEANT, The pan-European Regional REN <i>Cathrin Stover, International Relations Manager, DANTE</i>
0950 - 1000	Discussion
1000 - 1020	Strategic Communication for NRENs and RRENs <i>Dr. F.F Tsubira, CEO of UbuntuNet Alliance</i>
1020 - 1030	Discussion
1030 - 1100	Health break
<i>Sub-theme 4: Regulation, Chair: Dr. F.F Tsubira, CEO of UbuntuNet Alliance</i>	
1100 - 1230	Moderated Panel discussion with audience input on Regulation: Is the regulatory environment in Eastern and Southern Africa supportive for the development and operation of NRENs and the Alliance Chair: Tusu with <i>Moses Bayingana, ICT Expert, HRST, AUC, Ms Joanita Namwepa, Manager, Enforcement and Compliance, UCC, Garry Mukelabai, Director, Technical Services, ZICTA</i>
11:00 - 11:30	Regulation Environment in Africa <i>Moses Bayingana, ICT Expert, African Union Commision</i>
11:30 - 12:00	Regulations and RENs <i>Garry Mukelabai, Manager Information Systems, Zambia ICT Authority</i>
12:00 - 12:30	Supportive Regulation for Research and Education Networking in Africa <i>Joanita Nampewo, UCC</i>
1230 - 1245	Sum up and closing
1245	<i>Lunch and departure</i>

3. CONFERENCE OPENING

The opening session was ably chaired, Dr Iman Abdelrahman, the CEO of SUIN who is also the Vice Chair of the UbuntuNet Alliance.

After a round of introductions of country delegations, managed by eng Dr Tusubira, CEO, the Chair of UbuntuNet Alliance, Professor Z D Kadzamira, welcomed all the participants to this the third UbuntuNet Connect Conference as follows :

Vice Chancellor Prof Ngwabi Bhebe
Our Very Special Guests from the

- African Union Commission,
- NEPAD,
- Association of African Universities,
- DANTE,
- CLARA,
- WACREN,

Representatives from other institutions,
Distinguished Conference Participants
Ladies and Gentlemen

Our Guest of Honour

It is quite clear from the extensive introductions just made that apart from the immediate family of NRENs that constitute UbuntuNet Alliance there is wide representation from our continent and from Europe and the Americas.

I daresay that we have before us a most impressive gathering of personages in the history of the Alliance especially in view of the impending launch of the AfricaConnect Project.

I am therefore delighted to welcome, on behalf of the Alliance, all the distinguished participants to this important meeting. While echoing the Chairperson's message of welcome, let me extend a special welcome to our Guest of Honour. Protocol demands that I do so even though the rest of us are technically his guests since TENET is hosting the conference. We are most grateful that you have spared some time from your busy schedule to join us this morning.

I am also mindful of the fact that, within the hour or so, you will be chairing the meeting of the TENET Board at these premises. We can hardly fault your choice of venue since a good host should never be too far from the guests. We fully appreciate the hospitality extended to us.

In view of what promises to be a tight schedule let me end my welcome remarks by expressing our deepest gratitude to the sponsors of the series of meetings we have been holding since Monday. To begin with, our thanks go to TENET for making all the arrangements at this fabulous resort: Kopanong that appropriately mean "a meeting place".

Without the supplementary funding support from IDRC, Cisco, SEACOM, Dimension Data, MWEB and all those who facilitated the participation of our delegates, this UbuntuNet Connect conference would still be on the drawing board.

Thank you all for your collaboration, confidence and trust. Thank you for supporting this review of achievements to date as the regional infrastructure rolls out for our mutual benefit. As we have witnessed already there are still many challenges to face and these will call for even greater collaboration in the immediate future.

Once again, a cordial welcome to all.
Thank you.

4. FULL PAPERS

There follow the 4 peer reviewed papers submitted for the Conference, three in Subtheme 1: Content, Applications, Innovations, Collaboration and one in Subtheme 2: Infrastructure

New models for NREN's and Universities in era of Broadband and Web 2.0 Applications and Innovations:

Ashraf PATEL

*SAFIPA Programme, c/o Meraka Institute, P.O Box 395, Pretoria 0001, South Africa
Phone: +27 76 753 9158 Email: ashrafp07@gmail.com*

Abstract

National Research and Education Networks (NREN's) are relatively new institutions that have evolved in Sub-Saharan Africa Higher education landscape. The changing role of universities in context of globalisation, participating in global scientific and research communities and the recent role internet and web's transformation in education delivery have seen sea-changes. The advent of undersea cables and open access principles in many SSA's presents an opportunity for upgrade in value chain-purchasing wholesale capacity and passing benefits to members (i.e. UbuntuNet Alliance).

With advent of a new 'broadband abundance' environment, there is logical evolution of both NRENS and their role in education networking. As Higher Education Institutions (HEI's) evolve into 21st century, they will require new generation NREN's with capacity, networking, advocacy and managerial capability for the 21st century. Through NREN collaboration, new research and development capacity, increased post-graduate student, universities are developing corporate models management functions – *strategic management, managing IPR and patents, commercialization of technology, etc.* Hence a new business model for Universities and NRENS are emerging.

Broadband abundance in SSA's Higher Education landscape will enable and drive many new generation innovation areas such as *apps development, incubation service, cloud computing, etc.* New trends in open education resources (OER) and the creating enabling environment for new content as well as new application development will require that many universities to provide new generation services like incubation services, shared services and support and tech entrepreneurship services. This require HEI's and NREN's to develop new services to be in line with rapid and multi-layered demands of the 21st century university.

1. Background and Context

On the eve of the 10th year of the UN review of the UN Millennium Development Goals (MDG's) in New York in September 2010, the ITU/UNESCO's new Digital

Commission for Broadband Development (DCBC) formally launched its 2010 Declaration of Broadband for Inclusion for All at the UN General Assembly with a clarion call for an inclusive broadband agenda:

'We believe that the Internet should be used for the benefit of mankind. Beyond any physical and virtual infrastructure that has preceded it in the industrial revolution or information age, and as a catalyst of and critical enabler for recovery in the wake of the global financial meltdown, broadband will be the digital invention and innovation and foundation for digital and other investments that lie at the very heart of our shared knowledge economy and society...' ITU UN Broadband Commission Sep 2010(www.broadbandcommission.org)

It is significant (and not surprising) that one of the key recommendation of the ITU/UNESCO Broadband Commission (recommendation 3.1) calls for investments in 'future proofing' technology. *'Optical fibre is desirable at the core of the internet, and for the majority of backhaul traffic, to achieve a high-capacity backbone....'* And it is international undersea optic cables & national fibre-networks that will deliver the high speed broadband networks for both developed for developing regions.

2. Plugging SSA' Info-Infrastructure Gap - Undersea Cable boom in SSA

However, Sub-Saharan Africa's (SSA) exhibits many 'telecoms paradox' deficits & outcomes' preventing it from accessing and using broadband services.

While developed and developing regions (Europe, Asia, Latin America, Oceania) of the world have made good progress at providing internet and broadband to citizens at affordable rates. Sub-Saharan Africa (SSA) *internet access, usage, affordability* and hence social appropriate is the lowest in the world. Several structural, policy, regulatory, investment and other variables has led to what I term Sub Saharan Africa's (SSA) 'high cost, low access & usage telecoms/internet paradox'. This paradox expresses itself in multiple areas and spheres.

- Monopoly bottlenecks of undersea cables leading to high an Internet high cost, low access/usage situation;
- Policy regulatory and institutional disconnect – imperfect markets/outcomes;
- High investment in Undersea cable systems but low sub-regional and backhaul backhaul national roll-outs – 'Demand model stimulation gaps;

LAYER	ACTIVITY	EXAMPLE COMPANIES
VI	<i>Customers/Consuming</i>	-
V	<i>Applications Layer, including contents packaging</i> (e.g. Web design, on-line information services, broadcasting services, e-commerce etc)	Bloombergs, Reuters, AOL-Time Warner, MSN, Newscorp, etc
IV	<i>Navigation & Middleware Layer</i> (e.g. browsers, portals, search engines, directory assistance, security, electronic payment, etc)	Yahoo, Netscape, Vizzavi, Genie, etc
III	<i>Connectivity Layer</i> (e.g. Internet access, Web hosting)	IAPs and ISPs
TCP/IP INTERFACE		
II	<i>Network Layer</i> (e.g. optical fiber network, mobile network, DSL local network, radio access network, Ethernet, frame relay, ISDN, ATM, etc)	AT&T, BT, NTT, WorldCom, Qwest, Colt, Energis, Vodafone, NTT DoCoMo etc
I	<i>Equipment & Software Layer</i> (e.g. switches, transmission equipment, base stations, routers, servers, CPE, billing software etc)	Nortel, Lucent, Cisco, Ericsson, Nokia, etc

Source: M. Fransman, <http://www.TelecomVisions.com>

Fig. 2. A layer model of the infocommunications industry.

Figure unpacks the various layers in new generation networks and services and applications in the telecoms value chain. Broadband 2.0 will catalyse many African players to compete in the players 4 and above.

Jensen (2006) unpacks this open access model /concept as a distinct model whereby any entity would be free to invest, either as an operator (tied to guaranteed amounts of bandwidth), or a non-user shareholder who may invest funds to provide right of way. Ownership of a cable can also be defined on a national level, with shares held by a Special Purpose Vehicle (SPV) that will own and operate landing cable and points. The main objective of an SPV is not profit, but to facilitate profits made elsewhere by participating companies. It is not to exclude incumbent telecom operators, but allow others to participate and bring additional funding and advantages to the table. This approach, Jensen notes would ensure that the wholesaler (SPV), is separated from retailers, licensed in each country, thus ending international gateway monopolies.

3. Sub-Saharan Africa's National and Regional Backhaul Fibre

The rise of open access models in undersea cable model and the EASSy cable (through WIOCC) as enabled smaller players like NREN's to own and operate cable access. Together with competition at landing stations, open access has 'first tier' access to the development of backhaul access and national fibre infrastructure and development. The recent formation of UbuntuNet Alliance as a dedicated regional consortia and its foray into AfriConnect consortia to purchase capacity and access to undersea-cable access is significant development. It signals the potential of broadband for a development and increasing education access, but also African schars and

students to participate in global science and education networks (GEANT, ERINA, JANET etc).

3.1. Backhaul access and national fibre consortia development

According to Southwood, the broadband provision model is changing lower prices of international bandwidth mean (tenth cost of satellite costs) move from wholesale to services and applications. International and competitively priced bandwidth is driving new investment plans for national roll outs. Which will be the best and most appropriate? Competition will drive redundancy and lower prices; operators to hope to build cheaper networks. Competition at wholesale level (between operators) needs to be accompanied by competition at retail level end-user customers) co-dependency

3.1.1. Commercial infrastructure sharing. Many factors such as the recession and lower ARPU's as well as high sunk cost to roll out national networks, are encouraging commercial operators to build and own common fibre infrastructure. With experience in the diverse undersea-cable consortia co-investment has set good precedence for nation commercial sharing. For example, in SA Neotel, MTN and Vodacom have built a new 5 000km fibre network. Operators agreed to share cost and trenching, project management- but provide own transmission - they are sharing the ducts. Neotel estimates to save R 400 million – could pass on savings to consumer and users.

3.1.2. Third party providers: third party providers have emerged in context of **maturing** markets. These are 1) 'carrier carriers (wholesale capacity to market, neutral & trusted) and are providing links between countries and within countries; 2) alternative infrastructure operators - only marginal cost to upgrade fibre only existing network (like Infracore was) and 3) dark fibre operators – new model selling dark fibre to both operators and maintains the physical infrastructure for those its leasing capacity to users on the needs basis.

UbuntuNet Fibre Chart

We already beginning to see regional fibre systems such as COMESA's East Africa Broadband Network, Burundi Broadband System (BBS), SADC's SPII develop backbone networks offering open access services to users. With education being a priority, many NREN's are having the benefit of first tier wholesale access to broadband. This is changing negotiating power in the sector and offering broadband to key constituencies, especially universities.

4. Higher Education Transformations in 21st century knowledge economy

As the global economy becomes increasingly reliant on Information Communication Technologies (ICT), the competitiveness of local economies and self reliance of associated societies become ever more dependent on access to 'e-Skilled' workers who have achieved a measureable level of competence (ideally certified, quality assured & benchmarked against an international standard) & engaged citizens. The WSIS Process (2005) stated that

“e-Skills are essential in empowering individuals so that they can participate fully as citizens of the Information Society, and take advantage of all the opportunities before them: opportunities for employment and wealth creation, for taking advantage of

innovative education and learning strategies, and for using new life-enhancing services, such as interaction with public authorities”¹ .

A starting point for discussion on NREN models would be a discussion on the evolving role of restructuring of Higher Education institutions globally and regionally.

Broadly driven by information and knowledge economy, mobility of workforce and new forms of work and skill requirements for the 21st century economy. (UNESCO, 2008). Higher education institutions are undergoing a series of systemic transformations and transition that impacting organisation and model.

These key variables include:

- New Governance models at HEIs’;
- Private public partnerships in knowledge production;
- Commercialisation of higher education;
- Competition from private education providers;
- New accreditation and quality assurance systems;
- University cluster co-operation and peer-production;
- Increased student ratios and mobility of students that require multi-modal education delivery systems;
- Importance of distributed & distance learning education models that require quality ICT and management-operations infrastructure;

Rapid technology a regulatory environment is having major impacts on the roles of NREN’s. Extensive research on NREN’s role and transformations has showed a strategic, qualitative, organizational and business model shift. Many refer to the capability maturity model (CMMI) and the various layers of evolution) Martin, 2008).

This transition model can further be allocated as follows.

NREN- Current Model	NREN 2.0- New Generation Model
ISP service function Bulk broadband purchases, negotiations, contracting; Aggregator role and traffic management; Training	Multi-stakeholder negotiations with cable operators, backhaul providers, ISP’s etc; Investor in broadband consortia role; Knowledge Management services and functions; Policy and Advocay role in national and regional policy; Participating in layers, 4 &5 (Fransman 2001) Potential Incubator services.

Business Models and information models

According to Osterwalder (2004), a business model seeks to describe a process of the how organization offer within a value chain, processes and operations. In the context of information economy and web 2.0 business world, the boundaries of business model (ie. What you do and how you do it) is in constant flux and evolution. He describes the concept as:

‘....A business model is a conceptual tool that contains a set of elements and their relationships and allows expressing the

business logic of a specific firm. It is a description of the value a company offers to one or several segments of customers and of the architecture of the firm and its network of partners for creating, marketing, and delivering this value and relationship capital, to generate profitable and sustainable revenue streams...'

Hence, NRENS will be called upon to develop new generation services and expand its capacity model roles, responsibilities.

5. Next generation opportunities in the Broad Band value chain

5.1. Innovation, Applications as next generation drivers for broadband

In the previous section, it was highlighted that the plugging the Info-structure gaps and evolution of broadband abundance environment through international internet connectivity in Sub-Saharan Africa (SSA) is one track. With extensive investments in undersea cable systems from a diverse funding sources (operators, World Bank, IFC, private capital etc), broadband diffusion would be rapidly increased. The broader regulatory and investment infrastructure is in place for extensive national and fibre-backbone infrastructure investment. So what's next? I argue that the 'emerging broadband abundance' in Sub-Saharan Africa creates new opportunities for Higher Education Institutions (HEI's)

5.1.1. New drivers regarding in broadband ecology and Web 2.0 era

Broadband enables a new ecology of Web 2.0 services and allows various countries (even in developing regions) to move up along the value chain in new Information, Technology and Electronic Services (ITES) to take route for Web 2.0 applications.(InfoDev 2010). In context of NREN ecology and the primary objective to provide quality internet for higher education, NREN's and Universities and UOT's are in the perfect position to leverage quality broadband these development.

a) Web 2.0, Virtualisation and Green computing: is set to be the next wave in the PC and software industry. The growth of Web 2.0 web applications and Google massive demand for data- warehousing. As Sub-Saharan African (SSA) universities and community colleges tap into broadband abundance, entrepreneurs are in and with new generation and access to broadband, African cyber-entrepreneurs are place in global application developments; develop business process off-shoring (BPO) capability.

b) Open Innovation & Content: the internet core architecture is one of openness and interoperability. The rise and success of free and open source movement has generated thousands of new innovations; the creative commons copyright as pushed the boundaries of copyright and opened up new innovation spaces. These models have provided expansion of education access through open education resources (OER).

c) Social Media Apps - The phenomenal rise of social media enabled devices (i-phone, blackberry, Nokia, Google phone) opened up peer-to-peer software development. Apps are associated with Apple's i-phone generation of devices and are is the fastest growing sector in the software, industry employing thousands in the USA and Europe and generating (hundreds of USD millions) for thousands of small scale apps developers globally. With the incubation services, tech capacitated universities and new generation mobile devices African apps developers can be equal players in the global apps space.

Both are required to bolster African education and can contribute to job creation, generate new content, develop new applications, education content for internal African market as well as contribute to global application and software development programmes.

It is clear that the boundaries of higher education and market place interaction are complex, multi-layered and dynamic and interactive. Universities producing graduates in line with skills development in 21st century market place. Furthermore, New generation science and technology policy such as South African's IPR and Publically Financed Research & Development Act (PFDAAct) (2008) new frameworks on Public R&D and the requirements to commercialise IP knowledge and research within clear timeframes.

This is catalyzing many Universities to adjust strategic policy and develop new management systems. These policy frameworks will enable Higher Education Institutions (HEI's) to generate new income by commercializing IP and developing technology transfer policies. My assertion is that this will require Sub-Saharan Higher Education Institutions (HEI) are increasingly asked to provide incubators *or innovation hubs* infrastructure & services. These incubators would provide new generation services;

- ICT Incubators;
- Technology entrepreneurship services;
- Business planning and commercial marketing etc;
- Shared services – HR, Operations,
- IPR legal and contracting services;
- Call centre services;
- Mentorship and Coaching;
- Tech Transfer Offices (TTO's) to manage IPR and commercialization potential of HEI's;

Already many South African universities have identified the rapid growth of tech enterprises and are setting up dedicating innovation hubs and incubators at university level. Examples include Tshwane University of Technology's (TUT). Donors funded programs such as the InfoDev/Finland partnership seeks to develop and grow mobile application capacity at universities, setting up of incubation hbs, science park development, IPR and virtual incubation services** (Infodev 2010)

Pillar	Business Model Building Block	Description
Product	Value Proposition	Gives an overall view of a company's bundle of products and services.
Customer Interface	Target Customer	Describes the segments of customers a company wants to offer value to.
	Distribution Channel	Describes the various means of the company to get in touch with its customers.
	Relationship	Explains the kind of links a company establishes between itself and its different customer segments.
Infrastructure Management	Value Configuration	Describes the arrangement of activities and resources.
	Core Competency	Outlines the competencies necessary to execute the company's business model.
	Partner Network	Portrays the network of cooperative agreements with other companies necessary to efficiently offer and commercialize value.
Financial Aspects	Cost Structure	Sums up the monetary consequences of the means employed in the business model.
	Revenue Model	Describes the way a company makes money through a variety of revenue flows.

Figure 2: Business Model ontology describes the changing nature of Web 2.0 businesses in broadband rich era.

5.2. Towards Open Education Resources (OER) and Distance Learning

As developing regions like Africa begin to participate in the 'knowledge economy' world, and if so, two processes seem worth noting. First, societies of the global south are struggling with everyday challenges of education and literacy, while their institutions and governments perform the inevitable balancing act between scarce resources and burgeoning human resource needs. Second, producers of knowledge goods, heretofore located in the north, are increasingly global in scope; exporting, with their expansion, an intellectual property rights (IPR) regime that poses current and potential deterrents to learning. (Tralac, 2006)

5.2.1. Rise of Access to Knowledge (A2K) movement

It is against this backdrop that the global Access to knowledge ('a2k') campaign emerged. In the context of economic development in the south, and education world in particular, curricular resources in primary, secondary and tertiary education bear examination. While much of the changes wrought recently in IPR (in the domain of multilateral and bilateral trade negotiations) concern changes to the digital environment, their effects are as yet minimal in the southern African context. But while this is currently true on account of the relative lack of affordable and available telecommunications and computing infrastructures cannot be overlooked in that they pose a potential threat to the learning environment and curtail opportunities available – now and in the future – to institutions with adequate capacity.

The a2k movement¹ grapples with exactly such categorical difficulties while calling for action on two broad fronts: first, to limit the barriers imposed on access to knowledge by current and forthcoming intellectual property policy (in the most part, copyright law) second, to widen the horizons of access by positively licensing knowledge goods (to protect and populate the public domain).

Today's technology makes possible the widespread low-cost distribution of high quality intellectual property. The first notable expression of this openness, known as

the open source movement, took place in computer software. The concept of openness, applied to intellectual property related to teaching and learning, has been expressed through open education (or educational) resources (OER), open courseware (OCW), and open knowledge. These terms are more than just words; they are concepts actively being advanced by serious people. And these concepts are beginning to converge.

Another trend is an emphasis by foundations and governments on **teacher training**. Improving teaching in all countries is seen as a necessary accompaniment to any form of OER, and one with a high impact that provides a high return on patron investment. This same search for leverage is the reason that **existing, effective networks** need to be identified and supported. No funding source, private or governmental, can achieve its goals alone or without the effective “institutionalization” of the effort: a sustainable infrastructure dedicated to carrying forward initiatives beyond the funding term.

5.2.2. OER requires new institutional design and delivery systems

For Sub-Saharan African universities and education providers, OER offers new frontier of expanding knowledge by developing mixed models of course delivery (internet and web-learning as a platform). These present exciting challenges for the universities and potentially new roles:

- Design new instructional learning and e-learning organizational units;
- Engage with Community Technology Centres (CTC's) to deliver foundational course and programmes;
- Peer learning and community of with other African HEI;
- New broadband requirements (i.e.
- Streaming educational content to devices (mobile, phones smart phones)
- Wireless community networks for villages

Examples of recent successful and innovative open education initiatives include the Free Science Textbook Initiative (FSTI) of the UCT that seeks to offer free science textbooks, these removing cost barriers. The MobileMath project is a math education /curricula is offered online by live tutors via South Africa's MxiT portal. The Eifl e-journal project offers many universities and library consortia in Africa the ability to access build purchasing of e-journals at discounts, thus reducing barriers to knowledge and expanding education in the 21st century economy.

6. Conclusions and Recommendations

The paper argues that It is clear Higher education institutions in Sub-Saharan Africa are first tier beneficiaries of the broadband boom. Key drivers of new generation innovation, applications and new open content and education resources OER) model will require significant changes in University strategy and innovation proactive need to be embedded in strategic management, operations management and in the new multimedia education delivery and design. Much more work lies ahead in the near future. The following is recommended

- Commission new research on broadband and innovation readiness
- Explore new generation Science and Tech Policy and its implications for IPR, patent, commercialization and tech transfer.
- Develop niche Training and development programme for national NRENS High level training for Universities in Innovation management;

- Promotion of incubators at Higher Education
- Quality engagement with sector technology providers and industry

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Developing the National Research Index for Information Sharing Model

Nora MULIRA PhD

*Directorate of ICT Support (DICTS), Makerere University, P.O.Box 7062, Kampala,
UGANDA Tel: +256 772 420929, Email: nora@dicts.mak.ac.ug*

Abstract

At the last UbuntuNet–Council of Members meeting (Kigali, 21-23rd April 2010) it was recognised that UbuntuNet alliance has progressed faster in achieving R&E objectives compared to the majority of member NRENS. Notable achievements include gateway access to global R&E networks like GEANT and DANTE, IP addressing of NRENS and the realization of increasingly affordable bandwidth with typical prices at USD 500 per Mbps, among member institutions.

The challenge is how to accelerate progress to a level where NRENS are able to utilize the available regional resources that are now largely redundant and under utilized.

A high impact opportunity to effectively utilise the regional infrastructure is readily available with library consortiums that exist in most NREN countries to share the vast research information (in both electronic and physical form).

This paper proposes a development approach for an NREN information index **that is user centred** for information sharing, integrated with key tenets of a functioning/viable NREN and replicable in varying institutional e-readiness contexts. *The simple definition for an Index in this context is a system used to make finding information easier.* The NREN index will be scaled up into a regional research index that can act as a gateway to access this rich information across borders by providing searchable metadata that can enable researchers to identify information relevant to their needs.

An approach is commonly understood to be a coherent set of activities, guidelines and techniques that can structure, guide and improve a process.

If successfully deployed, NREN information index, can fast track information sharing and trigger content development at the NREN level as well as nurture the development of new research interest /groups at the regional level

Keywords:

Index, Research, Information Sharing, Innovation, Approach

1. Introduction

At the last UbuntuNet–Council of Members meeting (Kigali, 21-23rd April 2010) it was recognised that UbuntuNet Alliance as the regional network has progressed faster to achieve objectives, compared to the majority of member NRENs. Notable infrastructure achievements include gateway access to global R&E networks like GEANT and DANTE, IP addressing of NRENS and the realization of increasingly affordable bandwidth with typical prices at USD 500 per Mbps, among member institutions.

The challenge is how to accelerate NREN progress levels to be able to utilize the available regional resources that are now largely redundant and under utilized.

The acceleration should target a high impact, quick win using readily available resources.

It should be noted that rolling out the regional infrastructure assumes a functioning NREN infrastructure, supporting institutional ICT policies, skilled technical people at the NRENs and awareness amongst potential content providers and users of the availability and potential of increased connectivity.

The acceleration should target a high impact, quick win in R&E using readily available resources.

2. Objective

In this paper, we propose a development approach to create a national/regional research index for information sharing model integrated with key tenets of a functioning and viable NREN and, replicable in varying institutional e-readiness contexts. It was anticipated that the Research and Education network of Uganda (RENU) would develop and pilot this model supported by the proposed development approach in four universities. The key output would be a nascent aggregated NREN research information sharing index that would emerge from an iterative process of user testing and refinement and derive lessons and challenges for further improvement

An approach is commonly understood to be a coherent set of activities, guidelines and techniques that can structure, guide and improve a process.

A simple definition for an Index is a system used to make finding information easier. *Index* may also refer to: Bibliographic *index*, a regularly updated print periodical publication.

2.1 Development Approach

The development approach for the NREN information index, is user centred focusing on the researcher's needs with technology to support access to improve researchers ease and accuracy of information requests.

This development approach for the Information sharing Index was developed in consultation with

Library staff in charge of e- resources, archiving at Makerere university library and the information systems and Network management professionals at the Directorate for ICT support (DICTS). The approach draws from Library information management and systems development principals and best practices

Development of the NREN/regional research index resource will:

- Automate the collection of metadata from various academic and research resources identified by NRENs.
- Develop, host and maintain a national/regional repository index for this metadata
- Devise innovative tools/mechanisms that allow researchers/users to interact with this metadata to identify information pertinent to their needs
- Provide support for groups and their collaborations around this metadata to promote interest/research groups within the region

2.2 Outputs

Following this development approach the expected outputs are:

- Documented institutional research profile that updated
- A nascent aggregation of Institutional research metadata
- Policies, Process and procedural guidelines on information access including copyright obligations for individual, group publishing
- Index with links, pointers and contacts that identifies sources for full access of aggregated key institutional research repositories, scaled up to NREN
- Monitoring and evaluation instruments on usage of the Index including availability, ease of access and accuracy of searches to research information

2.3 Outcomes

As such the following are the expected outcomes:

- Wider access to, improved ease and accuracy of access to local institutional research repositories
- Accurate definition and documentation of dynamic local research needs
- Adding value to ordinary biblical indexes
- Inbuilt monitoring and evaluation mechanism of research trends
- Quality assurance mechanisms

3. The Rationale - Key message

UbuntuNet NRENs have vast research information/resources (in both electronic and physical form), which are not well known even within respective national borders. The goal is not to strive to collect all this information in one place, a task that would never end given the continuous process of knowledge creation.

We propose to develop a national/regional research index supported by a replicable approach. The national/ regional index can act as a gateway to access this rich information across borders by providing searchable metadata that can enable researchers to identify information relevant to their needs. Researchers can then leverage the additional contact information provided to get in touch with people, institutions or other entities so as to access the actual information.

If successfully deployed, such a central resource can fast track information sharing and trigger content development at the NREN level as well as nurture the development of new research interest /groups at the national and regional level.

4. Information Sharing and Content Creation

The national/ regional research index model will avail a collection of research metadata (Title, Name, institution, abstract) in one e-location leading to easy access to institutional information repositories of usefully packaged information through pointers (like urls, abstracts, research contacts). Priority of collection and access will be given to highly ranked research interest. The effectiveness of the Index is highly dependant on the lessons and challenges at the institutional level and thereafter can be scaled up to NREN and REN levels. The model addresses the following questions:

- What are the key research interest requirements of NREN researchers?
- What research information/data is available to serve this interest?
- Where are the information repositories located and who is in charge?
- What are the information access and availability challenges encountered by researchers?
- What are the challenges faced by libraries in archiving and storage of high demand/essential collections?
- What information/data format and tools would facilitate and sustain collection, easy access and availability at institutional, NREN and regional levels?

5. Opportunity and Justification

The library is the core of any academic and research institution with a long networking experience within associations and with Patrons. It is a high impact place to start in terms of quick wins for information sharing by an already available critical mass of researchers and potential content developers. Library resource sharing remains high on the agenda and justifies the development of a central Index for increased sharing, and ease of access to scarce research information and local institutional repositories with internally generated publications.

5.1 Why library resource sharing remains on the global LIS Agenda

Library resource sharing is a priority due to:

- the ever growing cost of literature without corresponding raise in the institutional budgets
- Information explosion coupled with growing demands from users.

The poor ICT infrastructure in most Sub-Saharan Africa academic and research institutions still remains an obstacle but trends indicate falling rates of bandwidth costs to around \$500 per Megabyte.

As evidenced by Makerere University Library (Maklib) research information sharing is essential, already exists and has the potential to grow if facilitated by electronic means. Maklib has build capacity among its professional staff, who share the knowledge and skills by training library Consortium members staff. Maklib staff expertise is also exported to other libraries outside Makerere/Uganda – Southern Sudan – 3 universities, Nigeria – 6 universities using VTLib sys, Sokoine University, National University of Rwanda, etc.

The information sharing index will leverage library consortium sharing potential and improved bandwidth connectivity to increase sharing of NREN member library resources and especially local institutional repositories.

5.2 Current Research Challenges and Potential for Sharing Research Information

5.2.1 Information Sharing Experience - Makerere University library

Library users who fail to access full-text articles online can request for the specific article(s) through the Document Delivery Service (DDS) in the Library Documents supplied from Maklib in '05-'07 to the 4 major universities showing a decline in the numbers due to the *slowly improving ICT infrastructure and the increase in full-text journal articles.*(see Table 1)

Institution	2005	2006	2007
Gulu -	26	15	11
Mbarara	29	20	15
Mukono	21	11	10
Nkozi	17	16	12
Total	93	62	48

Table 1 Institutional Document Delivery

However, although the individual requests are decreasing, note that lecturers reproduce articles further for their growing student numbers. (*Maria Musoke, University librarian Maklib*).

5.2.2 Available e-Resources for Research & Education Networking at Makerere University library

- Online Journals –over 20,000 full text journal titles now - country access to all Perii members
- DATAD –A database of African theses and dissertations from selected African Universities
- AIM – African Index Medicus (Uganda Health Literature database).
- Electronic Books - Maklib subscribes to 271 online books in science and gender. However, there are a number of free online bks in other subjects.
- ELIN System – providing a single interface for searching multiple journal databases.
- USDL – is Makerere University's institutional repository launched in 2006 to digitise research output.
- PERii (AJOL, Ebscohost, etc)
- AGORA/HINARI, AORE = Research4Life
- ELIN, e-books, MakULA, DDS, USDL – for Mak Univ

The library sharing of e- resources are divided into 3 categories:

- Internet based external resources
- Institutional repositories
- Local resources

The sharing experience has focused on the first category with ELIN and Peri which present a already made opportunity for improved information sharing.

- a) PERii = “Programme for the Enhancement of Research Information – now in 2nd phase.

- It aims at supporting capacity building in the research sector in developing countries through strengthening the production, access, & dissemination of info resources.
- Uganda, Tanzania, Ethiopia (and other African countries listed on the INASP site: <http://www.inasp.info/peri/countries.html>) have been receiving some of the electronic resources since 2000/1.

b) ELIN (Electronic Library Information Navigator)

This is a service developed in 2001 by Lund University Libraries, Head Office in Sweden. It has been availed to and used by the Makerere University library through the Swedish International Development Agency (SIDA). ELIN is hosted locally and accessible via the Makerere network. It provides access to all electronic resources licensed/recommended by the library through one single interface which is designed to be simple and self-instructive. The system makes it possible to search among different types of resources like articles, journals, databases and ebooks.

The system is open and transparent, based on non-proprietary software, and adapted to demands from both patrons and librarians.

- Currently the system is only available at Makerere University but could be expanded to the 4 Public Universities. Each institution could access it either from their network or Makerere would grant access through proxy server but the issue of bandwidth should be taken into consideration in all the institutions.
- Currently the metadata for a few databases was added into the system but to access all the journal databases subscribed to by the 5 public universities would mean that all the data for all the databases should be added into the ELIN system and this could be done after consultations with the developers of the system.
- Access to grey literature of each institution would be made possible by creating links to these or using the Inter Library Loan system. The 5 Public universities involved will discuss this option.

ICT Infrastructure readiness is the single most important item hindering the sharing of EELIN resources.

c) ELIN@PERI

ELIN@PERI is a special setup of ELIN. It is a collaboration between International Network for the Availability of Scientific Publications (INASP)/Programme for the Enhancement of Research Information (PERI) and Lund University Libraries, Head Office.

One of the PERI objectives is to help developing countries (partners of INASP) get access more easily to scientific information. For this purpose they are introduced to ELIN to allow the user to search resources from multiple sources using one single user-friendly interface.

5.2.3 Institutional Repository

Makerere University library is the only one with an institutional repository among consortium members. Makerere's experience in terms of publication and access to local research output shows that most researchers are ignorant of the copyright publishers' guidelines. *Most academic staff regard academic papers as a requirement for promotion and jealously guard their output.* There is reluctance to submit research into institutional repositories. Rigid publishing and access guidelines are interpreted by library professionals to a research audience that is not fully aware of how to exploit publishing guidelines to access and pick information from other sources. Examples of such guidelines include lack of access to online journal articles unless if the publishers have allowed inclusion of post -prints and pre-prints putting a lot of information under restricted access.

There are *open Metadata protocols* that would enable Institutions and groups to share this information. There is a need to train and create awareness among researchers about the subtle differences regarding intellectual property issues and how to exploit them to enable increased publication and access to local research output. (see <http://www.sherpa.ac.uk/romeo/> -publisher copyright policies & self -archiving

DSPACE – Makerere uses DSPACE as the institutional repository for internal research publications. DSPACE is an Open Archive Initiative (OAI) - compliant open-source software released by MIT for archiving eprints and other kinds of academic content.

The uploading of academic research to this platform has been met with a lot of reluctance from researchers.

According to Faith Akiteng Makerere librarian in-charge of e-resources, publishing and sharing of local Research Output is hindered by:

- Ownership
- Copyright
- Quality control

It is evident from the Maklib sharing experience that INASP and the Lund University have promoted the sharing of external library e-resources (ELIN @PERI) at the national and regional levels. The ELIN service can be provided to any academic library on a subscription basis. Lund University Libraries takes care of the import and processing of metadata, and each library can, via an administration tool, tailor their own services based on licenses, subscriptions etc. Students and staff need an authentication to access. Currently ELIN is used by a number of libraries in different countries.

Local research output of institutional publications from the DSPACE institutional repository is not easily accessible within Makerere and hardly accessible externally. This practice is replicated in the majority of NREN institutions and should be the focus of widening availability scope to other institutions with ease of access.

6. Development Approach for the NREN Research Index

An approach is commonly understood to be a coherent set of activities, guidelines and techniques that can structure, guide and improve a process (Sol 1990). In this case, the development approach for creating an NREN/REN research index will include as a

first guideline the pre requisite of the mandatory minimum requirements for a functioning NREN including the right policy environment, a functioning Network Operating Centre (NOC) with the infrastructure and skilled technical people.

This development approach for the Information sharing Index was developed in consultation with

the library staff in charge of e- resources, archiving at Makerere university library, the information systems and Network management professionals at the Directorate for ICT support (DICTS) and RENU CEO and Chief technical officer. The approach draws from Library information management, systems development and network management principals and best practices

The development of this approach was led by ;

iii) *Directorate for ICT support (DICTS) Makerere University*

Director – Nora Mulira

EndUser Support Manager – Mr Ali Ndiwalana

in consultation with:

ii) *Makerere University Librarians*

The University librarian – Dr Maria Musoke

Librarian in charge of e-resources- Ms Faith Akiteng

Librarian in charge of Archives- Ms Miriam Kakai

iii) *RENU*

CEO – Dr Patrick Mangheni

CTO- Mr Joseph Kimaili

In this section, the conceptual model of the development approach for the NREN/REN index for information sharing is prescribed. The rationale for sharing library resources has been established and the challenges identified justifying the need for guidelines to support the development of central NREN index that improves information sharing through creating wider, easy and accurate access.

The emerging development issues for the index shows a need for support requirements outlined by the questions in section 3 in the following areas:

- Development methodologies that would focus on user/researcher requirements (*includes research interests , information availability and ease of access, challenges*)
- Network formation and coordination (*location of repositories, access policies ,process and procedural guidelines and in-charge contacts*)
- Adequate technical skills to:
 - develop innovative search tools and instruments that would facilitate and sustain aggregation of selected institutional research information, easy access and availability at NREN/REN levels
 - User training, and support in developing an institutional research profile, using, trouble shooting,
 - Monitoring and evaluation of Index service
- A robust technology infrastructure with resources and BW to deliver reliable services is *a minimum requirement*

6.1 Researcher-Centered Implementation

The user in this case is the researcher. Literature on creativity and improvisation indicates that user-centered implementation can be supported by a variety of other contextual elements and techniques. One such element that is relevant to this research is participative approaches, using techniques for group working and end-user involvement (Cooper, 2000). It is recommended that to guide the trade off between the network and the service formula, the implementation process must start with understanding user requirements and monitoring changes in user appreciation to elicit feed back. The user contribution compliments the creativity of the developers who must have innovative ideas and designs.

The researcher as targeted user should participate in all phases of the implementation process.

Guideline 1 Develop the institutional research profile by investigating research context and needs

- a) *Conduct a researcher survey based on predetermined core research interest groups in the institution.*
- b) *Document profile and general challenges by research group*
- c) *Train and teach researchers about intellectual property issues, publishing and information access policies, process and procedures*
- d) *Develop and populate an Institutional repository through a link with the Institutional library and Graduate School.*

6.2 Agreement on Intention to Collaborate

It is important to note that most of the difficult fundamental work to develop and implement the information sharing index is done at the institutional level and this is the focus of the approach.

Guideline 2: Institutions must agree to commit in writing the intention to participate in the general capacities decided for each partner in the library consortium at both the national and regional levels

.Letters of intention can fulfil this requirement. At the end of the preparation stage the following deliverables are expected in line with the three elements that constitute service systems:

- a) *Letters of intention outlining motivation for collaboration to develop and implement the information sharing Index as members of the library consortium, implementation methodology and work plan and formation of the network.*
- b) *Enabling technology: Minimum infrastructure requirements. Overview of institutional technology status and gaps for the implementation project.*
- c) *Document a summary of core research information access collaboration areas and requirements by Institution.*

6.3 Technical skill requirements

After the institutional agreements, documentation of requirements and preliminary training, the NREN should convene a dissemination workshop and take over to develop the Information sharing Index, with full participation of the member institutions. The availability of technical skills of professional librarians and ICT developers is fundamental to the successful development and use of the Index and eventual scale up to the NREN and regional levels. The shortage of expert skills and technology to execute the project must consider the development of an inter-skill pool and resource centre as mandatory. The library team champion should be identified primarily based on built capacity among professional library and ICT staff to share the knowledge and skills by training library Consortium members' staff and export expertise to other libraries outside.

Guideline 3: The NREN should use the library consortium (library) champion(s) existing skill pool to share technical best practice and facilities, in the short term but aim at gradual development of necessary technical skills through short term training, in the long term.

Constitute institutional project teams made up of library, ICT professionals and selected researchers to work with the NREN team. The team leader is a library/information system professional at all levels.

6.4 Analyse existing services and available and usable technologies

Initiating the development of the NREN research index service requires innovative tools that add value to existing web search tools/engines and standard research information searches. The development of these tools should start with investigating the existing functionality in the library systems and reviewing potential FOSS applications that are relevant to developing the new service. Selection and analysis requires an exhaustive search from internal existing resources and systems as well as the Internet.

It is necessary to draw up an overview of functional and technical design decisions. In addition to starting with the targeted user's needs and context, it is necessary to investigate the availability of technologies that are reliable and robust enough to develop and enable the Index. Outsourcing should be also be guided by selection of robust components.

Guideline 4

a) Start the development of tools with analysing existing library system tools and resources for a quick win.

b) Potential technology solutions should be shared with institutional project teams conducted by both the ICT and library team with a representation of researchers.

7. Development

7.1. Define Roles, Tasks and Responsibilities

The roles, responsibilities and tasks for the actual Index development, usage and testing activities, include the researchers as the users, the library expert staff and the ICT team. All the three groups constitute the development team and participate in the design, developing, testing and implementation of the Information sharing index. The procedures for the test of the service that will be executed in the next phase must be clearly understood by all participants. This includes the test scenario, who does what when and how, what guarantees test validity. Workflow models can support this process. To run a usage test, it is necessary to organize willing participants, a prototype available to participants, mechanisms for collecting data and a process for interpreting feedback (Isaacs and Walendowski, 2002).

Practical details that should be planned include:

- user manual, questionnaires and contracts
- Arrangements for conducting the test.
- Developing a test log, potential points of failure and support and escalation procedures for parallel and distributed Help desk

Guideline 5: The development team must identify points of user involvement in the development

7.2 Compliance with User-Centred Design

A simplified view of the user-centred design process is to conduct the user research, set usability goals, design, model and test the user interface, and specify the user interface (Wiklund, 1994). The underlying process of getting a user interface that is usable is user-centred design process; this means that targeted user has to be participate in the entire implementation process (*guideline1*). Access to the NREN central resource, usefulness and ease of use should be part of the quality assurance criteria for the Index, evaluated by the researchers. These attributes should be iteratively tested by researchers to determine whether the designers are still complying with user-requirements. The rationale is that researchers and developers explore the possibilities and constraints of the technology using hands-on experience and providing feedback for modifications. This session is a participative evaluation process that enables researchers to evaluate the service and define usability problems. The aspects can be technical like slow speeds, or functional like functionality that is perceived as not useful or with minimal usefulness.

Guideline 6: Models and tools for elicitation of feedback should be articulated and quality assurance instruments to collect user suggestions for revision and incorporation into the refined version should be determined.

- a) *Create an NREN central information resource by collecting and host Metadata in an e-location including research title, names, contacts institutions and abstracts based on requirements.*
- b) *Design corresponding tools for information access like links, pointers and contact information to full texts.*

c) Different methodologies for usability evaluation can be practiced including surveys, expert evaluation/usability focus groups and prototyping to get hands-on experience.

7.3 Testing the NREN Research Index

The testing of the NERN research index follows set standards in systems development. It makes sense to predetermine representative group of researchers (target end user), assisted by library staff (application managers) and supported by the ICT staff (technical support) for testing the Index. The test-log is used as a checklist. General parameters like ease of use, accuracy and availability of research information must be predetermined as the starting point.

Depending on the number of users in the test group this might be a labour intensive activity. Equipment pre-installed, and instruction manual written.

Guideline 7: Test NREN (Consortium), Institutional and research group levels separately to be able to capture specific system queries and issues for each research group.

b) Quality assurance tests for users should request user evaluation based on satisfaction, effectiveness and efficiency criteria.

c) The librarians supported by the technical team should note all and solve problems that crop up during the test.

d) Use opportunity to have informal discussions with the researchers and get a better understanding of usage.

7.4 Monitor Usage and Evaluation

The usage of the network, platform and applications has to be logged. The operators can test the load and peak load of the network. The service providers can use the log files to scale the necessary capacity on the servers. At the same time, the usage designers can log files to evaluate usage. Observation is also an important evaluation method. Pertinent key questions for the Information sharing Index performance are stated in section 4. The mandatory technology goals from these questions can be interpreted as reliability, flexibility, scalability and easy maintenance (Cooper 2000). User feedback should be incorporated in the next versions and iteratively tested towards the final draft.

Guideline 8: NREN members should agree on common and Institutional performance indicators for the short and long term M&E

b) Develop common M& E reporting instruments

7.5 Realization

7.5.1 Review Business Case

The consortium members should analyze and evaluate their benefits from participating in the implementation project to decide if the Information sharing Index serves institutional internal research agendas and if they are willing to continue with the pilot. This activity requires reports by the project management committee report on implementation activities, system projections and challenges. This should be compared with the original network objectives to decide the network continuity into the exploitation phase.

Guideline 9: Review the technical equipment needs and technical support gaps.

Draw up a pre-implementation checklist which includes all technical and support requirements needed to roll out the service

7.5.2 Launch the Pilot

The relationship with the user fraternity starts with the distribution of the service. The service is now distributed to test parallel and distributed usage, synchronized at the different participating sites. The index should be accessible to all participating institutions and provision of mutual redundancy by/for all partners is critical. The rotation of the service provision in case of failure from a participating site can also be tested. The high cost of bandwidth remains a problem but it is acknowledged as a transient issue given that trends show declining costs. All member institutions must test their technical support. The distributed user support must also be tested at this point. A Common reporting interface for failures and queries by users from all sites instituted under an existing joint collaboration office is recommended to optimize scarce technical skills. This works on an escalation basis that starts with local network support.

Guideline 10: Implement a pilot of not less than 6 months to evaluate impact and benefit at both institutional and consortium levels.

Document and publish lessons and challenges.

Gather research experience beginning with institutional pilot sites

a) It is recommended to use a combination of multiple sources to get a good feedback on the usefulness and usability of the service.

b) Questionnaires for users should ask whether the service is easy to use and useful for the tasks to be executed.

c) After each round of modification resulting from user feedback, the refined service should be distributed to a larger pilot test group.

7.5.3 Scale up Service - Analyze the business case

An agreed period for piloting has to be agreed by all NREN member institutions and thereafter the consortium should analyse the *business case and whether the pilot has met the research agenda as of the member institutions both collectively and individually. Institutions should report individually on the benefits and gaps from the deployment of the research index.*

This meeting enables partners to define the progress plan and outstanding issues to be addressed before the pilot scale up.

This ends the pilot and launches the service fully for all network partners. Scaling up the use of the Information sharing Index, requires an aggregation, hosting and maintaining of the NRENs resources by the regional REN and access tools enabling access to the full texts. This phase is heavily dependant on the monitoring and logging all technical and operational queries events at the pilot phase and resolving them. At this point research partners can start full exploitation with mutual contractual engagement, as providers and consumers of the Index service.

8. Planned RENU Pilot

The planned pilot using the above guidelines will be led by Makerere University library and DICTS. The Consortium of Uganda libraries will be leveraged to start the collaboration among selected RENU member Institutions. A survey for infrastructure requirements was completed in 2009. The selection of the participating public universities to participate in the pilot, is based on compliance with the minimum requirements.

It was not possible to conduct the RENU pilot from August to Dec 2010 as anticipated but the plans are still underway based on the same proposal.

RENU welcomed the proposal of the pilot for the information sharing index because it was compatible with planned activities of engaging users for content production. This pilot was timely and an appropriate initial engagement of both researchers and librarians.

The following were noted in readiness:

- The pilot would benefit from the infrastructure survey that was conducted in 2009
- It was noted that the pilot required modest e-readiness and infrastructure to enable (server of 500Mb HD and a minimum bandwidth capacity of 5 Mbps of at participant location, network support personnel and information manager
- All participating universities had the minimum readiness requirements apart from 5.
- A time line of 6 months period starting mid November was earmarked to start the pilot
- ELIN/Peri and DSPACE the repository for local research output, were identified by the library staff as a ready fit for free information sharing.
- The Makerere library staff and DICTS agreed to engage the institutional researchers on the issues hindering the sharing and development of institutional repositories

- In addition RENU would develop a methodology to help ICT directors to develop their ICT function and indicators to enable self assessment.

8.1 Implementation

It was noted that the lack of adequate infrastructure is the biggest hindrance to sharing readily available ELIN information resources. The assessment of infrastructure readiness is therefore a necessary pre-cursor to implementation of the research index pilot.

- Detailed e-readiness status will be conducted to prioritise the assistance required by the member institutions. Given the time limitation for conducting this pilot, the level of readiness was decided as the basis of participation in the pilot.
- The setting up of a band width consortium as a necessary precursor to this pilot and future R&E collaboration was proposed effective September for an initial period of 4 months, by one of the service providers (Uganda Telecomm). The offer is yet to be effected due to as most institutions cannot review their budgets for a bandwidth (BW) increment. It is still apparent that BW is still not yet affordable to increase current capacity substantially at the same cost. Table 8.1 shows RENU draft work plan

Activity	Objective	Timeline	Deliverable	Remarks
1. Conduct detailed ICT infrastructure readiness survey. (set spec: 4GB(2 x 2GB) RAM, 300GB SAS HDD x3, DVD-ROM drive, 36/72GB DAT drive, Dual-port Gigabit Ethernet adapter, 2 redundant power supplies @ \$7000	Assess infrastructure readiness for participating institutions. (minimum bandwidth capacity of 5 Mbps)	Nov 2010	E-readiness report highlighting gaps to be addressed for infrastructure readiness.	-A priority list of institution for the pilot implementation is derived from the survey findings. -Priority will be given to institutions with the least requirements for e-readiness
2. Implement infrastructure requirements	Establish minimum requirements for information sharing		Minimum ICT infrastructure for research networking	ELIN is the readily available for sharing
3. Identify and establish core research interests and groups in different institutions	Match research information available in ELIN with Institutional research requirements		-Institutional research focus areas with high potential -Research interests and groups	Institutional Access to and availability of ELIN will be based on areas with the highest research potential/ interest
4. Define and match tools for info requirements -develop tools for information search including contacts	Determine appropriate tools for identified research needs		Tools and instruments	
5. Publish on Intranet/Internet the tools, key Research areas and bibliography of frequently used information sources	Create awareness among researchers and library staff		Published Internal and external Institutional research profile and instruments	
6. Conduct awareness and training sessions on information access by consortium, institution and interest groups.	Develop information search skills for researchers		Access/ search and information management skills	Training starts with basic research information access skills and will gradually lead to inter-mediate and advanced levels
7. Monitor information (ELIN) use. <i>Include user surveys and online</i>	Derive lessons and gaps for further improvement and		Usage report -A replicable RI model for NRENS	The lessons drawn from the pilot will inform other NRENS future

<i>data collection</i>	scaling up RI model to other institutions /regional level		-requirements for scaling up to a regional RI	requirements and cost of scaling up the RI model
8. Analyse and Publish research stats and recommendations at a dissemination workshop followed by small research groups	Publish results and generate further research opinions for sustainable improvements		Published results of the research stats and recommendations	

Table 8.1 RENU draft Work plan

9. Conclusion

The development of the NREN information sharing Index and eventual scale up to the regional (UbuntuNet) level is largely dependant on the institutional e-preparedness and availability of Institutional repositories from which metadata can be centrally aggregated and referenced at the NREN (RENU) level. The NREN information resource is further aggregated at the regional level thereby cascading into a regional searchable metadata. The development of innovative tools and instruments for accessing information, the collection, hosting and maintenance of referenced metadata is done by the NREN and the regional REN.

The planned RENU implementation of the Information sharing index pilot will derive actual lessons, challenges and emerging issues for information sharing in practice. The output will be used to refine the Approach which can be replicated among other NRENs.

There are indicative lessons and challenges drawn in the preparation phase of the anticipated pilot by RENU.

The critical staff shortage of professional library /Information management staff with expertise in e-resource sharing, archive and e-library consortiums continues to deter efforts to improve the sharing of vast information resource in member NREN institutions/countries.

The sharing of local research output in institutional repositories is sustainable and key to the information sharing among Africa NRENS but very few (as in the case of RENU) have developed this capacity. Obligatory, timely submission and institutional publishing of local research is key to improving IR capacity. Institutionalisation of Quality control measures is also required.

In addition use of this information by researchers requires teaching and training researchers about the fine print of intellectual property issues and how they can be fully exploited for access, not hindrance for information sharing. Understanding and resolving intellectual ownership and quality control before information is included in the IR is necessary before information access/sharing of local research output can be improved.

The setting up of a bandwidth consortium as a necessary precursor to future R&E collaboration is yet to be fully effected even with the substantially reduced bandwidth rates. The current reduction is not yet low enough to gain substantial increment at the same BW subscription budget for growing requirements.

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Enhancing ICT Development in Africa: a framework for collaboration between NEPAD and African Research and Education Networks

Towela NYIRENDA-JERE

NEPAD e-Africa Programme, CSIR 43B, P.O. Box 395, Pretoria 0001, RSA

Tel.: +27 12 841 434, Fax: +27 12 841 4094, Email: tjere@eafriacommision.org

Abstract

This paper presents a collaborative approach between NEPAD and Research and Education Networks towards the realization of Centers of Excellence for ICT Development. Centers of Excellence that focus on the development of a critical mass of ICT expertise in R&D and innovation are key to moving Africa into the next phase of ICT development. The framework for the NEPAD Centers of Excellence is based on a model that brings together academia, private sector, government and civil society as stakeholders. Research and Education Networks (RENs) have a key role to play in the establishment of Centers of Excellence both through the underlying infrastructure and services that they provide as well as through their linkages to a wide pool of diverse expertise. The collaborative approach places NEPAD in the position of facilitating the creation of an enabling environment for RENs and the Centers of Excellence. This includes advocating for good policy-making in research, education and ICT development and working with the relevant legal and regulatory authorities on mechanisms that facilitate cross-border networking. The establishment of Centers of Excellence for ICT Development is complementary to the establishment of RENs in that while the RENs provide the physical networks between institutions, the Centers of Excellence provide human and institutional networks.

Keywords

NEPAD, Research & Education Networks, Centers of Excellence, ICT Development, Africa

1. Introduction

The development and growth of the Internet and ICTs in Africa necessitates the development of requisite capacity to sustain the growth and propel it further. There is need to develop specialized capacity on the continent that will be able to proactively respond to the challenges of incorporating ICT into everyday life for the majority of

Africans. The emergence of Research and Education Networks (RENS) in Africa is an important cornerstone for facilitating future developments in ICTs and the use of the Internet in Africa. RENs will provide opportunities for collaboration, research and development and innovation both within the continent and internationally.

The NEPAD e-Africa Programme is working towards the establishment of Centers of Excellence in ICT Development to further the continent's socio-economic development. The proposed centers are complementary to existing initiatives in that while most of the existing initiatives are focused on (technical) capacity building through training, the NEPAD Centers of Excellence would focus on (institutional) capacity building through research and development (R&D) and innovation. They would extend the scope of ICT activities beyond the technical level and also look at issues of applications and content, thus requiring broad participation by a variety of research and education institutions. Broadband connectivity between institutions is an important element of this initiative as it would enable Africans to collaborate both within the continent and with other global institutions - leveraging broad knowledge and expertise from numerous organizations, sharing information, sharing workload, and producing results that individual institutions would be hard-pressed to accomplish within a reasonable time or for a reasonable cost.

This paper proposes a collaborative framework between the proposed NEPAD Centers of Excellence and the Research and Education Networks in Africa. The Centers of Excellence initiative is complementary to the achievements towards the realization of RENs in Africa and provides motivation for a proactive approach to leverage the infrastructure and connectivity for the benefit of the institutions and the continent at large.

2. Overview of NEPAD

The New Partnership for Africa's Development (NEPAD) is a long-term vision of African-owned and African-led development with the objective of eradicating poverty in Africa and placing African countries, both individually and collectively, on a path of sustainable growth and development, thus halting the marginalisation of Africa in the globalisation process [1]. The anticipated outcomes are economic growth and development and increased employment; reduction in poverty and inequality; diversification of productive activities, enhanced international competitiveness and increased exports; and increased African integration.

For the infrastructure sector some of the objectives of NEPAD are to enhance regional cooperation and trade through expanded cross-border development of infrastructure and to build adequate knowledge and skills in technology and engineering for installing, operating and maintaining infrastructure networks in Africa. Within the ICT sector, the development of research capacity is an objective that will lead to the establishment of African programmes as well as technological exchange programmes capable of meeting the continent's specific needs. This links to one of the objectives for the education sector which is to promote networks of specialised research and higher education institutions. The NEPAD framework calls for the establishment of a network of training and research institutions to build high-level manpower and specialized technical capacity.

The NEPAD Planning and Coordinating Agency was formally established as a technical agency of the African Union in February 2010, replacing the NEPAD Secretariat which had been in existence since 2001 [2]. The mandate of the NEPAD Agency is to facilitate and coordinate the implementation of continental and regional priority programmes and projects and to mobilise resources and partners in support of their implementation. It is also required to conduct and coordinate research and knowledge management, monitor and evaluate the implementation of programmes and advocate on the AU and NEPAD vision, mission and core values. The establishment of the NEPAD Agency is a reflection of renewed commitment from Africa's leadership towards the implementation of the NEPAD vision.

The NEPAD e-Africa Programme is a unit of the NEPAD Agency, established after the dissolution of the NEPAD e-Africa Commission, in line with the integration of NEPAD into the processes and structures of the African Union. The NEPAD e-Africa Programme retains the operational mandate of the e-Africa Commission which is to develop policies, strategies and projects at the continental level, manage the structured development of the ICT sector in the context of NEPAD and develop broad strategies and a comprehensive action plan for ICT infrastructure and the use of ICT applications and services on the continent.

3. The NEPAD ICT Centers of Excellence

The overall goal of the NEPAD ICT Centers of Excellence initiative is to increase the socio-economic benefits afforded by the Internet and ICTs in Africa. The specific objectives are:

- To increase regional and continental collaboration between African universities and research institutions in the field of Internet and ICT Development
- To develop high-level capacity and expertise in Internet and ICT Development for R & D and innovation
- To establish African resource centers and knowledge repositories and increase the use and generation of scientific knowledge in ICTs for Africa's development.
- To increase collaboration in the field of ICTs between African institutions and global institutions

The NEPAD ICT Centers of excellence are envisioned as virtual or physical institutions which:

- bring together a set of essential functions to support the successful delivery of ICT programmes and projects;
- can bring diverse people and groups together and create teams of people that use best practices around a specific focus area to drive results or solve difficult problems.

- focus their efforts to build expertise and achieve excellence so that they can become a (national/regional/continental) resource in a particular area.
- enable collaboration, learning, the sharing of knowledge and act as catalysts for innovation and new strategies.

The African Union Conference of Ministers responsible for ICT (CITMC) at their third meeting in Abuja in August 2010 reaffirmed their commitment to the establishment of Centers of Excellence for ICT [3].

3.1. Collaborative Framework

The framework for the NEPAD Centers of Excellence is premised on adopting a model that brings together academia, private sector, government and civil society as stakeholders so that the activities of the Centers are informed by and inform policy, address public and private sector needs for research and innovation, contribute to the body of knowledge on African ICT development and inform African programming and spending on ICT projects and interventions.

The role of NEPAD in this collaborative arrangement is to foster the development of an enabling environment that allows RENs and hence the Centers of Excellence to flourish. One element of this enabling environment is the regulatory and policy environment for cross-border networks. The NEPAD e-Africa Programme has prior experience in this regard, having worked with countries in Eastern and Southern Africa on the Kigali protocol which provides for open and non-discriminatory access to broadband infrastructure and which paves the way for cross-border terrestrial networks to be deployed [4]. The Kigali Protocol is currently being revised to include the remaining regions in Africa. NEPAD will also play a role in providing affordable bandwidth through its terrestrial and submarine network infrastructure which will be implemented in line with the Kigali Protocol and be available on open, non-discriminatory basis.

Another element concerns the requisite policies for education, research and ICT which are required for the success of the Centers of Excellence and the collaboration with the RENs. NEPAD will work towards sensitizing, advocating and recommending in consultation with all stakeholders, the relevant policy frameworks that will strengthen research initiatives in ICT and ICT-related development. This includes highlighting the importance of public funding for research initiatives as well as the promotion of public-private partnerships for research and development. NEPAD will also provide linkages between the Centers of Excellence and grassroots communities that stand to benefit from ICT projects and Internet development. This will be accomplished through a community informatics network that is under discussion.

Within this framework, the Research and Education Networks also have important roles to play on several fronts. The first role for the RENs is to provide broadband connectivity between institutions that would enable collaboration, access to and sharing of information. This opens up opportunities for the establishment of regional repositories of information and knowledge, for sharing of high-performance computing facilities, for collaborative research spanning multiple geographic areas, among others. The AfricaConnect Project is an important landmark in the evolution of

RENs in Africa as it will provide RENs with increased capacity for Internet access and connectivity to resources and other institutions globally [5].

The second role for the RENs is that through the infrastructure and associated hardware over which broadband connectivity is supplied, institutions would have the opportunity to create test-bed environments for researching various issues relating to technology deployment in the continent. This would include design, development and testing of applications and services such as those required for e-health, e-learning, e-commerce, etc. In this way, member institutions of the RENs could also be member institutions of the Centers of Excellence.

Lastly, through measurements on the networks, the RENs would provide data and statistics that could be used for academic research as well as for informing regional and continental policy making with respect to ICT and Internet Development.

Through this collaboration synergies can be created between the RENs, NEPAD and the proposed Centers of Excellence. Whereas the RENs provide the physical network, the Centers of Excellence provide the human and institutional networks that leverage the physical networks to enhance ICT development in Africa.

4. Conclusion

The NEPAD Centers of Excellence initiative is aimed at developing research capacity in ICTs and Internet development in line with the objectives of the NEPAD vision. Key to the success of this initiative is the ability of research and education institutions to have affordable access to broadband ICT infrastructure, national and intra-regional connectivity as well as connectivity to other global institutions. The Research and Education Networks (RENs) in Africa are an important part of the collaborative framework that will make these Centers of Excellence a reality.

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Biography

Dr. Towela Nyirenda Jere holds a PhD in Electrical Engineering (Networking and Telecommunications) from the University of Kansas and an ACCA Diploma in Financial Management and is currently the Programmes Manager (e-Africa Programme) with the NEPAD Planning and Coordinating Agency.

She has previously worked with the University of Malawi in both academic and administrative roles. She has also served as a United Nations Volunteer (UNV) with the Cisco Networking Academy Program and as a facilitator for the British Council InterAction Leadership Program.

Her research interests are in ICT Policy and Strategy and Measurement of e-Readiness and ICT Development.

Adding Academic Networks as an External KML Map Layer to the Web Version of the Africa Transmission Network Map

Paul HAMILTON

Hamilton Research Ltd., Bath Brewery, Toll Bridge Road, Bath BA1 7DE, UK

Tel: +44 (0)1225 852554, Fax: +44 (0)1225 852528,

Email: hamilton.paul@btinternet.com

Abstract

This is probably the world's hardest jigsaw: the Africa Telecom Transmission Map first published in 2009 by Hamilton Research represents the culmination of over seven years research and cartographic work. A high resolution version is also published on a Javascript web-based mapping platform, which is updated quarterly. To help the UbuntuNet Alliance facilitate the rapid deployment of academic networks in Eastern and Southern Africa, for network planning and maintenance purposes it would be possible to add an overlay network of academic networks including Higher Education Institutions (HEIs), National Research and Education Networks (NRENs) and Regional Research and Education Networks (RRENs) on top of this web-based map using the KML format. This would leverage the mapping work which has already been done, and allow the UbuntuNet Alliance to concentrate on developing detailed maps of academic networks for use by its community.

The web version of the Africa Transmission Map is published in the password-protected client area of the Africabandwidthmaps.com website, and is provided to customers on a single-user and multi-user annual subscription basis. The KML format is by its nature designed to be put in the public domain, and can be used in Google Earth desktop application and Javascript API web maps. Because it is possible to add a KML file as a selectable layer into Javascript API web maps, a map of academic networks can be superimposed as an overlay network on top of the Africa Transmission Map. This can be used as a network planning tool to assist NRENs and RREN in building national and regional networks. The same KML file can be published for download to be used in Google Earth, or a public Javascript web map, to be shared with its whole community.

Keywords

Map. Transmission Networks. Fibre. KML. Javascript. HEI. NREN. RREN.

1. About the Africa Telecom Transmission Map

The Africa Telecom Transmission Map² shows the terrestrial fibre and microwave, submarine cable transmission networks for 113 operators in 54 African countries. It also shows major network nodes, GSM coverage, Internet Exchange Points (IXPs), and the pattern of international Internet bandwidth.

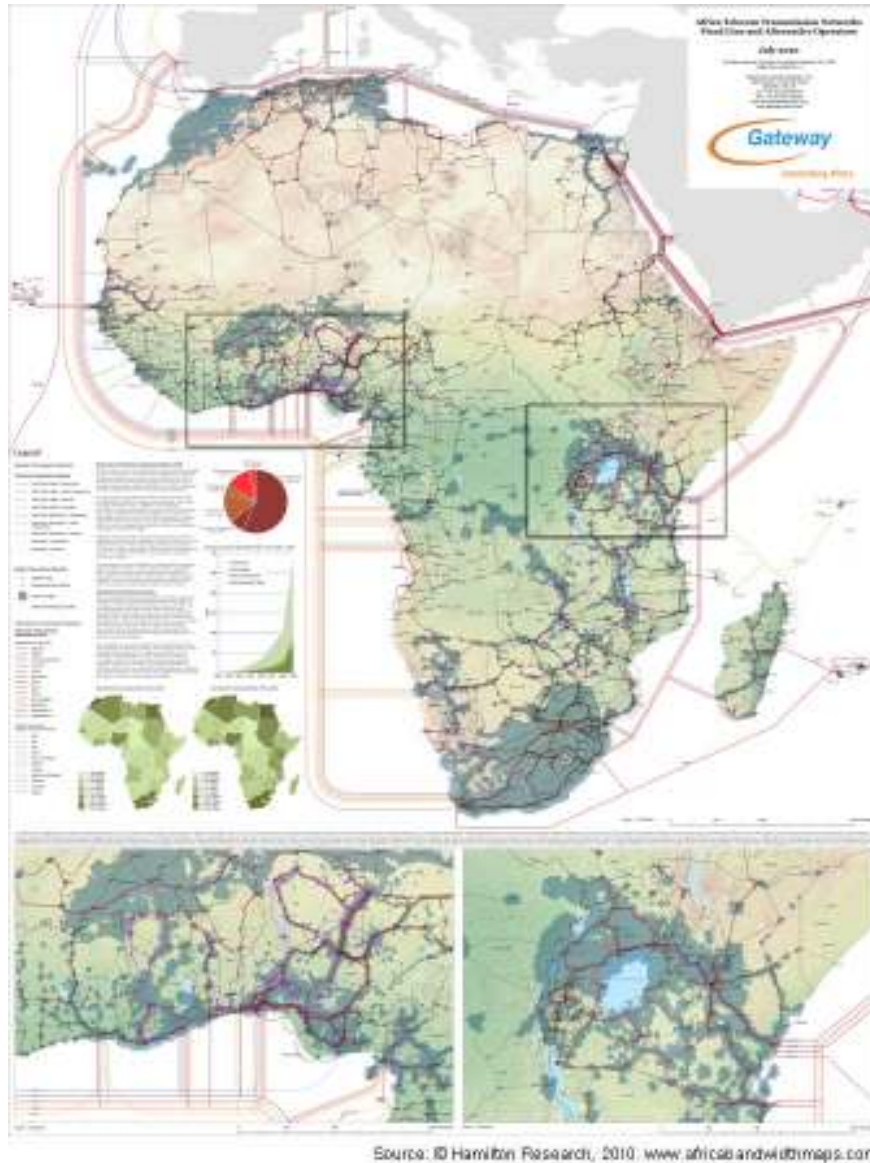


Figure 1: 2010 Africa Telecom Transmission Map

1.1. Inventory of Transmission Networks

The two maps below show the speed with which fibre networks have been deployed in the year to July 2010. The poster map is published once a year, and the web version of the map has been updated quarterly since Q3 2009.

² "2010 Africa Telecom Transmission Map", published by Hamilton Research, ISBN 978-0-9562970-1-3 Available at: <http://www.africabandwidthmaps.com>

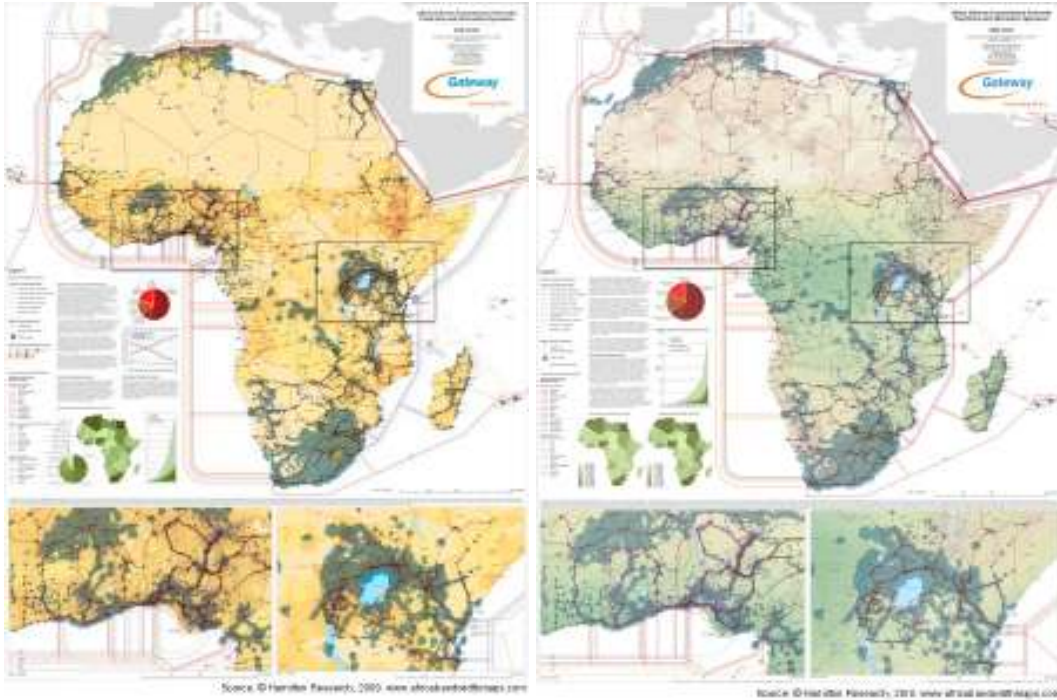


Figure 2: 2009 Africa Telecom Transmission Map Figure 3: 2010 Africa Telecom Transmission Map

Key findings:

- By July 2010 the map shows a total inventory of 585,471-kms of network infrastructure. Laid end-to-end that is enough to wrap around the earth 14.6 times.
- In July 2009, there was 465,659-kms, a 26% increase in one year on a like-for-like basis. (The 2009 map shows 401,282-kms, but was rebased to include additional network not previously shown).
- In 1987, there was around 74,000-kms of microwave network.
- The total length of operational network (rather than under construction, planned or proposed) was 411,686-kms. This was an increase of 57,560-kms compared to July 2009. Laid end-to-end, that is enough to wrap around the earth 1.5 times.
- In addition, a further 44,651-km was under deployment as at July 2010, over 5,000-kms of which entered service during the third quarter.
- Africa's international Internet bandwidth surpassed the 300 Gbps mark in the first quarter of 2010, and Sub-Saharan Africa surpassed the 100 Gbps mark.
- The completion of new cross-border links, and expansion of capacity on others, has seen the volume of intra-regional traffic to submarine cable landing stations increase to over than 10 Gbps. The activated capacity on cross-border networks is increasing, from STM-1 circuits to 2 x STM-1, becoming STM-4 and beyond.

1.2. Production

The Africa Transmission Map is produced using ESRI ArcView GIS software v10.0. Operator's transmission networks are added into the map in a variety of ways depending on the format in which it is provided, in some cases using native GIS files, in others by plotting co-ordinates and joining the dots, and in others by hand-drawing on the basis of named waypoints provided. Prior to the first publication in 2009 we underwent a clearance process to ensure that we had permissions to publish this data.

There are now over 5,000 separate links and 3,000 nodes contained in the map. On average each quarter several hundred links and nodes are updated or new entries made. Each separate link (from node A to node B) is recorded as an individual polyline. The map is attached to an underlying database, in which as much technical detail of that individual link is recorded, including country, operator, Node A, Node B, capacity, length, type, operational status, date and a section for additional notes.

This database approach enables the map to be a "live" map, its status is continually updated by editing the underlying database rather than having to restyle each individual line manually and separately whenever there is a change. By keeping a rolling record of these developments it is also possible to track the status of network roll out in route-kms by country, operational status and so on.

1.3. Background

The first iteration of the transmission map came in 2002, published in the AITEC African Communications Infrastructure and Services Report 2002/3³, showing the relationship between submarine cables, satellites, regional fibre projects and international bandwidth. In Chapter 5, the report contained an inventory of submarine cables and regional fibre connectivity projects, which was compiled into a year-by-year powerpoint presentation comparing the deployment of network infrastructure against international bandwidth.

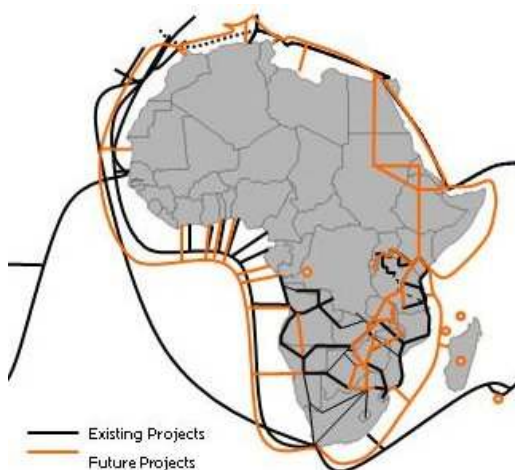


Figure 4: Existing and Future Fibre Connectivity Projects 2002

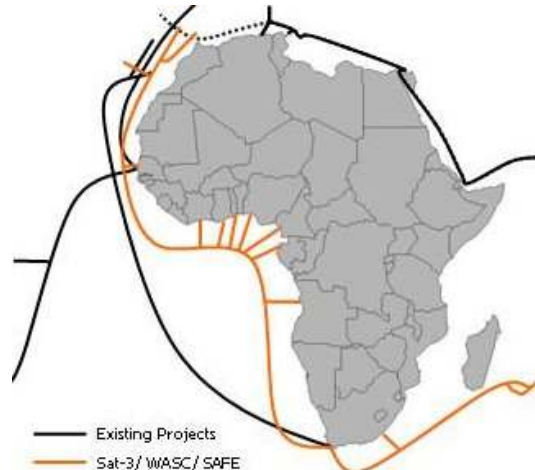


Figure 5: Existing Regional Submarine Cable Projects 2002

We are grateful to the International Development Research Centre (IDRC) for producing the Internet Out of Africa (2003) and Open Skies satellite coverage (2004)

³ P. Hamilton, S. Moroney, A. Opoku-Mensah, M. Mureithi, M. Jensen, R. Southwood "The African Communications Infrastructure & Services report 2002/03", Aug. 2002.

maps, and commissioning the Acacia Atlas⁴ in 2005. The Acacia Atlas contained a later version of the transmission map in its centre pages, and notably also a section on Academic Networking presenting some of the findings of the Promoting African Research and Education Networking (PAREN) study.

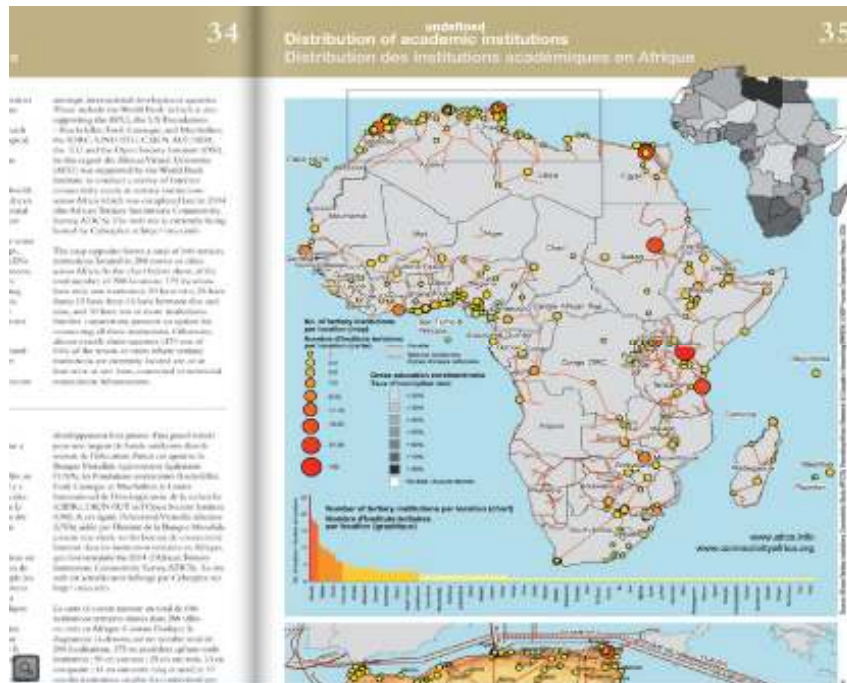


Figure 6: Bandwidth and African Universities, The IDRC Acacia Atlas 2005

1.4. Sources and funding

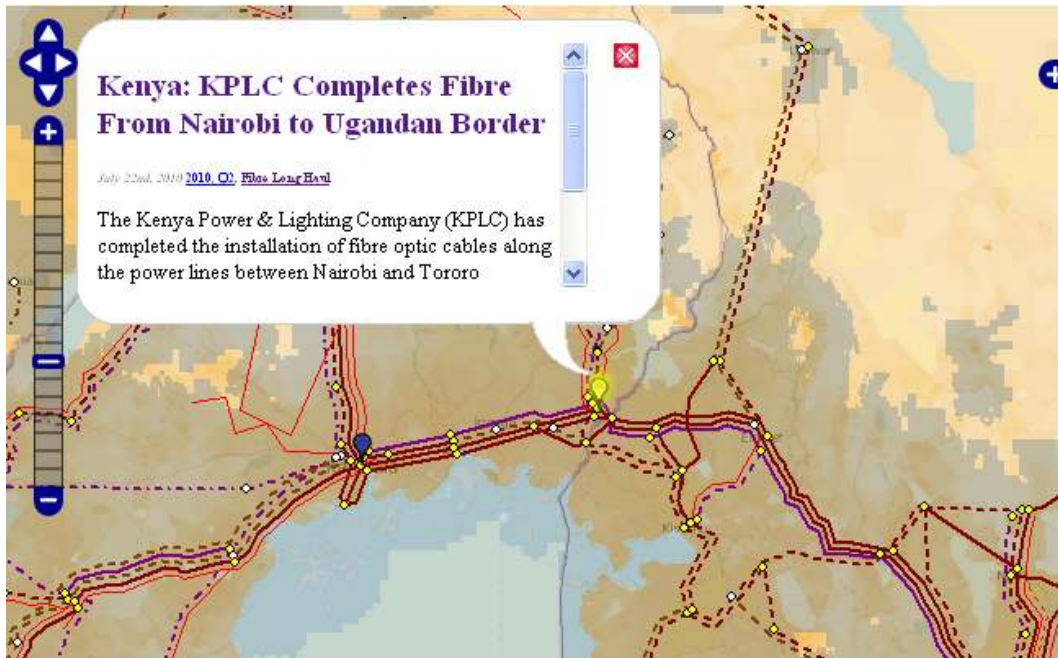
The development of the Africa Transmission Map has been a long-term project, which has taken over seven years to research and produce. It is an open ended project in the sense that it requires continual maintenance in order to remain accurate and up-to-date. It will never be finished, as it is constantly going out of date. The map's existence relies on the support of dozens of network operators, consulting firms, industry associations, financial institutions and regional organisations including ECOWAS, ECCAS and NEPAD which have generously provided information and updates over the years. We have undertaken consulting work for a number of organisations regarding African transmission networks, but the Africa Transmission Map itself receives no public funding. Its viability is therefore supported by sponsorship, sales and subscriptions, the revenues from which support the map's continued maintenance and development. We are grateful to Gateway Communications for agreeing to sponsor the map in both 2009 and 2010.

2. Web Based Version of the Africa Telecom Transmission Map

We purposefully do not make electronic versions of the map available, for two reasons. First, the existence of the map in PDF, KML or other high resolution easily

⁴ "The IDRC Acacia Atlas 2005: Mapping African ICT Growth", Oct.2005. Bandwidth and African Universities p.34, Distribution of Academic Institutions p.35.<http://www.idrc.ca/acacia> also available at http://www.africabandwidthmaps.com/?page_id=78

disseminated format would jeopardise the viability of continuing to produce the map. Second, many operators are sensitive about the level of detail of their physical networks which is put into the public domain, for a number of concerns. However, in the third quarter of 2009 we published the first web-based version of the transmission map in a manner which satisfies these concerns. After analysis of the various Javascript APIs available, the OpenLayers API was chosen as the most suitable for the purpose. The web map is available to customers on an annual subscription basis, with discounted multi-user subscription options available.



All rights reserved. Copyright © Hamilton Research Ltd., 2009. Full citation and list of sources.
Figure 7: Rolling Transmission Map, Hamilton Research <http://www.africabandwidthmaps.com>

2.1. Web-based GIS and Javascript APIs

There are many implementations of Geographic Information System (GIS) on the web, many of which required the specialised hosting on a dedicated GIS server. The development of Javascript mapping APIs has really revolutionised the field, and was really opened up by Google Earth and Google Maps which are the most well known. There are at least 6 Javascript APIs, Javascript libraries which invoke commands to render maps in your browser, and others include: Yahoo, Microsoft (Bing Maps), Openlayers, Michelin and so on. These enable both GIS and non-GIS data to be displayed on robust, lightweight maps on web pages. Each API has its pros and cons, both in terms of functionality and licensing. The different APIs are notably subject to different terms of service, which both developers and providers need to be familiar with and comfortable using. We have chosen to use the OpenLayers API for the Africabandwidthmaps website because it fits our requirement best.

2.2. Zooming and Scale

One of the key tasks of cartography is accounting for scale; to show as much granular detail as is required at different scales. This involves striking a balance between making the map as useful as possible by showing relevant information, but also readable. On the one hand it would be possible to show the labels (names) for all

towns and villages when you look at the whole continent, but the map would become a mess of typeset characters that would prevent you from reading anything on it. On the other hand, if you were to zoom in close and only had the labels for capital and major cities showing this would not provide enough information to provide any detail. For this reason, standard conventions are used to incrementally display greater levels of detail at different thresholds. For example, only the names of countries appear at a first scale, then capital cities at a second, major cities at a third, towns at a fourth, and villages at a fifth.

We have developed three web versions of the Africa Telecom Transmission Map, each with different features and showing more granular levels of detail at different scales. The first “Rolling Transmission Map” shows all networks to a scale of 1: 1,560,000 (1cm = 11.56 km), and network nodes when zoomed in to the closest scales. The Silver Transmission Map also shows an additional map layer showing the range (in kilometres) from these nodes, and the labels of nodes (> 3,000 nodes). In addition, the Gold Transmission Map also shows labels for operators (>5,000 labels).

3. The UbuntuNet Alliance for Research and Academic Networking

The UbuntuNet Alliance for Research and Education Networking was established to capitalise on the emergence of optical fibre and other terrestrial infrastructure opportunities to become the Regional Research and Education Network (RREN). Established and emerging NRENs (National Research and Education Networks) in Kenya, Malawi, Mozambique, Rwanda and South Africa came together as the Founders of a new grouping: the UbuntuNet Alliance for Research and Education Networking. The vision of delivering very high speed - gigabits (Gb/s) connectivity instead of the current kilobits (kb/s) between African Universities and Research Institutions is driving the Alliance forward at a rapid pace. The founding NRENs have been joined by DRC, Sudan, Tanzania, Uganda, Zambia and most recently Ethiopia and SomaliREN⁵.

The development of this RREN and NREN networks depends on the availability of fibre transmission networks within and between different countries in order to interconnect Higher Education Institutions (HEIs). NRENs and RRENs will purchase capacity in IRU (indefeasible rights of use) or as leases from the network operators which own and operate these networks. Given the capacity requirements of HEIs, NRENs and RRENs become important anchor tenants for these operators. In pursuit of this goal the UbuntuNet Alliance developed and in July 2010 published its own fibre map of Africa in PDF and KML format. Given the time and resources required, and open-ended nature of such an endeavour, I would offer to suggest realigning this project to develop a detailed, live map of academic networking in Africa.

Such a map might contain three layers, and their underlying data:

- **Locations of HEIs:** Plot the locations of African HEIs as points (nodes). Match HEI locations against database of HEIs connectivity requirement. For example in

⁵ Source: UbuntuNet website: <http://www.ubuntunet.net/>

West and Central Africa, the AAU compiled a database of HEI connectivity which could be linked to the map, to show HEI demand by users, bandwidth requirement and so on. For example the map shown below plots the results from 51 HEIs surveyed in the AAU Connectivity Survey⁶ against the Africa Transmission Map.

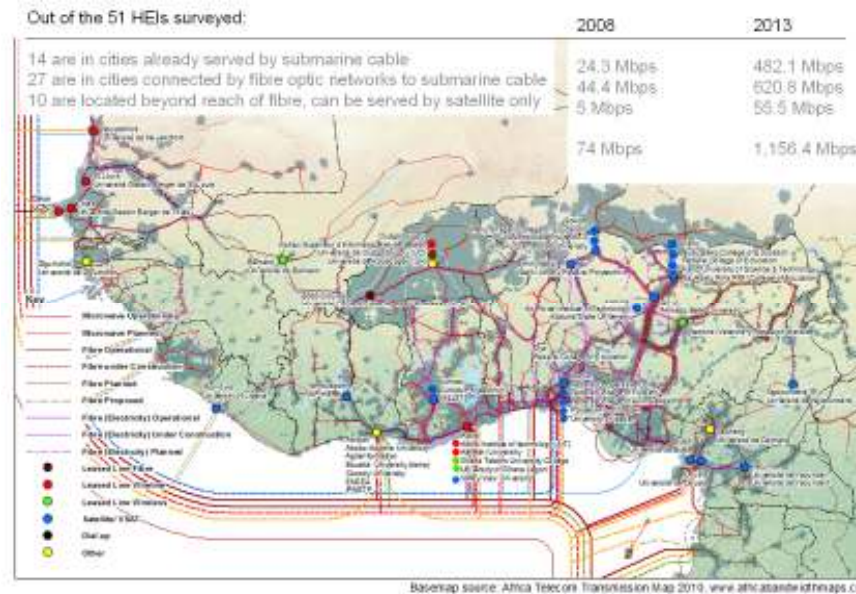


Figure 8: AAU Connectivity Survey: Addressing the Demand for Connectivity of HEIs in the West and Central Africa Region (map updated in October 2010).

- **NREN Connectivity:** Produce a detailed map layer of NREN connectivity (links), showing the current and planned national network links between HEIs. This file can contain technical data on the amount of capacity purchased or leased, network status and so on.
- **RREN Connectivity:** Produce a detailed map layer of RREN connectivity (links), showing the current and planned regional network links between NRENs, and onward connectivity by satellite or on submarine cables to RRENs such as Geant. This file can contain technical data on the amount of capacity purchased or leased, network status and so on.

4. Adding KML Layer of Academic Networks to the Africa Transmission Map

The web version of the Africa transmission supports the loading of external KML files as an overlay superimposed on top of the base layers. This has already been done for one client, is tested, stable and now in use. It is therefore possible to add KML file(s) showing HEIs, NRENs and RREN regional connectivity network as overlay(s), which is/are maintained, updated, published and hosted by the UbuntuNet Alliance. These KML files can be updated on a regular basis, to show a rolling update of academic network connectivity (nodes and links) as the network(s) evolve, capacities are upgraded, and an increasing number of HEIs are connected. This will initially

⁶ Source: <http://events.aau.org/content.php?id=14&/lang=en&mid=12>

show dozens of links, which will grow into hundreds as more planned networks become operational.

The KML format contains a number of properties, such as related information for each object, which are hard-wired as static information into the file. By connecting the KML file to an underlying database and/or using network links for example, this map file can be more efficiently and dynamically kept up to date, by maintaining the underlying database. The KML file(s) and/or underlying database could potentially therefore show all African HEIs, their co-ordinates and demand requirements, the current and planned national (NREN) and regional (RREN) network links with their capacities and status.

These KML files can then be published in the public domain for the whole academic networking community to use. They can be made available as KML file for downloading into Google Earth, placed into a Javascript API such as Google Maps, and/or published as PDF or other documents. Each format has its own pros and cons, for example using a Javascript API platform would enable the streaming of news items through the map (“South Africa: SanRen Network Completed”) and so on. Another advantage of publishing through a Javascript API is that the map which is shown can always be the current version.

The KML files can also be compared against the underlying Africa Telecom Transmission network map to show which of the physical links have become operational or have become feasible over time. This can be used for network planning and maintenance purposes by the technical staff of NRENs and the UbuntuNet RREN. This would be a customised web version of the Africa transmission map which contains the KML file(s) hardwired into them. This customised map would be contained in the password-protected client area of the Africabandwidthmaps website, and provided on a discounted multi-user subscription basis. The KML files themselves will continue to be owned, maintained and hosted by the UbuntuNet Alliance, but appear as a selectable overlay in the transmission map.

References

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- [3] “The IDRC Acacia Atlas 2005: Mapping African ICT Growth”, Oct.2005. Bandwidth and African Universities p.34, Distribution of Academic Institutions p.35. <http://www.idrc.ca/acacia> also available at http://www.africabandwidthmaps.com/?page_id=78
- [4] UbuntuNet website. <http://www.ubuntunet.net/>

[5] P.Hamilton. (2010) “Addressing the Demand for Connectivity of Higher Education Institutions in the West and Central Africa Region”, paper presented at High Level Conference on the Connectivity of West and Central African Higher Education Institutions: Providing Adequate and Affordable Bandwidth to African Higher Education and Research Institutions, African Association of Universities (AAU) research and Education Networking Unit (RENU), Accra (Ghana) 18 – 19 October 2010. <http://events.aau.org/content.php?id=14&/lang=en&mid=12>

5. CONFERENCE PRESENTATIONS AND DISCUSSIONS

Sub-theme 1: Content, Applications, Innovations, and Collaboration ***Rapporteur: Solomon Dindi, CEO, MAREN***

Co-ordination and Harmonisation of Advanced e-Infrastructures (CHAIN) ***Tiwonge Banda, UbuntuNet Alliance and Dr Bruce Becker, SAGrid***

Discussion

It was noted that the problem faced is the interoperability of solutions. Serious issues to be addressed include languages. There is need for transparency on technologies. It was also noted that electric power is another major problem since a greater part of Africa is not well served with power – interconnectivity should come along with power. There is need for capacity building along with publicity and awareness of the various projects involving e-infrastructure applications

There is a scarcity of resources in Africa. There is need for collaboration at national level in addition to collaboration at regional and global levels.

There is need to bring in solutions that solve local solutions in the African context.

The Presentation is available at:

<http://www.ubuntunet.net/sites/ubuntunet.net/files/tiwongeuc2010.pdf>

The role of broadband networks for the social and economic development of the countries

Alireza Khosrow, e-Government and e-education Director, Alcatel-Lucent

Discussion

While recognizing the very stimulating presentation, there is recognition of the for NRENs to actively involve researchers (Researchers drive NREN's) not just to be talking about bandwidth.

The Presentation is available at:

<http://www.ubuntunet.net/sites/ubuntunet.net/files/alirezakhosrowuc2010%20%5BCo%20mpatibility%20Mode%5D.pdf>

New Models for Education Access and Innovations for NRENs in Africa

Ashraf Patel

Discussion

As in the previous discussion, again, the need to actively involve researchers (Researchers drive NREN's) was emphasised and not only to think about bandwidth

There was a question on whether there is any e-learning system to be established in Ethiopia. The question was asked in the context of collaboration i.e. implementers of the e-learning system can collaborate with EthERNet. In response, it was noted that University of Western Cape has developed so many tools which can be used in development of e-learning. The University of Witwatersrand has an e-learning unit which is continuously developing new tools. It is necessary to check with such universities.

Presentation available at:

<http://www.ubuntunet.net/sites/ubuntunet.net/files/ashrafpateluc2010%20%5BCompatibility%20Mode%5D.pdf>

The UbuntuNet Research Index for Information Sharing Model

Dr Nora Mulira, Director, Directorate for ICT Support, Makerere University

Discussion

There was a question on why the UbuntuNet Alliance needs to develop its own index since standard indexes (indices?) do exist. In response, it was highlighted that there are no known international standards that cater for local needs, therefore the local index to be developed should conform to international standards.

It was proposed that the indexing model being developed at University of Makerere should be adopted by the whole of Africa to avoid duplication of effort.

There was a question on how researchers are encouraged in Uganda to submit their publications. In response, it was reported that researchers are made to understand how their research papers, once published, help in ranking of Universities.

Presentation is available at:

<http://www.ubuntunet.net/sites/ubuntunet.net/files/noramulirauc2010%20%5BCompatibility%20Mode%5D.pdf>

Enhancing ICT Development in Africa: a framework for collaboration between NEPAD and African Research and Educational Institutions

Dr Towela Nyirenda-Jere, Programmes Manager, NEPAD e-Africa Programme

Discussion

There was a question on how NRENs can partner with NEPAD in development of centres of excellence. In response, it was reported that the issue of centres of excellence is conceptual. It is yet to be implemented.

The presentation is available at:

<http://www.ubuntunet.net/sites/ubuntunet.net/files/towerauc2010.pdf>

Sub-theme 2: Infrastructure

Adding Academic Networks as an external KML map layer to the web version of the Africa Transmission Network Map

Paul Hamilton, Independent Consultant

Discussion

There was a question as to whether Maps are available for a fee. And if so was there any discounts for NRENs? In response it was reported that indeed, the web version is available in single and multiuser editions with discounts

There was a question as to whether UbuntuNet could host versions of these resources. In response it was said that, UbuntuNet can own and host the KML files of this product with a Google map templates / Earth Map plug-in

There was a question as to whether these map available with time stamps to facilitate research of time series kind? In response, it was agreed that this is possible ; , it is interesting to see the rapid evolution of these maps over time and time labels can be added for that purpose. The maps are copyrighted materials available to researchers / scholars.

The presentation is available at:

<http://www.ubuntunet.net/sites/ubuntunet.net/files/paulhamiltonuc2010%20%5BCompatibility%20Mode%5D.pdf>

Emerging NRENs in Western and Central Africa and WACREN

Dr Ousmane Moussa , University of Moumouni, Niger, WACREN Representative

Discussion

There was a question as to whether many WACREN (potential) members have fiber off their coastal waters and are there many fibre landings points? In response it was clarified that indeed, WACREN may have many good options which are being documented as the NREN and RREN si started.

There was a question concerning the situation with regard to organizing the RREN / NREN traffic in WACREN? The response was that WACREN has applied for ASNs/ IP address space from AfriNIC and expects good news by early 2011

There was a question concerning what might be the “low-hanging fruits” to spur the start up – for example where might the first cross border (cross NREN) links be in WACREN? The response was an expression of optimism that Ghana, Nigeria and Senegal can break the ground in this regard and even host the first RREN routers in the network.

The presentation is available at:

<http://www.ubuntunet.net/sites/ubuntunet.net/files/oussmaneuc2010%20%5BCompatibility%20Mode%5D.pdf>

The Direction of Further evolution of fibre to and within Africa: Moderated Panel discussion with audience input and questions

Chair: Steve Song, Director UbuntuNet Alliance and Shuttleworth Foundation

Panellists: Axel Cleaberg (Cisco), Erik Osiakwan (AfrISP), Karl Keppke (SEACOM)

Introduction:

Steve Song gave a brief overview of the growing fiber links around (submarine) and across (terrestrial) Africa – an astounding rate of growth measured in kilometers and in carrying capacity.

Presentations: CISCO and SEACOM then made Powerpoint presentations

Discussion

There was a question concerning the efforts existing to extend terrestrial fiber to and across land-locked countries in Africa? The answer from SEACOM is, that they plan to extend fiber to Zambia (Copper Belt) by the end of the first quarter of 2011 and to Zimbabwe (Harare) possibly sooner than January 2011.

In answer to a question concerning the strategies that exist to promote infrastructure sharing in the region, the response was that there is evidence that operators are moving towards infrastructure sharing so as to roll out services faster, cut costs. But this is still largely limited to urban environments and governments need to be proactive in getting infrastructure roll out in rural areas. SEACOM achieves resilience of its services through capacity swapping and infrastructure sharing arrangements.

There was a question concerning SEACOM's role in providing managed services? It was asked whether SEACOM has become an operator and "part of the old world" and not "the future promise"? SEACOM answered that the company is not in the retail market but rather it is a whole seller of capacity to ISPs – at STM1 level, non-SDH market for countries that need such solutions. Managed services are for small consumers (40MBps, 80Mbps). There is not competition with NRENs. The price that SEACOM charges NRENs is actually below commercial costing rates for the capacity provided.

In answer to the question on the choice of landing points, the reply was that each landing is a commercial decision – costs and prospective business opportunity are evaluated. With hindsight it was felt that there are missed opportunities in some cases where landings were not implemented.

Given the growth in demand for and access to local content, there was a question on how this would affect the business models of cable operators. The reply was that SEACOM in the third phase of its existence may become a content creator and provider making use of growing local exchange points and infrastructure to build its business

Regarding internal networks in Africa, it was explained that there is now a large body of knowledge to guide practice - construction and management - in this area and good regular sector studies -for example by Research ICT Africa.-

Panel Closing Remarks:

For the roundup, the representative of AfrISPA's advice to delegates was "Get cross border (fiber) connectivity working across Africa NOW!", SEACOM's contribution was "Regulatory regimes need to open up space for competition even across border to deepen the gains from the first wave of deregulation in Africa." While CISCO concluded as follows: "NRENs started in highly regulated environments and survived

by getting exemptions from regulators. We need to get those exemptions wherever necessary / possible to create thriving NRENs “

Subtheme 3: Sharing Experiences and Innovation, and Initiative into Africa

Chair: Prof. Zimani Kadzamira, Chair UbuntuNet Alliance

What kinds of organisations may NRENs serve?

Dr Duncan Martin, CEO of TENET

Discussion

There were discussions on the difference between the Members of the NREN and the Beneficiaries. The major Public Universities and Statutory Research Councils are the Members in the case of TENET and the beneficiaries may be smaller universities, research associations in the not-for-profit education and research sphere. The separation helps prevent the Board from becoming too large to be productive. In terms of the Articles of Association, these define the types of institutions eligible.

The emerging concept of UCAN, Unified Community Anchor Networks that are emerging in the US are impacting the concept of NRENs, in that services are being provided to public institutions outwith the area of education and research.

On the subject of the current exclusion of private academic institutions from TENET, it was stated that this could change at some point. When asked about the relationship of TENET with the Regulator, it was stated that TENET is registered as an ISP and is treated as a normal ISP.

It was pointed out that the NREN must always avoid unfair competition

The presentation is available at:

<http://www.ubuntunet.net/sites/ubuntunet.net/files/duncanmartinuc2010%20%5BCompatibility%20Mode%5D.pdf>

Internet2, USA,

Dr. Louis Fox

Discussion

The emerging UCAN concept, (Unified Community Anchor Networks) raised a great deal of interest and some questions. Considering the inclusion of the health sector, it would be the not for profit health sector. On a question about providing service to community groups such as Police and Security, it was said that they would develop their own acceptable use policy (AUP). Local loop issues would still be there and last mile would still require commercial providers. But with bandwidth prices reducing rapidly, the future for ISPs will be different.

The presentation is available at:

<http://www.ubuntunet.net/sites/ubuntunet.net/files/luisfoxuc2010.pdf>

GEANT, the pan-European Regional REN
Cathrin Stover, International Relations Manager, DANTE

Discussion

After a comprehensive description of GÉANT, the answer to a question on usage revealed that traffic is not split, this is dealt with at a national level. Concerning research carried out by GEANT, the answer was that there is research into the extent the network is being used for educational activities. There was some discussion on data exchange, access to journals and shared research databases, it was felt that NRENs need to work at encouraging sharing by their member institutions, moving away from working in isolation.

Regarding GEANT and UCAN, GEANT Is aware of the changing situation and its potential for conflict. The policy committee has not yet committed to this direction, but if it does and AUPs are developed, then that is considered enough.

The presentation is available at:

<http://www.ubuntunet.net/sites/ubuntunet.net/files/cathrinstoveruc2010%20%5BCompatibility%20Mode%5D.pdf>

Strategic Communication for NRENs and RRENs
Dr. F.F Tusubira, CEO of UbuntuNet Alliance

Discussion

After a lively presentation where it was made clear that each NREN requires a Communications Strategy, a question was asked as to why, given the importance, UbuntuNet Alliance does not yet have a Communications Strategy? The reply was that the Alliance has the key elements of a strategy and a full communications audit is what is required. It was added that interaction by UbuntuNet with CLARA, which has a well developed Communications Strategy, is assisting the Alliance. The importance of an institution speaking with one voice was emphasised.

The presentation is available at:

<http://www.ubuntunet.net/sites/ubuntunet.net/files/tusuuc2010.pdf>

Sub theme 4: Regulation

Chair: Dr F F Tusubira, CEO, UbuntuNet Alliance

Moderated Panel discussion with audience input on Regulation: Is the regulatory environment in Eastern and Southern Africa supportive for the development and operation of NRENs and the Alliance Chair: Tusu with Moses Bayingana, ICT Expert, HRST, AUC, Ms Joanita Namwepa, Manager, Enforcement and Compliance, UCC, Garry Mukelabai, Director, Technical Services, ZICTA

Supportive Regulation for Research and Education Networking in Africa
Joanita Nampewo, UCC

Presentation available at:

<http://www.ubuntunet.net/sites/ubuntunet.net/files/joanitauc2010.pdf>

Regulation Environment in Africa

Moses Bayingana, ICT Expert, African Union Commission

Presentation available at:

<http://www.ubuntunet.net/sites/ubuntunet.net/files/mosesbayinganauc2010%20%5BCompatibility%20Mode%5D.pdf>

Regulations and RENs

Garry Mukelabai, Manager Information Systems, Zambia ICT Authority

Presentation available at:

<http://www.ubuntunet.net/sites/ubuntunet.net/files/garrymukelabaiuc2010.pdf>

1st Round of Discussion and Questions

In response to a request for details of the HIPSSA project, the details information on HIPSSA project, the audience were informed that EACO could play a role of smoothing the work of regulators like UCC and KCC at the cross border link

In response to discussion led by delegates from Rwanda and Zimbabwe as to whether the Regulator was more of a facilitator, the presenter responded that EACO is not an enforcer so it cannot be a regulator: its role is more of a facilitator. The political situation for example in some of the nomadic areas on the Kenya Uganda border makes information on cross border issues cable issues more complex.

The Director of Technical Services of ZICTA pointed out projects in such areas as emergency response and cyber security started at a regional level and were taken up then at national level. The CEO of UbuntuNet contributed drawing experience from NRENs that they may believe they have are visible when in fact they are not. Formalising of EICO would assist in giving it the necessary visibility.

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2nd Round of Discussion and Questions

A stimulating round of questions and discussion followed concerning partly the role of the Incumbent vis a vis regulator and the fact that the regulator seems at times to have to wear two or more hats. While the NRENs do need more visibility, it was also expressed that in some countries the researchers and NRENs are really doing their best but would appreciate more active reaching out to them by the Regulator. It was pointed out that the resources that accrue to the Regulator from licenses should be used to regulate and not to control.

A speaker enlarged on the cross border issue stating that there did not seem to be a problem with fibre crossing the Zimbabwe South Africa Border.

The regulator acknowledged that when the regulator and incumbent is one and the same, the situation is extremely complex. They encouraged the DGs of Regulatory bodies to ensure that information that comes to them is filtered to all who can benefit, and the NRENs should work to ensure their own visibility with DGs.

Last comments from presenters:

- NRENs-Sell yourself – Lets get to know about you. Formalise EICO about the barriers in the borders we are working on them.

- Things in Government happen very slowly, we play to the tune, lets keep each other knowing what is going on.
- Lets work together, each of us has a very important role to play – we all have the same goal and that is social developments

SUMMING UP

Tusu Tsubira

- We have learned a lot from each other
- What is true is that they are all respective
- NREs – We need to be more proactive – what I like is the idea of lobbying
- We have all a common mission

Annexe 1: List of Participants to the UbuntuNet-Connect 2010

NAME	INSTITUTION	COUNTRY	E-MAIL
Dr. Iman Abdelrahman	SUIN	Sudan	imaaly@suin.edu.sd
Prof. Awad Ahmed	SUIN	Sudan	awadha@neelain.edu.sd
Tarig Ahmed	SUIN	Sudan	tarig@suin.edu.sd
Reuben Akim	TERNET	Tanzania	reuben.akim@out.ac.tz
Yanet Alemu	EtherNet	Ethiopia	yanet_alemu@yahoo.com
Andrew Alston	TENET	South Africa	aa@tenet.ac.za
Kennedy Aseda	KENET	Kenya	kaseda@kenet.or.ke
Prof. John Asibo	RENU	Uganda	opas_jn@yahoo.com
Zelalem Assefa	EtherNet	Ethiopia	raszalalem@gmail.com
Dr. Jabiri Bakari	TERNET	Tanzania	jabiri.bakari@out.ac.tz,
Tiwonge Banda	UbuntuNet Alliance	Malawi	tiwonge.banda@ubuntunet.net
Moses Bayingana	AUC	Ethiopia	bayinganam@africa-union.org
Bruce Becker	CSIR Meraka	South Africa	BBecker@csir.co.za
Prof. Ngwabi Bhebe	ZIMREN	Zimbabwe	bheben@msu.ac.zw
Erik-Jan Bos	SurfNet	Netherlands	erik-jan.bos@surfnet.nl
Axel Clauber	CISCO		aclauber@cisco.com
Solomon Dindi	MAREN	Malawi	soldindi@yahoo.com
Etienne Ntagwirumugara	RwEdNet	Rwanda	entagwir@yahoo.fr
Louis Fox	Internet 2	U.S.A.	louisbfox@gmail.com
Fikiri Hafidh	TERNET	Tanzania	hfikiri@costech.or.tz
Paul Hamilton	Hamilton Research Ltd.	U.K	hamilton.paul@btinternet.com
Dr Gilford Hapanyengwi	ZIMREN	Zimbabwe	ghapanyengwi@compcentre.uz.ac.zw
Patrick Holahan	TENET	South Africa	patrickh@tenet.ac.za
Geoff Hoy	TENET	South Africa	ghoy@tenet.ac.za
Hisham Ibrahim	AfriNIC	South Africa	hisham@afriNIC.net
Richard Jonathan	TENET	South Africa	tenetadmin@tenet.ac.za
Prof. Zimani Kadzamira	UbuntuNet Alliance	Malawi	profzdk@gmail.com
Prof. Dibungi Kalenda	Eb@le	DRC	dibungikalenda@yahoo.com
Augustin Kanyimbu	Eb@le	DRC	augustin.kanyimbu@unikin.cd
Prof. Meoli Kashorda	KENET	Kenya	mkashorda@kenet.or.ke
Amon Kasonda	ZAMREN	Zambia	amon.kasonda@unza.zm
Karl Keppke	SEACOM	Kenya	keppke@seacom.mu
Alireza Khosrow	Alcatel-Lucent	France	alireza.khosrow@alcatel-lucent.com
Bonny Khunga	ZAMREN	Zambia	khungab@cbu.ac.zm
Prof. John Kondoro	TERNET	Tanzania	principal@dit.ac.tz
Wilfred Kuria	Xnet	Namibia	wilfred.kuria@gmail.com
Christiaan Kuun	CSIR Meraka	South Africa	ckuun@csir.co.za
Daniel Lete	HEAnet Limited	Ireland	daniel.lete@heanet.ie
Ludmila Maguni	MoRENet	Mozambique	ludmila.maguni@mct.gov.mz
Zukisani Makalima	SANReN	South Africa	zmakalima@csir.co.za
Prof. Patrick Mangheni	RENU	Uganda	mangheni@renu.ac.ug
Juvencio Manjate	MoRENet	Mozambique	juvencio.manjate@mct.gov.mz
Dr. Duncan Martin	TENET	South Africa	ceo@tenet.ac.za
Teboho Masiteng	Alcatel	South Africa	teboho.masiteng@alcatel-lucent.co.za
Ronald Milford	NSRC	U.S.A	rmilford@grmoc.iu.edu
Simeon Miteff	CSIR	South Africa	smiteff@csir.co.za
Prof. Paul Muinde	KENET	Kenya	pmuinde@daystar.ac.ke
Garry Mukelabai	CRASA	Zambia	gmukelabai@zicta.zm
Dr. Nora Mulira	RENU	Uganda	nora@dicts.mak.ac.ug
Mike Mwambakulu	MAREN	Malawi	mwambakulum@lustech.org.mw
Joanita Nampewo	RENU	Uganda	jonam@ucc.co.ug
Beatrice Ng'ambi	UbuntuNet Alliance	Malawi	beatngambi@ubuntunet.net
Vera Ngosi	AUC	Ethiopia	ngosiv@africa-union.org
Margaret Ngwira	UbuntuNet Alliance	Malawi	mengwira@ubuntunet.net
Prof. Loyiso Nongxa	SARUA	South Africa	loyiso.nongxa@wits.ac.za
Albert Nsengiyumva	RWDA	Rwanda	albert_nsengi@yahoo.com
Etienne Ntagwirumugara	RwEdNet	Rwanda	entagwir@yahoo.fr
Towera Nyirenda- Jere	NEPAD	South Africa	tjere@scientia.co.za
Omo Oaiya	WACREN	Nigeria	kodion@gmail.com
Eric Osiakwan	AfriSPA	Ghana	eric@afrispa.org
Ashraf Patel	SAFIPA	South Africa	ashraf07@gmail.com
Linda Saka	MAREN	Malawi	secretariat@maren.ac.mw
Hillel Shrock	Internet Solutions	South Africa	hillel@is.co.za
Clifford Sibanda	ZIMREN	Zimbabwe	cclsibanda@nust.ac.zw
Dale Smith	NSRC	U.S.A	dsmith@uoregon.edu
Cathrin Stover	DANTE	U. K	cathrin.Stover@dante.net

William Stucke	ICASA	South Africa	william@gpop.co.za
Moroka Frank Tapala	TENET	South Africa	frankt@uj.ac.za
Prof. Juvenalis Tembo	ZIMREN	Zimbabwe	dvc@cbu.ac.zm
Ousmane Mousa Tessa	WACREN	Ghana	ousmane@wacren.net
Dr. Francis Tusubira	UbuntuNet Alliance	Uganda	fftusu@gmail.com
Roland Van Hout	RwEdNet	Rwanda	rvhout@nur.ac.rw

Annexe 2: Capacity Building Activities

Sunday 14th November	<i>Arrival of participants for CTO Training Workshop and the AfricaConnect Administrative Meeting</i>
Monday 15th November	<ul style="list-style-type: none"> <i>i. Capacity building workshop for CTOs of NRENs (by invitation)(See Programme attached)</i> <i>ii. Africa Connect Administrative Meeting(by invitation) (See Agenda Attached)</i> <i>iii. Arrival of Chairs and Members of Boards of NRENs</i>
Tuesday 16th November	<ul style="list-style-type: none"> <i>i. Capacity building workshop for CTOs of NRENs (day 2)(See Programme Attached)</i> <i>ii. Executive Workshop for Chairs, CEOs, and Board Members of NRENs (See Programme attached)</i>
Wednesday 17th November	<ul style="list-style-type: none"> <i>i. Meeting of ExCom 8:30 – 10:00</i> <i>ii. Meeting of CEOs with CTOs in Attendance 10:30 – 13:00</i> <i>iii. Technical outing (afternoon) for CEOs and CTOs arranged by TENET</i> <i>iv. Board of UbuntuNet Alliance Meeting 15:00 – 17:00</i> <i>v. Arrival of UbuntuNet-Connect participants – Registration at Kopanong</i>

Tuesday 16th November		Facilitated by Tusu
0800 – 0830	Registration	
0830 – 0845	Self Introductions	
0845 – 0915	Setting the stage: What is the purpose of an NREN? What are the Roles of the CEO and the Board? What kinds of governance structure are suitable for an NREN?	Duncan Martin, CEO, TENET
0915 – 0945	Discussion	
0945 – 1030	What are the challenges and that CEOs and Boards face? <i>Each NREN represented will take not more four minutes to share the challenges it faces</i>	
1030 – 1100	Health Break	
1100 – 1145	Sharing best practices: Taking into account the presentation, and the challenges faced by NRENs, participants will be invited to shared best practices and/or their thinking on how NREN Boards and CEOs can more effectively fulfill their mandates	
1145 – 1215	Fundraising and Working with Development Partners: key success factors	F F Tusubira, CEO, UbuntuNet Alliance
1215 – 1245	Discussion and sharing success tips	
1245 – 1400	Lunch Break	
1400 – 1440	Service costing and pricing: principles and recommended practice Our two most advanced NRENs, TENET and KENET, will share their perspectives and practice	Duncan Martin, CEO TENET; Meoli Kashorda, CEO KENET
1440 – 1515	Discussion	
1515 – 1545	Health Break	
1545 – 1630	Open Forum: All participants will have the opportunity to raise questions relating to topics discussed during the day, or to related areas. Answers will be sought from among all the participants	
1630 – 1645	Recap and Evaluation; planning future interactions	
1645 – 1700	Summing up and closing	Prof Z. Kadzamira, Chairperson, UbuntuNet Alliance

