

**Workshop on Enhancing Research and Education
Network Connectivity to and within Africa
Co-organized by the
Internet Education Equal Access Foundation (IEEAF) and Internet2**

*May 5, 2005
Arlington, Virginia*

Introduction

Network connectivity is a key enabler for research and education (R&E), technology transfer and commercial development. Building a strong global R&E community is a cornerstone for prosperity, societal development and stability. Consequently, adequate connectivity to and within all regions of the globe to support robust R&E collaborations is essential. The last ten years have seen the development of national research and education networks (NRENs) on a global scale, linked together by regional R&E backbones, as well as the creation of intercontinental links typically operating at speeds measured in multiple gigabits per second (Gbps). However, Africa has been largely absent from the worldwide network revolution. A very graphic illustration of this is the map of “Global Lambda” bandwidth between regions available for international R&E network application and middleware research experiments (see <http://www.glif.is/>).

The US research and education community is keenly interested in improving connectivity with African institutions and colleagues; many individuals and organizations are willing to be active partners with African leadership and other international partners. Among them are Internet2 and the Internet Educational Equal Access Foundation (IEEAF). As a leading US R&E networking organization, Internet2 has worked to partner with similar organizations and NRENs around the world to promote the development of a seamless international R&E network environment, as demonstrated by its International Partners program and the International Workshops at its semiannual member meetings. More recently, a Special Interest Group for Supporting International Collaborations in Hard to Network Parts of the World was formed to focus member interests in extending R&E networking even further, including to Africa. The IEEAF was formed as a public-private partnership to generate private sector donations of connectivity, facilities and hardware in support of global research and education — what IEEAF calls “The Global Quilt”. Successes to date have provided bandwidth donations at the 10 Gbps level and fiber donations that span 17 time zones.

The IEEAF and Internet2 launched this joint effort to build on the 2004 Internet2 workshop on “Extending the Reach of Advanced Networking” and a January NSF workshop on “I.T. for Enhancing US-Africa Collaboration on the Environment”. The purpose was to focus on the issues and barriers preventing Africa from joining the international R&E networking community, as a step toward understanding what the US R&E networking community, together with its counterparts in other countries, can do to improve African connectivity.

The following summarizes the workshop objectives, overall content, and possible next steps. The complete workshop agenda, copies of presentations, and list of participants can be obtained at <http://international.internet2.edu/resources/events/2005/smmafricamtgagenda.html/>.

Executive Summary

Objective of the workshop

The workshop brought together organizations engaged in active major initiatives to improve R&E network connectivity with and within Africa — to share plans and projects, and to identify opportunities for collaboration between agencies and organizations. Participating organizations included the National Science Foundation, National Library of Medicine, World Bank, Network Startup Resource Center, Rockefeller Foundation, Carnegie

Corporation, International Development Research Center (IDRC), E-Africa Commission, National Knowledge Commission of India, Tertiary Education Network (TENET), Internet2, IEEAF and others.

The overall goals of this workshop were to:

- Stimulate communication and collaboration — to share and coordinate, and collaboratively develop plans for Africa-wide connectivity and connectivity with the global R&E community
- Focus on action agendas and next steps
- Build critical mass and momentum

The presentations were intended to provide meeting attendees with insight into what infrastructure is needed to support international collaboration in research and education; currently available and evolving telecommunications infrastructure; programmatic initiatives in research, education and health care; and plans for commercial and R&E networking in African countries. The results of several recent surveys and studies about research and education networking and the state of African university information technology infrastructure and utilization were presented. Organizations already working in these areas discussed their projects, objectives and current status. Finally, the meeting concluded with a discussion session with all meeting participants focused on identifying opportunities, areas for collaboration and next steps.

Assessment of the situation

- Connectivity for universities and other R&E institutions is sparse, unreliable, expensive, and low capacity; it needs to be dense, reliable, cheap, and higher capacity. Due to the current state of development of applications and usage, it doesn't yet need to be at the same level as currently being implemented in the US, Europe and the Asia-Pacific region.
- There are many African and international initiatives in this area. There is a need to take stock of all these initiatives and to develop better mechanisms to share information, coordinate activities to create a more comprehensive and inclusive plan, set priorities, and reduce duplication and gaps.
- Its essential to ensure that Africans are included and active in setting the agenda.

What the global R&E networking community can do

- Recognize that the situation is one of mutual need. Because of African R&E's dire need for connectivity and Africa's importance to global R&E, global R&E is an ideal constituency to help push African R&E networking forward.
- Bring people together. There was strong interest in regular meetings and follow-up workshops, with a view toward coordinating projects, building relationships with African R&E, and better understanding African networking priorities.
- Jump-start the private sector. The private sector must be central to the development of African R&E networking, but can't do it alone. Projects should aim to encourage the growth of, and competition among, commercial Internet providers.
- Help build NRENs and regional consortia in Africa. NRENs play a unique role in development of R&E connectivity and capabilities. They are a proven model on the international scene in promoting and moving forward the needed infrastructure and expertise in both developed and developing countries.
- Focus on capacity-building on African campuses. African universities should play a central role in developing the human infrastructure required for an "information society", as universities have done elsewhere. Development of needed campus networks and NRENs is a key component of providing actual experience in designing, building, and operating modern communications networks.
- Keep the larger perspective. R&E is key to development of the Internet more generally (the original NSFnet model, as well as multiple examples in other countries), and the Internet is key to African development more generally. Accordingly, we should look for projects in areas related to R&E that have potential for wider impact, above all in the health sector.

Presentations and Discussion

The workshop was divided into four sessions.

The Big Picture: Research and Education Networking

Larry Landweber, NSF Senior Advisor, opened with an overview of the National Science Foundation programs and NSF initiatives in international R&E networking connectivity. This year NSF is spending \$5.4 billion in support of R&E; of that, \$23 million is going to support more than 100 projects in Africa. NSF has just provided funding of \$5 million per year for five years, through the International Research Connections (IRNC) program, for five projects which will provision high-speed links with Europe, Asia-Pacific, South America, and Korea-China-Russia. Landweber indicated that NSF is interested in trying to fund a similar link to Africa, but stressed that the focus needs to be on interconnecting research communities, not just building networks. Landweber's perspective is that while NSF can only be a small part of what is really needed in Africa, NSF's support can perhaps be a catalyst for much larger developments.

Elizabeth Lyons, NSF regional coordinator for Africa, stressed that NSF's international activities in general and African activities in particular are a key part of NSF's mission to further American science: the nature of science is such that international collaboration is an essential aspect of this mission. About 20% of NSF awards involve international collaboration. Lyons noted that the quantity, geographic breadth, and disciplinary breadth of NSF awards in sub-Saharan Africa are all on the increase; from the perspective of US science, much sharing of data with Africa is needed, and collaboration with African institutions is key and must be enhanced. Better means are needed for collection, generation and dissemination of data for both US and African researchers. Lyons laid particular stress on the problem of the lack of adequate Internet access and related infrastructure for African institutions and researchers.

Internet2 CEO Doug Van Houweling presented an overview of Internet2's international partnerships. Van Houweling observed that the US is no longer the global Internet center; as with NSF, Internet2's international work is key to its US-centered mission. This work is based on bilateral partnerships with national research and education networks (NRENs) around the world; a key advantage of NRENs is that they are often able to get telcos to grant them better pricing and exemptions from rules, even where liberalization has not yet taken place. Van Houweling seconded Landweber's emphasis on interconnecting communities: "the real network is person-to-person."

Ed Fantegrossi, Chair and CEO of Geographic Network Affiliates (GEO), the moving force behind the creation of the Internet Educational Equal Access Foundation, outlined the IEEAF's plans for an African Global Quilt Initiative collaboration, leveraging the NSF planning grant (see Sadowsky presentation summary) that will focus initially on Southern and West Africa. Fantegrossi acknowledged that similar efforts have failed and asked "what's different this time?" He pointed to the large body of experience on the ground in Africa that has been gained through various initiatives. Africans are now active in charting their own course, based on these experiences, and sustainability is key. Add to this the demonstrated success of Fantegrossi's own company (GEO), working in a public-private partnership with IEEAF, in generating a wide range of donations. As a "high-tech real estate developer," GEO has many long-term relationships with the financial and telecom communities that have been key to these donations, and that are now being brought to bear on the project with Africa. Fantegrossi believes that with the support of the global R&E community this can contribute to the "final push" for world-class connectivity in Africa. IEEAF is looking for letters of support from research initiatives as well as possible collaborations. Interested parties should send email to Ed.Fantegrossi@geo-usa.com and driley@umd.edu.

The session closed with Sam Pitroda, Chairman of the National Knowledge Commission of India, discussing the importance of networking to international development as a whole, and noting that its benefits to India have been enormous. He made four key points:

- "Information brings openness."
- Globalization makes education necessary to survival.
- Worldwide, "the best brains have been busy solving problems of the rich"; this must change.
- With the exception of the health sector, most research has roots in defense, not development; this too much change, and the time is now.

Pitroda also noted a personal experience with lack of political will in Africa, trying and failing to convince 29 African telecom ministers to connect via fiber. There is a need to cultivate “local champions” for such projects. In addition to offering a good example, India has a long tradition of involvement in Africa, and wants to help.

African R&E Connectivity and General Infrastructure Issues

Henry Chasia, Chair of the E-Africa Commission, outlined the ICT program of the New Partnership for Africa’s Development (NEPAD), which is itself a project of the African Union. There are two key parts: broadband ICT infrastructure, and the e-schools initiative. The infrastructure component aims to build networks to connect Eastern and Southern Africa to the planned EASSy cable along the eastern coast of the continent. The e-schools program is satellite-based, aiming to connect up to 600,000 primary and secondary schools to the Internet, starting in early 2007. Chasia observed that based on the number of leaders coming forward to focus on keys to development, there appears to be growing political will to improve networking in Africa.

Bob Hawkins of the World Bank Institute outlined results of the African Tertiary Institution Connectivity Survey. Some key points:

- The bandwidth available to the average African university is less than that available to a US home, despite high demand. “Universities need at least ten times what they currently have.”
- Links are at 100% of capacity more than 60% of the time.
- Bandwidth costs approximately fifty times what it costs US universities.
- West Africa pays the most, despite the SAT-3 cable; North Africa pays the least, due to connections with Europe.
- There are large disparities within countries.
- There is an average of 55 users per computer.
- Recommendations include bandwidth-buying consortia, improved management, centralization of management and technical expertise, and improved regulatory policies.

Hawkins also introduced the African Virtual University, which spun off from the World Bank in 2002. It aims to use the Internet to broaden access to higher education in Africa.

Roy Steiner followed with an overview of the Promoting African Research and Education Networking (PAREN) report. Key points here included:

- Research networks and education networks are often separate.
- Infrastructure is growing within countries, but often not connected between them; cables land but don’t go anywhere.
- Satellites, on the other hand, cover “every square inch of Africa”.
- There are now NRENs in nine African countries.
- The demand for bandwidth is huge; there is a great need to get people working together to purchase it. There is potential for consortia around both submarine cables and VSAT satellite access. The PAREN report recommends a structure for these consortia, modeled on the structure of TENET.

TENET CEO Duncan Martin discussed his organization, which is the NREN for S. Africa, Swaziland and Lesotho. TENET has only four staffers and doesn’t run a network — the network is run by TELKOM SA, which means that negotiating with them is central to TENET’s work. TENET gets connectivity for a third of the commercial rate, but this is still “lousy” by US standards; cross-border costs are “punitive”. Martin characterized African R&E networking as being about affordable Internet access and enabling collaborative research internationally. TENET is owned by the 24 public universities in South Africa and acts as a connectivity purchasing agent for a total of 45 institutions.

Cecile Niang, Global Information and Communication Department, World Bank, gave a World Bank perspective on the networking situation in sub-Saharan Africa. She stressed the importance of liberalizing the telecommunications sector — noting that while progress has been made in this area, there is still a long way to go — and of private-sector involvement more generally. Niang noted four obstacles to greater private sector investment: high risks, lack of coordination among projects, lack of support from African governments, and low traffic due to lack of competition.

Niang also emphasized the importance of regional infrastructure (much inter-country traffic still goes via Europe) and introduced the World Bank's Regional Communications Infrastructure Program, which will support NEPAD's connectivity initiatives and interconnection to the planned EASSy cable system.

Key projects/initiatives to aid African R&E networking development

Jennifer Pawlowski gave an overview of the Partnership for Higher Education in Africa, a project of the Carnegie, Ford, MacArthur, and Rockefeller Foundations. The Partnership is focusing on seven countries, chosen for their market liberalization and openness. Its current focus is building a consortium of African universities to get better leverage in buying bandwidth; the AVU is key to this effort. The early phases of this process have already yielded a 33% increase in the bandwidth available to participating universities.

Julia Royall, National Library of Medicine, National Institutes of Health, offered an in-depth look at the Multilateral Initiative on Malaria Communications Network (MIMCom). MIMCom was initiated by malaria researchers in 1997, with the goal of improving access to medical literature. Royall detailed the many daunting practical issues faced by the project, such as uncleared landmines and lack of reliable electric power; on the other hand, she noted that this being a health project helped a lot with regulatory issues. While it's not yet clear whether this project has made a difference to patient welfare, it has made quantifiable improvements in the productivity of individual researchers. Royall also noted a Ugandan medical school's project to equip all its students with PDAs for data gathering. This project involves a striking and highly effective mix of high and low tech, as users bicycle from clinics with no electricity to upload data from their PDAs over the Internet. Throughout her presentation Royall stressed the importance of keeping our attention on the ultimate aims of improved networking — in the cases she describes, healthier people. She closed with a quote from Vint Cerf: "The Internet is a reflection of our society and that mirror is going to be reflecting what we see. If we do not like what we see in that mirror the problem is not to fix the mirror, we have to fix society."

George Sadowsky, Internews, opened his talk by emphatically agreeing with Royall on the need to keep ultimate ends in mind. Sadowsky and Internews are partnering with the IEEAF and GEO, along with John L. Mack & Associates, on a US National Science Foundation grant to develop a plan for providing a high-speed link with Africa. The goal would be similar to those of the other links that NSF is funding under their International Research Connections (IRNC) program. The NSF wants to facilitate research collaborations between US and African researchers. The initial goal of the project is to bring submarine cable bandwidth into two West African countries, work with existing networking centers and consortia to make use of the new connections, establish an exchange point, and develop or strengthen any existing NRENs — and then to extend to additional countries. WiMAX wireless access will extend the bandwidth access in the vicinity of the exchange point. The outcome of the planning project will be a plan and proposal to NSF for five years of funding. If NSF funding is approved for the proposed project, implementation is anticipated to begin by the end of 2005. Sadowsky stressed that "what we are doing is opportunistic" — while we might like to start where help is most needed, we need to start where the right conditions exist: stable democratic government, universities doing research with US colleagues, strong local institutions with which to partner, good regulatory and legal environment, existing fiber infrastructure, and an existing submarine cable landing. The countries that look most promising for the first year or two of the project are Senegal and Ghana. During this stage, the team would work to identify other countries that meet the requirements for possible extension during the next phases — as well as to identify other partners with whom to collaborate, with the goal of linking up projects to reach across Africa. For purposes of the plan and NSF proposal, Sadowsky is looking for examples of African projects and US-African collaborations that would be helped by this project. Contributions and inquiries can be sent to george.sadowsky@attglobal.net and/or drirley@umd.edu.

Finally, Steve Song presented a perspective from the International Development Research Centre (IDRC) of Canada. Song stressed the importance of reducing duplication of effort and increasing economies of scale; he noted that between them Uganda and Tanzania have *nine* R&E networking initiatives. Song observed that "African universities are disenchanted with donors" and stressed the need to approach universities as collaborators rather than donors — to "get behind African universities as universities" and help with capacity building. Song also cautioned against a "liberalize and ye shall be free" attitude, stressing that, while liberalization is necessary, it's not sufficient. Local specifics matter a lot. Song suggested forming a working group to coordinate R&E networking efforts and encourage

the creation of African NRENs; the group could be chaired by the Association of African Universities, with participation from AfNOG and other African networking organizations.

Roundtable Discussion: Key Take-Aways and Next Steps

The workshop concluded with a wide-ranging informal discussion of what to do next. Also included here are points made during short Q&A sessions during the rest of the workshop.

- There was general agreement on the importance of building NRENs in African countries and fostering regional connectivity among them. John Martin noted that there is often contention for NREN status, making it necessary for the government to endorse one of the contending organizations. Negotiating for better pricing for commercial Internet service is one of an NREN's principal functions.
- There was also general agreement that, at this stage of African development, basic connectivity — including access to commercial services useful to R&E (e.g. Google) — is much more important than high-performance connectivity for research.
- John Mack (formerly with the US State Department) underscored Niang's emphasis on the private sector, and noted that US and European discovery of Africa in terms of "trade, not aid" makes him confident that progress is coming soon. R&E has a crucial role to play as a "driver" of the private sector.
- Julia Royall noted the role of connectivity in creating a feeling of being part of an international community; this effect illustrates that the impact of connectivity may not always be found where expected.
- Royall also stressed the importance of working to further local, African agendas, rather than pushing an agenda of our own. She noted Randy Bush of the NSRC as an exemplar of this approach.
- It was noted that as connectivity is empowerment, improved connectivity is sometimes perceived as a threat to local authorities, necessitating careful diplomacy. John Mack argued that we should avoid such situations entirely, and focus our efforts in countries in which there is full government support. In his view, an understanding that information benefits the whole society and a willingness to act accordingly are preconditions for successful collaboration and implementation.
- World Bank videoconferencing resources through the Global Development Learning Network (www.gdln.org) and the Internet2 Commons (commons.internet2.edu) are available to help with communication.

Don Riley closed the meeting by encouraging attendees to think of it as a recess rather than an adjournment; the real work remains to be done. Please contact Riley (driley@umd.edu) and Heather Boyles (heather@internet2.edu) with further suggestions or information.

Further Information

Slides from many of the presentations are available at <http://international.internet2.edu/resources/events/2005/smmafricamtgagenda.html>.

There is a great deal of detail in this material. This site also includes links to the PAREN and ATICS reports.

Many different organizations and projects were discussed in the course of the workshop; here are links to some of the most important.

AAU: www.aau.org

AfNOG: www.afnog.org

AVU: www.avu.org

GEO: www.geo-usa.com

IDRC: www.idrc.ca

IEEAF: www.ieeaf.org

NEPAD: www.nepad.org

NSRC: www.nsrc.org

NSF Office of International Science and Engineering: www.nsf.gov/div/index.jsp?div=OISE

Partnership for Higher Education in Africa: www.foundation-partnership.org

TENET: www.tenet.ac.za

WB-GICT: www.worldbank.org/ict/

WBI: www.worldbank.org/wbi/

Workshop Planning Committee

Special thanks to the following people for their invaluable help in putting this meeting together:

Meeting Co-chairs

Don Riley	University of Maryland; SURA IT Fellow; Chair, IEEAF Board
Warren Matthews	Chair, Internet2 Special Interest Group on Extending the Reach of Research Networking Internationally; Georgia Institute of Technology

Program/Planning Committee Members

Heather Boyles	Internet2
Bob Hawkins	World Bank
Steve Huter	Network Startup Resource Center; University of Oregon
Andrea Johnson	Carnegie Corporation; Partnership for Higher Education in Africa
Ana Preston	Internet2
George Sadowsky	Principal Investigator, NSF study grant on African connectivity; Internews Network
Anil Srivastava	World Bank