

## Linking up the layers: Campus Networks and Access to e-resources in Africa

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### Abstract

*The ability for researchers to access and contribute to the wealth of knowledge and electronic information is not simply a matter of 'hooking' Africa to the World Wide Web. Studies have shown that availability of e-resources does not automatically lead to immediate or easy access to such resources. Improving access to the internet for researchers can be understood as a 'layer cake'. At the highest level are Regional Educational Networks and National Regional Educational Networks. At the lower end are the individual campus networks. While the first two "layers" are important, it is university personnel who provide network connectivity and services at the campus level that play a crucial role as the first link in the networking chain, enabling libraries and researchers to gain access to electronic information and scholarly resources. If local technicians are to understand and meet the needs of researchers, it is crucial that they collaborate with experts in access and use of research literature – university librarians. This presentation describes the work of INASP (International Network for the Availability of Scientific Publications) to strengthen the technical capacity of IT managers in selected African countries. Recognising the multi-layered nature of ICT infrastructure, INASP is trialling a two-strand approach: local and national. The first aims to help universities to develop the expertise of their campus IT engineers and build their relationship with library staff; the second aims to help strengthen the capacity of the National Research and Educational Networks (NRENs) so that they can then train IT staff in their member institutions. The program and its evaluation through NREN, campus engineer and librarian feedback are described.*

### Introduction

INASP (the International Network for the Availability of Scientific Publications: [www.inasp.info](http://www.inasp.info)) is an international development charity funded by governments in the UK and Sweden, which works with a global network of partners to improve access, production and uptake of research information and knowledge, so that countries are equipped to solve their development challenges. INASP was founded in 1992, has a staff of c. 31, and is based in Oxford, UK

In April 2013 INASP launched a new flagship programme, Strengthening Research and Knowledge Systems (SRKS). This five-year programme now works closely with 22 partner

countries and provides online scholarly literature to a further 44 countries in Africa, Asia and Latin America. SRKS builds directly on the achievements of our earlier Programme for the Enhancement of Research Information (PERI) that ran from 2002 to 2012.

Through our SRKS programme we help and support academic librarians, ICT staff, researchers, journal editors and publishers to generate the knowledge needed to inform social and economic development

The programme includes:

- Working with international publishers to ensure researchers have affordable access to the latest scholarly literature in their discipline
- Supporting library consortia to negotiate successfully with publishers for the purchase of journals and books
- Building the academic literacy skills of researchers
- Giving early career researchers the skills to write up their work for publication
- Helping developing country journals improve their publishing processes and get their content online and visible to the global scholarly community
- Promoting the widest possible availability of local research through Open Access
- Working with library and information science schools to train librarians in the management and effective use of digital technologies
- Ensuring IT and computer staff can maintain university networks that allow easy access to digital resources

It is this last element of the programme on which I am now concentrating.

## Statement of Need

While prominent attention has been given to the provision of undersea cabling around the African continent and national backbone fibre networks, the importance of establishing basic infrastructure inside universities cannot be overlooked, and remains an unmet need in many institutions in the region. The lack of campus-level infrastructure and facilities for local bandwidth management has frequently been cited as a major constraint to be dealt with on the way to high-speed connectivity.

For example, Wilson-Strydom and Fongwa report:

*Most universities in the region are seriously constrained in their use of ICT by a shortage of computer stations and a lack of access to affordable high-speed Internet connectivity.*

*With traditional libraries now becoming a thing of the past and increasing dependence on online libraries and databases, higher education institutions in sub-Saharan Africa and the SADC region will urgently need to address the application of ICTs in the management of academic information services to enhance academic quality and knowledge output for a knowledge economy in the region<sup>1</sup>*

Insofar as campus-level networks are concerned the Arcadia study “Growing knowledge” noted that many survey respondents commented that:

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<sup>1</sup> Wilson-Strydom, M. & Fongwa, S.N. A Profile of Higher Education in Southern Africa. Vol. 1: a regional perspective. (SARUA, 2012)

*Poor connectivity, including slow speeds, dropping connections, and the related problem of intermittent power supply, frustrates their attempts to access electronic resources. One respondent commented that '[the] internet is very slow during "normal" working hours. I usually have to stay late or come during weekends to make effective use of the web'. Another complained that 'downloading electronic resources is not easy because our internet is too slow. It requires a lot of patience. To download important resources it can take one the whole day'.<sup>2</sup>*

Even with relatively good bandwidth poor network management at the campus level can rapidly lead to a significant deterioration in bandwidth availability as it gets used to access social networking and entertainment sites or bandwidth intensive mail systems such as Yahoo! Spam and viruses can also severely disrupt access. Hence it is imperative to address the issues of bandwidth management, traffic monitoring and control, filtering and security software etc. at the campus level.

The above observations tally with the conclusions reached by Echezona and Ugwuanyi:<sup>3</sup>

- Bandwidth is a scarce resource in developing world and requires strategic decision for its allocation.
- Consortium formation is necessary as it encourages economics of scale and purchasing of bandwidth in bulk through VSAT. It will equally facilitate migration from VSAT to terrestrial connectivity or the optic fibre connection.
- African universities operate at bandwidth capacity in kilobits while the developed world is in megabits and gigabits.
- Bandwidth management should be incorporated into the institutional objectives of African universities

And as Harle also points out:

*"In several cases, universities had introduced or are introducing wireless networks on campus, in order to provide internet access points for those with their own laptops, thus reducing the burden on fixed terminals. This has the potential to significantly open up internet access (many academics and increasingly some students have their own laptops) but, of course, the more computers on a network at any one time, the wider its capacity is shared, and the lower the capacity available to any single user machine. Good network and bandwidth management thus becomes of even greater importance".*

Correspondence with colleagues at the UbuntuNet Alliance (UA)<sup>4</sup> has similarly identified several problems at the campus level:

- Unskilled human capacity, arising from inadequate training at University and technical college level, and very limited exposure to good production networks
- Poorly configured campus networks, becoming the bottleneck in Internet access
- Inability to afford the necessary quality of equipment for a good network

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<sup>2</sup> Harle, J. Growing knowledge: access to research in east and southern universities. London, ACU, 2010.

<sup>3</sup> Echezona, R.I. & Ugwuanyi, C.F. African university libraries and Internet connectivity: challenges and the way forward. Library Philosophy and Practice 2010 (<http://www.webpages.uidaho.edu/~mbolin/echezona-ugwuanyi.htm>)

<sup>4</sup> The UbuntuNet Alliance is a regional association of National Research and Education Networks (NRENs) in Africa.

The author of a 2012 study of bandwidth in Zimbabwean universities summarises the situation succinctly:

*“Lack of appropriate bandwidth management is preventing the productive use of the Internet at the universities, which in turn yields to low quality academic and research work”.*<sup>5</sup>

## Programme Goals

In developing the objectives of the INASP programme we were very clear that our ultimate goal was to improve access at the desktop for researchers, academics and students to electronic journals, e-books and databases. Thus the focus would be on helping universities and higher educational institutions to develop the expertise of their campus IT engineers thereby contributing to improved campus network and bandwidth management, and to the development of solid ICT infrastructures and policies. At the same time we would strive to encourage a better understanding by campus IT engineers of the needs and priorities of libraries and their users.

As this activity was a relatively new undertaking for INASP it was decided to consider this programme as a “pilot” and to limit our involvement to three countries only: Tanzania, Uganda and Zambia. These countries were selected on the advice of the UbuntuNet Alliance as their respective NRENs (TERNET, RENU and ZAMREN) were relatively well established and considered “ready” to respond to this initiative.

## The Building Blocks

In the process of developing a meaningful programme of support in this general area INASP carefully considered the underlying infrastructure. Kotecha<sup>6</sup> suggests that ICT infrastructure can be conceived as a ‘layer cake’ or a pyramidal set of building blocks comprising:

- a. campus-level networks and ICT resources
- b. the national infrastructure network (National Research and Educational Networks or NRENs)
- c. regional and global links through wider-reaching RENs.

The personnel who provide network connectivity and services at the campus level play a crucial role as the first link in the networking chain. Local technicians are in a good position to understand the needs and aspirations of the users and help them to develop and use the services effectively.

NRENs<sup>7</sup> ideally serve as bandwidth consortia, creating economies of scale, negotiating affordable Internet access and the terms of access for member institutions, and sharing the

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<sup>5</sup> Chitanana, L. Bandwidth management in universities in Zimbabwe: towards a responsible user base through effective policy implementation. *International journal of education and development using Information and Communication Technology*, 8 (2), 2012, 62-76

<sup>6</sup> Kotecha, P. Dazzling technologies: addressing the digital divide in the Southern African universities. *African journal of information and communication*, 10, 2009-2010, 53-66

<sup>7</sup> For more information about RENs and NRENs see the issue of *Educational technology debate: exploring ICT and learning in developing countries*, June 2011 (<http://edutechdebate.org/archive/research-and-education-networks/>)

costs of connection to international RENS. NRENs offer opportunities for in-country collaborative research practices and for regional and international linkages.

RENS (e.g. UbuntuNet Alliance) enable African scientists to connect to each other and for global research teams to move from an era of research isolation to an era of research collaboration. The purpose of UbuntuNet Alliance is to support the development of NRENs in Africa and to support cross-border connectivity to enable research collaboration across African countries and beyond.

Although this Programme focusses on (a) above it is clear that each layer of the “cake” needs to function well if the INASP objectives were to be achieved.

## Programme Method

Recognising the multi-layered nature of ICT infrastructure management the INASP programme initially trialled a two-strand approach, which might be described as bottom-up and top-down.

The idea of the bottom-up approach was essentially to work with IT engineers at selected campuses in the three selected partner countries (Tanzania, Uganda and Zambia). This would take the form of support to attend regional or international training events such as AfNOG<sup>8</sup> and UbuntuNet Connect, or secondment to other institutions.

Under this strand 7 campus engineers from 5 campuses<sup>9</sup> were supported to attend the AfNOG training in Lusaka in May 2013. Detailed reports from the participants indicated that the training was effective in developing their skills, and all reported using their skills to make changes at their institution. The majority of the engineers trained reported changes specifically aimed at meeting the needs of researchers and several were taking steps to increase their understanding of the needs of librarians and library users.

The Librarians from the 5 institutions were also contacted, four of whom responded.

- Of the institutions where both librarians and engineers responded, there seemed to be agreement in the approaches that they intended to take to improve access for research users.
- Three out of four librarians said they were aware of the INASP training. Those that said they were aware of the training said that they had been in contact with the engineer since and two said that they had seen a marked improvement in the relationship:

*“There is an improvement in contact especially in detecting network problems particularly in the library”.*

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<sup>8</sup> African Network Operators Group (<https://www.afnog.org/>) offers regular training in network technology covering different elements (e.g. Advanced routing; Scalable network infrastructure; Network management; scalable Internet services, etc.)

<sup>9</sup> The institutions were: Copperbelt University, University of Zambia and Evelyn Hone College (Zambia); Uganda Christian University (Uganda); University of Dodoma (Tanzania)

*'The library and the IT unit have always had a good working relationship. However, since the Afnog training for our IT personnel, the attention to library services has escalated. We meet on several occasions to discuss and lay strategies on how to improve access to our online library resources and services.'*<sup>10</sup>

- All four librarians said that they had plans for collaboration with the engineer at their institution. Three gave details of how they planned to collaborate, two of which were quite detailed and one somewhat less clear.
- All four librarians said that they thought the training that the engineers had received would make a difference to research users' needs. Two librarians gave more detailed information, referring to an increased awareness of the need for a stable network for research users, both also referring to the important role the engineers play.
- Three out of four librarians said that changes had already been made at their institution. At Ugandan Christian University (UCU) and the University of Zambia, where both the librarian and campus engineer responded, there seemed to be agreement between in the changes that had been made.

Interviews were conducted with the two librarians from UCU and the University of Zambia several months later. Both had already indicated a positive relationship with the engineers at their university, which was further reinforced in their interviews:

- David Bukenya, from UCU, again showed a detailed understanding of the changes being made. In addition to other improvements in the library, he discussed how the library and engineering departments had pooled their funds to develop a presentation facility for researchers conducting their vivas and presenting their research. He also noted that it would be beneficial for more universities in Uganda to be part of RENU, but not all had the facilities to support this. He was supportive of the engineering department and what they were able to do with limited resources.
- Francina Makondo, from the University of Zambia, discussed how the engineer has asked her to educate him on the needs of the library and the concerns of researchers. She was working with the engineering department to develop a Moodle course and they are working together on other improvements. She said that the IT department is starting to see the library as a critical partner, and ideally there would be a permanent member of the IT department linked to the library.

Further feedback was later received from Agnes Chitambo, Librarian, Copperbelt University:

*'Yes, there has been some activity around wi-fi, which, I am delighted to report has had a positive impact on connectivity, and consequently, access to e-resources at CBU. Apparently, the signal reception is strongest in and around the Library building ... Regarding corporation with the IT staff, yes, we work very closely. In December, the Director and four IT staff also participated in our (Library) workshop to trouble shoot the library management system and look into various IT related issues pertaining to library operations. Similarly, library staff participated in an IT Strategy workshop organized by the IT department, towards the end of last year. I appreciate the manner we*

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<sup>10</sup> This and following citations are extracted from participants' workshop feedback, reports and correspondence

*(Library) are working with the IT department, and will continue to urge the Library Database Manager to outline and communicate suggestions on areas they can assist us with.'*

These responses clearly indicate that the relationship between the librarian and campus engineer had improved, and the librarian recognised the value of the changes made for increasing e-resource access. For three universities in particular (UCU, Copperbelt and the University of Zambia) there seemed to be evidence of a good level of collaboration, and at UCU a more detailed understanding from the librarian of the changes being made and how that would meet the needs of researchers. The two librarians who had developed the most collaborative relationships with engineers showed a good level of understanding in what they could develop together and seemed to be champions of the engineering department and vice versa. While the main improvements highlighted were linked to increased connectivity and the reach of the network, in those universities that showed the most collaboration, other initiatives had started to develop, linked to joint training and pooling resources for joint projects.

## **Strand 2: Top-down approach: NREN development**

Although working directly with campus engineers was successful it was quickly recognised that this approach would not be sustainable. INASP works with c. 1,200 institutions and the same level of support could never be offered to each one! Hence the second strand or approach – development of the training capacity of the NREN to enable them to assume a greater role in training of HEIs in their country.

NRENs are not-for-profit organisations providing advanced services to the research and educational community. There tends to be a single NREN in each country responsible for networking or interconnecting the local networks of the research institutes and institutions of higher education in the country. Enabling data transfer across these member networks at high speeds enables knowledge sharing and online communication among research teams, and with post-graduate research students, linking academic communities irrespective of their geographic location. It is argued that NRENs play both a supporting role for research delivery by enabling data transfer and communication, and a direct facilitation role in that they enable research teams to construct virtual platforms for experimental design and research collaboration.

They are part of the research and education community (indeed often located within a major university, or library in the case of Kenya) and hence close to the constituency that they serve. They are generally independent of specific suppliers and solutions and are trusted by the community. They are able to bring the benefits of collective buying power to universities by procuring networks and services on a national basis thereby to delivering good high quality services at an economic price. This provides savings for the community and the participating countries.<sup>11</sup>

Another important role of the NRENs is the training and support of local campus engineers, and helping to develop local campus IT infrastructure.

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<sup>11</sup> This description is taken from: Dyer, J. The case for National Research and Education Networks (NRENs). Amsterdam: TERENA, 2009

During the first year of the programme (April 2013-March 2014) we experimented with this approach simultaneously. NREN engineers from Tanzania (TERNET), Uganda (RENU) and Zambia (ZAMREN) were supported to attend the UbuntuNet Connect advanced networking training workshop in Rwanda.

After the workshop the 5 NREN staff completed a training assessment questionnaire. All said the training had helped them with both teaching skills and with technical skills, especially relating to best practices for building campus network for research and education and workshop logistics. All said they felt confident in this new area and had plans to hold training in the near future. In addition, the engineers were asked:

- how they would encourage campus engineers to incorporate the needs of librarians and research users
- what challenges there might be in ensuring that the training they provide will lead to better access for library users

In response to the first question two engineers indicated that they would communicate this through their training in some way. One, however, said that they would meet with librarians of the institutions where they would conduct training, and another said that they would include librarians in the training they would be conducting:

*'I will conduct a training workshop based on campus network together with Library and two engineers and librarian [from each campus] will have to attend the training. This is very important, in my experience I found that most librarians and library users to me seems like something is missing I using the library systems, so I think it's much better to be trained so that to be able working with automation library systems.'*

Interestingly the response quoted above indicated the benefits the NREN engineer perceived in training both librarians and campus engineers at the institutions. This also reflected the findings from the campus level approach that those librarians with the greatest understanding of the changes being made seemed to have developed a good working relationship with the engineering department.

The 5 NREN engineers were committed to delivering at least one training workshop for campus IT staff in their respective countries. These were duly completed with the result that some 75 campus engineers attended the events.

Findings at the end of the first year of operation clearly demonstrated that the training of campus IT engineers can be achieved in two ways: by supporting campus engineers directly to participate in international training events such as AfNOG, or by supporting the training capacity of NRENs so that they are able to train larger numbers of IT staff at their member institutions. Both approaches were seen to have their merits and disadvantages. While the latter is more sustainable, though harder to track library/IT staff collaboration, the former may be more appropriate for certain more advanced institutions (centres of excellence) or in countries with less developed NRENs.

Working directly with individual campuses clearly indicated that improving the relationship between campus engineers and librarians can have a positive impact on the changes made to campus networks to meet the needs of researchers and can provide the basis for further collaboration. However, in terms of sustainability, there was a strong argument for training NREN engineers in the skills required to train campus engineers. In addition, training several

NREN engineers from different countries at the same time was seen to help strengthen regional collaboration networks.

Consequently a decision was taken that from April 2014 we would concentrate on the top-down approach via the NRENs.

In May 2014 6 NREN engineers were supported to attend AfNOG training in Djibouti and a further 2 from RENU attended the 2015 training in Tunis. Six engineers participated in training-the-trainer workshops (facilitated by staff of NSRC <sup>12</sup>) at UbuntuNet Connect in November 2013 (Kigali) and in November 2014 six NREN staff participated in the UbuntuNet Alliance training workshop and conference in Lusaka (three from ZAMREN; two from RENU and one from TERNET). A second TERNET engineer was funded by Africa Connect and a fourth from ZAMREN by the NSRC. This was a good example of collaboration between different agencies working through the UbuntuNet Alliance.

These trainings are designed for ICT specialists with an already existing high-level knowledge and keep the NREN staff up-to-date on the latest technologies and working methods. As Bonny Khunga (CTO ZAMREN) explained:

*“One of the challenges that NREN’s face is up-to-date skills in an ever changing technologically driven industry. The ability to design, install and manage complex networks is paramount so that the NREN can provide advanced ICT services that are technologically appropriate and cost-effective in relation to commercial service providers.”*

Over the past year to April 2015 five further campus networking training workshops were organised by the NRENs (two in Zambia, two in Uganda and one in Tanzania) in total involving about 90 participants. One of the major benefits of these workshops, as with the advanced training for NRENs, is that they encourage human contact. Both RENU and ZAMREN spoke of the importance of these networks in promoting network collaboration among engineers from various member institutions of the NRENs. They are a valuable space for people who are members of the same NREN to get to know each other.

While the campus networking training events have been a combination of both theoretical and practical there is no better way of reinforcing the learning than by actually offering the opportunity for a hands-on examination and renovation of a real campus network. Such events are known as Direct Engineering Assistance (DEA) workshops and they have been the natural follow-on activity. They involve network engineers from different institutions working to renovate and improve a real campus network infrastructure.

DEA or campus network restructuring events were held in Mzumbe University (Tanzania), Mbale, Gulu and Makerere Universities (Uganda), and Moshi University College of Cooperative and Business Studies (MUCCoBS), Teofilo Kisanji University (TEKU) and Institute of Social Work-DAR (Tanzania).

Dr Amos Nungu (CEO of TERNET) explains that DEA provides a platform for members to implement with assistance of experts the theory parts being taught in our trainings.

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<sup>12</sup> The Network Startup Resource Center (NSRC), based at the University of Oregon, was established in 1992 to provide technical assistance to organizations setting up computer networks in developing areas for collaborative research, education and international partnerships (see <https://www.nsrc.org/>)

*“Most institutions have badly designed networks, DEA provides capacity building and network redesign at almost no cost, except for the up keep and catering during the workshop.”*

While the NRENs cannot tell campus engineers what to do - they can only guide - the NRENs have found that many of the campus engineers do follow their advice. The networks work hard to follow up training workshops with DEA support. For instance Isaac Kasana (CEO of RENU) explains that RENU *“works closely with them in supporting and guiding them.”*

Perez Matsiko (Technical Manager at Uganda Christian University/RENU) elucidates further on the strength of DEA support. *“DEA is one of the visible measures you can use to apply the knowledge gained in real life. And it gives engineers confidence to implement changes on their networks. This is because one of the key challenges that has been highlighted is engineers fearing to make changes to their networks but with DEA it’s very easy since the activity involves experienced engineers and DEA has been one of the best tools in creating awareness to institutions about the work of the NREN community.”*

Sarah Kiden, one of the engineers who benefitted from DEA, explains how it improved her skills and confidence and, as a result, she was able to make practical changes to the Ugandan Christian University network, *“The training and DEA helped me to improve my skills and confidence in working on our servers. Specifically, I have been able to carry out System Administration work more confidently. The second training specifically gave me a deeper understanding of security in systems and on the network. I realised that we were not being as cautious as we should in terms of security on our network. We have been able to implement some of the security measures that were emphasised during the training.”*

Between October 2014 and January 2015 TERNET conducted a needs assessment (e-readiness survey) of their members in the anticipation that this will allow them to provide tailored, effective DEA support to the campuses, both in terms of capacity building and equipment. Amos Nungu (TERNET) described how useful their needs assessment survey was: *“The Survey which was done ... enabled us to understand the gaps, the needs in our campuses and those who are ready to cooperate with TERNET. Hence, we are now ready to provide DEA to those who need it most. Also [we can] plan for the training workshops according the feedback we received during the survey.”*

These three project activities complement each other. Advanced training for NRENs produces local instructors/trainers and creates core engineering teams of collaborating experts in various specialties of network engineering. Local workshops for campus network engineers transfer the skills to research and education institutions network staff and yield a pool of skilled campus-based staff that share skills and experience with each other because of friendships that start during the local workshops. The direct engineering assistance (DEA) expedites the building of efficient campus networks while entrenching hands-on skills of trainees through doing.<sup>13</sup>

Of course INASP has made strenuous efforts to follow up on all of these activities with the respective NRENs and learn what improvements have been made at the campus network level and whether other benefits have accrued (e.g. better communication/liaison with the chief librarian at their institution and more collaborative work).

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<sup>13</sup> From RENU internal INASP report

The goals of the NRENS, in terms of the changes that they would like to see at campus level, are in line with the programme aims: *“Enhanced competence and confidence of network admin staff, improved network performance with regards to access, resilience and security. Increased collaboration and access to online research and education resources.”* (Isaac Kasana, RENU)

The NRENS are aware of the challenges in reaching these goals. There are two variable aspects that the NRENS cannot control: bandwidth and quality of network management. Despite working with campus engineers to improve networks, Isaac Kasana explained *“if the network is badly managed then the network capacity can be eaten up by students.”*

As well as improved e-learning and availability and access to e-resources in institutions and campuses, the NRENS want to build confidence and improve collaboration. RENU works to improve collaboration with librarians by attending each other’s workshops and forums (the librarians attend the non-technical workshops that RENU runs), but is aware that collaboration is limited.

Following the workshops a strong and ongoing relationship between the NRENS and the campus engineers is evolving, as Ronald Amanyire, campus engineer at Uganda Christian University wrote, *“RENU being our ISP we are always in touch to make sure that the Internet connection is stable and can go on improving.”*

As far as possible the NRENS follow up training workshops by providing direct support to campus engineers through visits and the DEA component of the project.

In terms of improved collaboration between campus engineers and librarians, there are positive reports. In several campuses interventions by the campus engineers have resulted in a noticeable improvement in terms of access to the network with students and staff now able to access e-resources while off campus. The Uganda Christian University engineer, Sarah Kiden, reported collaborating with campus librarians in the work setting up Dspace (repository) and EZproxy which supports off-campus access to library resources.

Campus librarian, David Bukenya (Uganda Christian University), is well-aware of this project and reports great changes in terms of accessing information at the desktop over the past 12 months (no doubt linked to the changes made by the UCU campus engineers). *“Our campus network has tremendously improved in terms of speed, availability (wider wifi access), is more reliable and provides us with stable public IPs which ensure stable access with the publishers. E-journal articles and e-books are downloaded faster; but apparently, as the network improves, so has the number of users. The peak hours tend to get the downloads slower but with a better baud rate than previously.”*

David Bukenya also reports collaborating with two of the campus engineers. *“I am in constant consult with our Network Engineers, specifically, Mr. Perez Matsiko and Mr. Alex Mwitil. I report any network slow-time, and downtime and often discuss improvements. In some instances, I have been advised that we do not have the adequate or appropriate equipment to efficiently run the network fully. They are extremely helpful.”*

Even if concrete collaboration has not taken place, Amos Nungu (CEO TERNET) believes that improved collaboration has been achieved indirectly through the raising of awareness: *“The activities improved awareness in general, indirectly leading to improvement of information access (and collaborations) on the campuses.”*

However, not all NREN representatives were so confident in their assessment. *“Except in a few institutions, there isn’t sufficient collaboration (such as joint innovation efforts) between librarians and campus engineers.”* (Isaac Kasana, RENU). He explained how he would like to bring librarians together but there is a conservatism / resistance to this in some universities. Isaac saw it as a generational divide: *“Young librarians want to engage in digital content. It is a generational thing. But young people do not hold much sway in their institutions.”* A similar sentiment was echoed by Salome Mathangani (LIS lecturer, Kenya Methodist University) who stated that new, private universities are much more flexible and more willing and able to embrace change, especially around ICT development.

As this programme is still regarded as an INASP “pilot” we have been keen to learn more about the sustainability of the NRENs themselves, whether they feel confident/comfortable about organising workshops for members without financial support, and what might be required to maintain training capacity at the national level.

In response to these concerns RENU and TERNET both have plans to provide ICT support on a consultancy basis. They feel that they have a very well-trained core of engineers who also know how to build capacity of others.

*“TERNET is a non-profit, member organization. As long as there is a need in our member institutions, we intend to use collective efforts to provide our support as needed by working with partners who have the same vision and missions, by charging moderate fees to our services - provided there is need/market for those services, and also by providing other services such as research and consultancy to the ICT industry in general”* (Amos Nungu, CEO TERNET).

The other strategy for generating income for the NRENs is to ask member institutions to contribute with annual fees. Isaac Kasana (RENU) explained how RENU plans to *“progressively get institutions to contribute to workshops. They now only contribute a small membership fee. RENU would like big universities (such as Makerere) to pay for additional people that they send to workshops (extra workshop participants)”*.

ZAMREN’s response to the sustainability question is a long-term approach that seeks to institutionalise ICT development by securing government funding and embedding ICT policy in institutions. *“The solution is to have government institutionalise ICT budgets in the education. Most member institutions do not have ICT structures or even a budget line targeted for ICT operations. As ZAMREN, we have been encouraging member institutions improve on what we are terming ‘ICT Maturity Level’: this looks at ICT Policy developments and strategies that need to be embedded in the institutions”* (Bonny Khunga, CEO ZAMREN). It is not clear how ZAMREN hopes to achieve this long-term goal.

## What we have learnt

We are now half-way well into the third year of the programme and there is much that we have learnt during this time.

- The NRENs are composed of dedicated and enthusiastic individuals, who are grateful for the support of INASP in helping them with their work and development. Jon Harle (INASP Senior Programme Manager) visited TERNET in November 2014 and came away from the meeting with this impression, which seems to summarize the impression created by each of the NRENs: *“TERNET seemed a very dynamic outfit,*

*doing a lot with fairly minimal resources and a lot of energy and enthusiasm. Their ethos is one of low cost / affordable support which fits ours. They have clear ambitions and are achieving things.”*<sup>14</sup>

- NRENs recognise their responsibility to train members but do not always have the financial resources or the technical expertise among their staff to undertake this activity. Capacity development of NREN staff has therefore been crucial.
- The NRENs and the UbuntuNet Alliance (UA) have already identified positive impacts as a result of INASP involvement: greater attention on their part to defining training outcomes in more precise terms, and perhaps more significantly, a greater recognition of the importance of librarian/IT collaboration, and the importance of thinking in terms of service provision and end users.
- We have learned through our partnership with UA that not all NRENs are ready to take advantage of this programme.
- NRENs acknowledge their responsibility for monitoring and evaluating the project activities and are keen to work with INASP in developing skills in this area.
- The needs assessments that the NRENs are carrying out to identify gaps/needs of networks are very important. Just as we have learnt about the state of readiness of the NRENs so the e-readiness surveys informs us about the institutions perceived as needing engineering assistance and being in a position to take advantage of the training.
- One suggestion (originating from RENU) is that NRENs be assisted in tackling the issue of networks skills at source by collaborating with selected undergraduate programmes.
- One activity that arose as being important for the NRENs (RENU and TERNET) is the intern programmes that they support. The interns receive a stipend and training support from the NRENs in which they are based. As Amos Nungu (TERNET CEO) explains, these internship schemes have two aims: equip the intern with skills and experience to further their careers and contribute to the work of the NREN during their internship.

*“Last year TERNET .. started a six month ICT internship program. We had two major objectives on this initiative: provide a exposure to graduates so that they can acquire experience to enable them get employment easily; to increase TERNET manpower at lower cost. We support with about 200 USD a month.*

*We trust that if we can afford to get more interns, keep them in our office for a month and then send them for five months to needy Institution to provide IT support, we can inspire those institutions to hire them after the end of those five months. Most importantly they will have made a difference/change in those institutions so that even if they are not hired, the institutions can plan for a permanent solution.”*<sup>15</sup>

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<sup>14</sup> INASP internal country visit report

<sup>15</sup> INASP internal communication

- There is a significant need for support at the campus level in terms of IT policy and practical network configuration. In the course of this work we have come to appreciate the diverse challenges facing many campuses in our partner countries:
  - Due to organic campus growth and building construction networks are not structured properly and cannot take advantage of high bandwidth even if available
  - Many make heavy and unnecessary use of firewalls
  - They are built with unmanaged network equipment that provide no ability to monitor or tune the network
  - Poorly configured campus networks, becoming the bottleneck in Internet access
  - Many campuses lack useful / up-to-date network design diagrams which document the network and allows planning for improvement
- Continued DEA work is thus extremely important and necessary
- The campus engineers are dedicated individuals. They participate in the training and carry out the network improvements despite the challenges of limited manpower and pressure from the users to make the changes quickly: *“The biggest challenge was that of staffing; changing our network structure was quite some work (re-configuration and deployment of equipment) yet the man-power available was not sufficient. We are actually still in the process of moving some network segments to the new set up. Another challenge was from the side of users whose expectations were quite high. They expected that as soon as DEA was over, the entire network would be changed in a few days, which cannot be the case”* (Sarah Kiden, Uganda Christian University engineer).

## Conclusion

If academics, researchers and students are to maximise access to the electronic resources increasingly available the campus networks must be resilient, secure and well-managed. Training NREN engineers as trainers with pedagogical skills and subject expertise has clearly been successful in providing a basis for ongoing training in their countries (and for regional collaboration on training). Developing local capacity at the national level is more likely to be self-sustaining and will reach many more institutions. This pilot programme has demonstrated the viability of this approach.

While there is evidence that the NREN engineers recognise the importance of strengthening the skills of librarians at the same time as engineers, more work needs to be done to encourage and foster these relationships. INASP will be considering ways to address this issue in the next phase of programme and will explore the feasibility of organising events which brings together librarians, researchers, NREN staff, and campus engineers to explore the relative priorities, problems, and expectations of each stakeholder group, improve understanding and to develop enhanced research and scholarly communication at both the institutional and national level.

To be successful NRENs need to offer more in order to compete with commercial ISPs – it’s not just a matter of comparative cheaper network connectivity, but also the quality of service offered to members. The key is to be able to provide capacity building, technical support and

advanced and value-added services to their member institutions. The INASP Networking Programme is making a valuable contribution towards this goal.