>>

Rowing Upstream

Snapshots of Pioneers of the
Information Age in Africa

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ICT in Africa

A Timeline

To look at the map below that depicts Internet capability in Africa in 2000, it seems almost unimaginable that Internet use in Africa is little more than a decade old—that e-mail utilization on a measurable scale began only in the late 1980s. In essence, the story of ICT in Africa is the story of how profound need coupled with intense creativity has driven the rapid spread of life-changing technology.

Internet in Africa in 2000

Internet in Africa in 1996
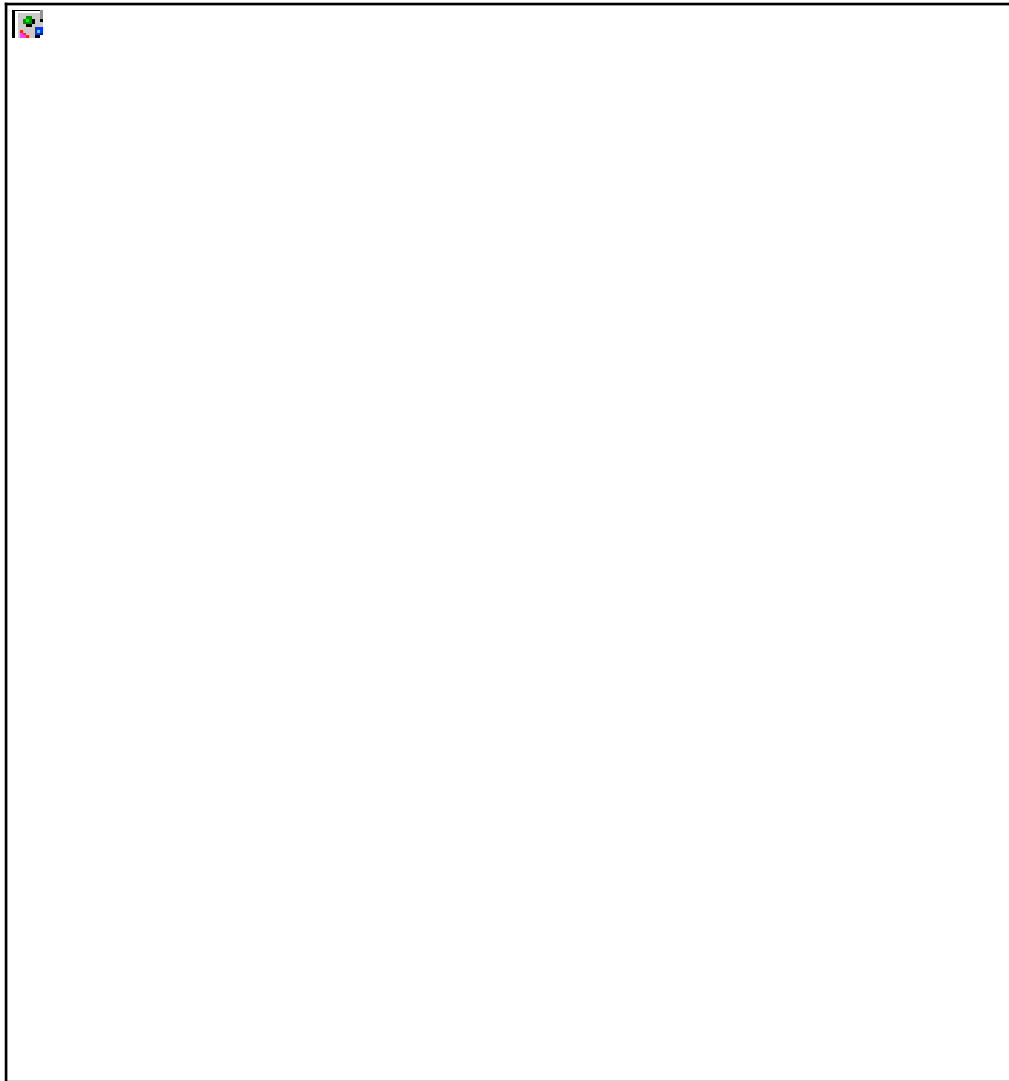
(Maps extrapolated with permission from Mike Jensen and edited by Nicholas Menzies.)

Before the advent of CD-ROM in sub-Saharan Africa's university libraries, for example, scholars could not possibly hope to keep current with new developments in their fields. The first CD-ROM drive north of the Limpopo was installed in the Chitedze Research Station in Malawi in early 1987, followed in 1988 by the implementation of CD-ROM in the University of Zimbabwe Medical School Library. When the American Association for the Advancement of Science surveyed some 100 academic and research libraries in 1990, only 48 of them had computers and 16 of them had CD-ROM capacity.[1]

Yet soon enough, the changes in communications enabled by CD-ROM and the Internet came to be considered necessities. The early pioneers of ICT were quick to grasp their potential; surmounting obstacles that ranged from official skepticism and insufficient funding to inadequate infrastructure, they did what it took to hasten ICT access and encourage its appropriate application.

As Chapter Seven, "Untold Stories," demonstrates, grants from the International Development Research Centre (IDRC) in Canada fueled Internet implementation on the Continent.[2] Now, Internet has spread to every country in Africa, and bandwidth is constantly increasing. The milestones noted in this timeline tell the story of how we got from there to here.

1987

WorkNet is established in South Africa in order to provide the NGO community with connectivity, and thus a voice, during the struggle against apartheid. (WorkNet changed its

name to SANGONeT in 1993.)

1990

The Environment Liaison Centre International (ELCI) establishes NGONET and begins to offer e-mail services to NGOs in East Africa, thus making Nairobi the first city in sub-Saharan Africa, outside of South Africa, to go online.

Volunteers in Technical Assistance (VITA) commissions a payload for development/humanitarian purposes on a Low Earth Orbit (LEO) satellite launched by the University of Surrey and installs its first station in Freetown, Sierra Leone for PLAN International. Since then, VITA has worked in a number of African countries throughout the continent.

1991

ESAnet begins operation as a network of computer centers in five African universities, using Fidonet store-and-forward technology. ESAnet provides Makerere University, the University of Dar es Salaam, the University of Nairobi, the University of Zambia and the University of Zimbabwe with much-needed experience in installing and using the Fidonet system.

SatelLife launches HealthSat on a Surrey LEO satellite. With HealthSat in the skies, SatelLife is able to establish pilot projects in health centers in Mozambique, Kenya, Tanzania, Uganda, Zambia and Zimbabwe to test the capability of e-mail transmission using computers, special modems and aerials to connect to the LEO satellite. (SatelLife now uses conventional telecommunications systems for e-mail and Internet, except in locations that lack access to telephones.)

1992

By 1992, there are 16 African e-mail nodes—from Algeria to Zimbabwe—all of them using Fidonet and connecting to the world via GreenNet, an NGO in the United Kingdom.

The Internet Society holds its first INET meeting in Yokohama, Japan. Eighty Africans, Internet pioneers in their countries, attended the INET '92 Network Training Workshop, far exceeding anticipated levels of participation. The number of African participants continues to grow at subsequent INET meetings, where special workshops for developing countries have been organized.[3]

1993

South Africa and Tunisia become the first countries on the continent to achieve full Internet connectivity.

1994

Zambia becomes the first sub-Saharan African country north of the Limpopo to use Internet, when the University of Zambia establishes ZAMNET, the country's first Internet service provider (ISP).

The electronic *Mail and Guardian* of Johannesburg, South Africa is Africa's first newspaper to go online.

1995

Mozambique follows closely behind Zambia when Eduardo Mondlane University goes online. Eight more African countries achieve Internet status in 1995.

The Symposium on Telematics for Development is held in Addis Ababa, hosted by the UN Economic Commission for Africa (UNECA). This meeting brings together computer and telecommunications experts from 38 African countries and results in the creation of an ICT High-Level Working Group, which leads to the adoption of the African Information Society Initiative (AISI) the next year.

A number of major ICT projects are funded in 1995, including *info*Dev (World Bank), the

Sustainable Development Networking Program (United Nations Development Program) and the Leland Initiative (US Agency for International Development). IDRC continues its support for ICT with funding to UNECA for the initiation of Capacity Building for Electronic Communications in Africa (CABECA).

1996

UNECA establishes AISI to stimulate interest in ICT for development in Africa and to encourage the creation of national policies and strategies on the continent.

By the end of 1996, four countries in Africa have full Internet connectivity at speeds greater than 64 Kbps; five countries can log on at 64 Kbps; and 18 countries have e-mail or very slow Internet connectivity at 9.6 Kbps.

The Information Society and Development conference (ISAD), jointly sponsored by the European Union and the South African government, is held in South Africa in May 1996. ISAD provides a unique opportunity for representatives from 40 countries and 20 organizations to come together and exchange views. ISAD participants come from both the developed and the developing world.

1997

The Association for Progressive Communications (APC) organizes a landmark "Africa Strategy Meeting" for APC affiliates from across the continent. Representatives from the major organizations responsible for the early days of African networking attend the meeting, which is held in Johannesburg. (An earlier APC meeting, focusing on connectivity, was organized by WorkNet and held in 1991.)

IDRC initiates the Acacia Project to bring ICT to rural communities in Africa.

2000

WorldSpace launches multimedia digital satellite broadcasting in Africa. WorldSpace receivers coupled with a computer provide sufficient bandwidth to receive information from Web sites around the world. (WorldSpace radio began transmissions to African in 1999.)

By the end of 2000, all 54 countries and territories in Africa have achieved permanent connectivity and the presence of local, full-service, dial-up ISPs. Although the presence of ISPs is still a capital-city phenomenon, more and more people have access to the Internet in other urban areas. In addition, Internet cafés in capital and secondary cities are becoming ubiquitous, and between 15 and 18 countries have local dial-up access anywhere in the country.

News from Africa is easier to obtain: almost 30 countries have at least one online newspaper.

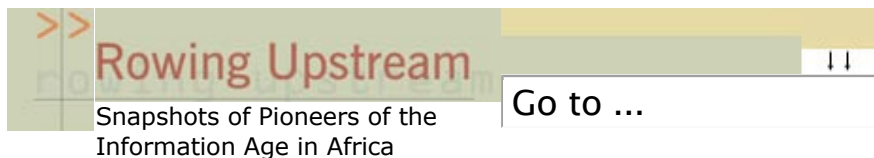For more information about the development of Internet in Africa, see the following Web sites:

African Information Society Initiative
http://www.bellanet.org/partners/aisi/

Mike Jensen's African Internet Connectivity and other Internet infrastructure information
http://www3.sn.apc.org/africa/

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1 Levey, Lisbeth. "Computer and CD-ROM Capability in sub-Saharan African University and Research Libraries." American Association for the Advancement of Science. Washington, DC; 1990. (These were very early days; the list of survey respondents does not even include e-mail addresses.)

2 David Balson's contribution Chapter Seven, "Untold Stories," on IDRC's telematics program, provides details about early support of e-mail on the continent.

3 See Sadowsky, George, "The Internet Society and Developing Countries," e-OTI, http://www.isoc.org/oti/articles/1196/sadowsky.html and Tarek Kamel and Terry Weigler, "African Chapters and the Role in Internet Development in African Countries," e-OTI, http://www.isoc.org/oti/articles/0401/kamel.html

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Chapter Four

Is the Glass Half Full or Half Empty? ICT in African Universities
Lisbeth A. Levey

Doing so much with so little: universities as nodes

In the United States, universities have been a major force behind Internet implementation, because scholars needed first to communicate with one another and then to access data.

Much the same can be said of sub-Saharan Africa. At the start, the focus was on communication—replacing expensive telephone calls, faxes, and telexes with e-mail. In the early days, universities in Malawi, Mozambique, Uganda, Zambia and elsewhere served as national nodes for the entire country.

The difference between the United States and any country of Africa, of course, is one of scale and finances. In the United States, many universities now require that their students come to school equipped with a computer. In most African countries, scores of students still must share a single PC. And yet, African Universities' accomplishments in ICT should not be denigrated. It's no accident that Venancio Massingue's story in Chapter Seven of how e-mail got its start in Mozambique is entitled "Building in Poverty." For many of us, the important thing is that so much has been done with so few resources.

One of the first regional e-mail projects was inaugurated by the International Development Research Centre (IDRC) in 1991, when it funded the creation of ESAnet, a network to link together computer centers at five universities—Dar es Salaam, Makerere, Nairobi, Zambia, and Zimbabwe—using very simple Fidonet-based store-and-forward software.[1] This IDRC initiative made connectivity a reality; it is described in several of the anecdotes included in Chapter Seven.

In November 1994, Zambia became the first sub-Saharan African country north of the Limpopo to achieve full Internet connectivity when the University of Zambia established its own for-profit Internet Service Provider (ISP) called ZAMNET. A $122,000 one-year grant from the World Bank made it possible to fund a leased line to South Africa and to purchase equipment. In March 1995, ZAMNET began to offer full commercial service on a national basis, and by the end of the year it was able to meet the Bank's requirement that the company be fully self-sustaining within twelve months. ZAMNET has since relocated to quarters in town, but it still provides highly subsidized rates to the University of Zambia, which owns 75 percent of the company's shares. And it now has competition: Zambia currently has three ISPs, although ZAMNET still captures the largest share of the country's subscribers.[2]

Eduardo Mondlane University moved away from Fidonet to Internet connectivity in 1995, followed shortly thereafter by the University of Dar es Salaam. Universities may no longer be the sole ISP for an entire country, as they once were in Zambia, Uganda and Mozambique; but many of them are increasingly busy wiring up their campuses and attempting to provide better Internet access to their staff and students.

At this writing, events on the continent are moving so rapidly that it is increasingly difficult to write about ICT in African universities without running the risk of looking like a beetle captured in a piece of amber. Therefore, this chapter does not attempt to survey ICT around

the region; rather it focuses on major issues influencing efficient and effective ICT implementation, using examples from a few universities where ICT is moving forward systematically and thoughtfully. These universities are also the ones I know best—primarily those in Eastern and Southern Africa with which I have been involved through my work for the Ford and Rockefeller foundations.[3] The issues that influence ICT implementation are far more constant than are the numbers of computers or network points installed at any one African university at any given moment in time.

Because Internet in African universities is still little more than a decade old, I cannot definitively answer the question implied by the chapter title, but I hope the discussion and analysis below provide enough documentation to give cause for hope and provide insights for the future.

To place these universities in context: All of the universities mentioned in this chapter have full Internet capability, primarily through VSATs (Very Small Aperture Terminals), i.e., an earthbound satellite communications system for data, voice and video signals that obviates the need for dialing in to a local ISP. Most of them already have, or soon will have, a full campus backbone; but implementing local area networks in faculties and units is a problem everywhere because of lack of funding. Every university discussed has strong ICT champions, although not all of them are blessed with leaders who are well-versed in the technologies. Planning has become an important component of ICT implementation. Thus, this chapter examines ICT planning and implementation at a fortunate subset of African universities. Finally, much of the information contained in the pages that follow stems from my participation in case studies at the University of Dar es Salaam (UDSM) and Makerere University, and in a sector-wide assessment of higher education in Mozambique.[4]

ICT implementation in African universities: what does it take?

Six essential, interrelated building blocks form the foundation of good ICT planning and implementation.

1. Strong and Knowledgeable Leadership

Eduardo Mondlane University (UEM) and the University of Dar es Salaam (UDSM) share certain similarities. At both institutions, the university leadership is knowledgeable about ICT, strongly in favor of Internet implementation, and eager to plan accordingly. Not every university is blessed with a "techie" vice chancellor, as is the University of Dar es Salaam, where the VC is a communications engineer; but good ICT planning and implementation require someone at the top who understands and advocates technological innovation.

At UEM, ICT planning and implementation is in the hands of the Vice Rector for Administration, Venancio Massingue, an engineer who headed the university's computer center when UEM first began to establish e-mail service for the university and the country. Massingue tells this story himself in "Untold Stories," the last chapter of this book.

"At the University of Dar es Salaam we have realized that the ongoing information revolution has, and will, continue changing the way we teach and learn, the way we do research, and above all the way we provide our services to the community at large. Hence the University of Dar es Salaam has evolved a vision of becoming a leading center of excellence in ICT." Professor M.L. Luhanga, Vice Chancellor, University of Dar es Salaam, at the opening of the new University Computer Center building, September 28, 1999

2. Strategic Planning

A compelling concern for administrators implementing ICT across a university system is obtaining sufficient funding. Without a good strategic plan, however, no amount of financial support can yield effective ICT use.[5]

Moreover, a solid strategic plan can help attract funding. Professor J.M. Mwenechanya, former Deputy Vice Chancellor of the University of Zambia (which may or may not have been the first sub-Saharan African university to engage in strategic planning, but was certainly among the first to incorporate ICT into its planning process), sees a strong link between strategic planning and the willingness of the donor community to support ICT at UNZA. In a paper presented at the African Development Forum in October 1999, Professor Mwenechanya said:

> **The experience at the University of Zambia is that Strategic Planning is a good way of achieving institutional consensus. Furthermore, a clear vision of institutional development facilitates the mobilization of resources. The University's strategic plan was the most important single factor that persuaded the Dutch NUFFIC organization to fund CAMAS [Computers for Academic, Management and Administrative Support].[6]**

At the University of Dar es Salaam, references to ICT have been incorporated into the university's most recent overall strategic plan, including the academic audits of each faculty. There is, therefore, voluminous and very impressive documentation of the status of ICT for the university overall and for each individual faculty.

Strategic planning can engender faculty-wide change, as well. In the *Annex to the 1998 Academic Audit Report*, the Faculty of Arts and Social Sciences was judged to be "relatively unprepared for making use of the new Information and Communication Technology (ICT) in either teaching or research. Computer use and literacy is currently unevenly distributed…"[7]

When the *Annex* was written, the Faculty of Arts and Social Sciences was engaged in its own strategic planning process, from which the realization emerged that faculty-wide access to ICT was essential. As a result, departments began to work together to implement ICT use within the Faculty. In 1999, the Ford Foundation provided two separate grants to the Faculty, which included support to purchase computers. Relevant staff decided to pool the computers and create a computer lab with a total of 20 PCs. Subsequently, the Faculty as a whole made a decision to use a portion of its University support to acquire additional computers—40 in all. To do so, the Faculty had to forgo other purchases, but computers were considered more important. Thirty-four computers were placed in the computer lab; the remainder went to departments sorely in need of them. The Faculty was subsequently able to acquire even more computers.

ICT received little attention in Makerere University's first Strategic Plan in 1996, but the second plan, which runs from 2000-01 through 2004-05, lays out strategies for moving forward with developing an ICT Strategic Plan. Makerere University may have started to plan for ICT later than some other African universities, but it has the advantage of learning from their experience, for Makerere technical staff have been able to visit the University of Dar es Salaam and Eduardo Mondlane University, where ICT planning and implementation are further along.[8]

3. ICT Champions

All leaders who push for ICT implementation are champions of ICT, but not all champions necessarily hold high administrative posts at their universities. Nevertheless, their voices can be heard. Charles Musisi at Makerere University, Rob Borland at the University of Zimbabwe, Mike Lawrie at Rhodes University, and others brought e-mail to their campuses, perhaps not

as a result of an official institutional strategy, but in response to a felt need.

In addition, what strikes me about the University of Dar es Salaam and other universities with which I am familiar is that those faculties, departments or units that have "ICT champions" benefit first (and perhaps greatest) from ICT implementation. At the University of Dar es Salaam, for instance, teaching staff within the Faculty of Engineering felt a strong need to implement ICT as quickly as possible. As a result, Faculty departments were networked at least a year ahead of the schedule laid out in the University's master timetable.

And at the University of Zimbabwe (UZ), the medical library began to use CD-ROM at least two years before the main library did, because the medical librarian took the initiative to send a proposal to the Carnegie Corporation of New York, requesting $25,000. (Helga Patrikios tells this story in Chapter Seven.)

4. Wires, Computers and Connectivity

You can use Internet without a campus LAN and a fast link: all you need is a dial-up connection. But unless you are going to restrict your staff and students to e-mail only, dial-up connections can be enormously expensive—not so much because of service provider charges, but because, in many African countries, making telephone calls is expensive. For example, when the Makerere University Faculty of Agriculture first installed its dial-up connection to the ISP in town, the Dean was the unhappy recipient of a bill for USh 1 million (about $700) for two months of service.[9]

Typically, African universities work to create a campus backbone and establish one or more points in each of the buildings on campus during the first stage of systematic ICT implementation. Wireless connections are also put in place for off-campus faculties and facilities.

This first step obviously makes a lot of sense because it will lead to campus-wide connectivity and obviate the need for expensive and inefficient dial-up connections. But progress does not come cheaply or without its own set of demands.

There is rarely sufficient funding to support local area networks throughout the campus. In some instances, donors will cover certain costs and it is up to the unlucky administrators to prioritize which faculties and units get networked first. (At the University of Dar es Salaam, the priorities for the first phase of Dutch and SIDA/SAREC funding were the Faculty of Arts and Sciences, the Faculty of Sciences and the University Library.) No choice is the right one, and less "advantaged" faculties or departments are required to seek their own funding.

In addition, it is impossible to determine how much bandwidth is really sufficient until you find out that what you have isn't enough. Bandwidth is expensive, and many African universities start with a 64 Kbps line, in part because they cannot afford anything faster and also because it is difficult to gauge rising expectations and demand. When the University of Dar es Salaam first installed a VSAT in 1997, it linked to South Africa at a speed of 64 Kbps. The speed was increased to 128 Kbps in 1998, and to 512 Kbps in 2000. This last upgrade costs the university $8,250 per month—almost double the fee for a 128 Kbps line. At Eduardo Mondlane University, increased user demands on the system and complaints about slow connections made an upgrade essential. The university upgraded its VSAT bandwidth last year—from a 128 Kbps uplink and a 1 Mbps downlink to a 1 Mbps duplex link, i.e., 1 Mbps each for uplink and downlink.[10]

At the beginning of this chapter, I said that I would not count computers, but someone has to in order to ensure that there are enough to go around. At the University of Dar es Salaam, administrators estimate that they need one PC for every 10 undergraduates, more for

postgraduates. UDSM has not yet been able to meet these minimum expectations, nor has any other African university outside of South Africa with which I am familiar. This situation gives rise to inequities—typically departments with more grant funding have more computers—and pressure on available resources, such as computer labs in faculties, departments, libraries and the computer center.

5. Meeting ICT Costs with Sufficient and Stable Funding

Workshop participants identified the following broad cost categories:

- Capital investment in the backbone, Internet connection, networks, hardware, software, etc.
- Maintenance
- Salaries
- Training

As must be painfully apparent by now, ICT planning and implementation do not come without delays, complaints and gnashing of teeth. An unsteady donor-grantee tango to the wrong tune can only add to the frustration. Eduardo Mondlane University, like other universities in Africa, has had to juggle different amounts of funding from each of the three donors assisting with ICT implementation—the World Bank and the Dutch and Swedish bilaterals. Each donor is responsible for a different component of the overall plan. The result is roughly similar to putting together a giant jigsaw puzzle, but perhaps not as relaxing.[11]

In December 2000, PIAC and the International Network for the Availability of Scientific Publications (INASP) jointly organized a workshop for African Universities on Evaluating Online Resources.[12] In formulating recommendations for African universities and the donor community on how to implement ICT effectively, the question of "who pays the piper" naturally came up for heated debate. Participants agreed that donor support is essential for capital investment in ICT infrastructure, but universities must be able to sustain the investment thereafter.

Participants also offered several recommendations for meeting ICT costs:

- Once a university knows what it needs and what it costs, it must establish priorities to meet budgetary requirements.
- Supporting ICT beyond donor funding requires that universities incorporate ICT maintenance into budgetary and fee structures, implementing effective models of cost-sharing and ensuring open accountability.
- The cost to universities of subscriptions to online resources must be reduced. This could be achieved through a number of strategies, including collectively negotiating discounts for Africa and establishing consortial arrangements with publishers and vendors. In addition, library acquisitions costs need to be shared more equitably and creatively across the university system.[13]

6. ICT Applications

Information access isn't necessarily the problem, but careful utilization is...

- Students are not always required to use ICT in their literature reviews.
- Students and other users do not always understand which

When African universities embark on ICT implementation, they often find themselves so busy laying cables, wiring up buildings and buying equipment that they sometimes lose sight of how ICT could be used to improve teaching, research and learning.

The first step in applying ICT in these areas often involves using ICT to access information. Early on, this meant using CD-ROM. Helga Patrikios recalls

- information resources are most appropriate for their needs.
- Users, particularly students, need better information-retrieval skills.
- Cost benefit analyses/comparisons between paper, CD-ROM, and online resources need to start—right now.

how important CD-ROM has been to her library;[14] other librarians could easily tell the same story. Today, the Internet is being used increasingly—if not to obtain full-text literature then to carry out literature searches and to gain access to the tables of contents of important journals. For example, a researcher in the chemistry department of Addis Ababa University routinely uses the Internet to learn about current research in his field. Because he lacks money to subscribe to journals or fund document delivery, he then writes colleagues in Sweden to request journal articles, which are sent to him as attached files at no cost.

But it is important to differentiate between the types of information available and the media in which they are found. Using a search engine to find Web sites is not the same as using a bibliographic database to identify appropriate journal literature.

Learning how to do both of these things well requires training, an extremely important activity that is frequently neglected. When they first enter the university, students typically receive a library orientation during which they are introduced to the basics of using a library, but little else. From my own work with postgraduate students using the Internet and CD-ROM, I have seen that they need much more help, particularly in learning how to formulate search strategies and how to evaluate what they find.

One of the recommendations that emerged from the December 2000 workshop specifically addressed student needs: "Students should be required to pass a credit-rated course on information literacy that links library skills with academic course work. Learning information retrieval skills should not be relegated to a one-week library orientation. Instead it should be a joint initiative involving the library, academic departments and the computer center, as relevant." Workshop participants also called on African academic libraries to take a more active role in establishing Web sites with descriptions and recommendations of online resources, a resource that academics and students in other parts of the world take for granted.

Younger teaching staff who have trained or worked outside of Africa are at an advantage because they had an opportunity to learn how to use electronic resources during their studies. Older members of the university community, including senior administrators, have been less fortunate. They need attention too, but it is difficult to envisage a Vice Chancellor taking a credit-rated course. Training tailored to a variety of users is crucial. Some African universities address this need by organizing special sessions for senior staff to sensitize them to the power of ICT and the issues involved in its use.

The weakest link in applying ICT fully relates to using it to change teaching and learning patterns, moving instructors toward an interactive engagement with students and away from a one-way dependence on facing the class from a blackboard and reading lecture notes. I know of a few initiatives, some of which are just now getting underway:

- **The University of Dar es Salaam** has secured funding from the Belgian government for the Technology Enhanced Independent Learning (TEIL) Project. Its aim is to create a virtual learning environment for both students and faculty. In addition, the university has received a large grant from the Carnegie Corporation of New York, which includes support for using ICT to improve teaching methodologies.

- The **Eduardo Mondlane University Staff Development Project (STADEP)**, which is funded by the Dutch, has offered university staff training in using PowerPoint and the Internet. The UEM Faculty of Medicine has been particularly active in examining how ICT can be applied to teaching and learning, and in requesting STADEP assistance.

Students taking biochemistry, for example, are expected to present their projects on a home page, and students of physiology will soon follow suit. In 2000, STADEP became the Centre for Academic Development, housed in the new Faculty of Education. This new center will begin to work with the student population; until now training efforts have focused on staff development.

- Also in Mozambique, the **Catholic University** campus in Beira opened a Faculty of Biomedical Sciences in August 2000. The Faculty plans a problem-based, patient-oriented approach, which will make heavy use of a well-equipped multi-media resource center. The Dutch government is providing some assistance to purchase equipment, CD-ROMs, and other electronic media. The US Agency for International Development's Education and Democracy for Development Initiative (EDDI) for Mozambique plans to enhance Internet capability in Beira as a whole and the Catholic University in particular.[15]

- With funding from the Ford Foundation, the Tufts University Department of Political Science is collaborating with political science departments at the **University of Dar es Salaam** and **Makerere University** on an exciting curriculum co-development project. The idea is to test the ability of instructors at the three universities to coordinate and connect three related courses on African international relations, using the Internet to the maximum extent possible. Students are encouraged to go online to engage in interactive dialogues, and to contribute materials of their own choosing to the Web site.

But despite these few good examples, much more work needs to be done. Technology can complement good teaching, but this requires careful thought and planning, and some innovative thinking as well.

Although the real costs of distance learning can be very high, it is sometimes seen as a panacea in Africa, where there are many more applicants for university positions than can be accommodated. Outside of South Africa, most distance learning programs rely heavily on printed materials, tapes and radio. There are very few Internet-based applications in sub-Saharan Africa.

The African Virtual University (AVU), which was initiated by the World Bank, is probably the largest and best-known initiative. However, although the education is "virtual," it is not really at a distance from the host university computers. A number of African universities house AVU learning centers to which students come for a variety of courses—everything from introduction to computing and sales & marketing to remedial or pre-university courses in languages and the sciences. AVU has come in for a good deal of criticism because, to date, all of its courses have been developed in the North. In addition, with the exception of Kenyatta University, AVU learning centers have been severely hampered by low-grade technology—old and inadequate computers, insufficient bandwidth, etc.[16] Moreover, few of the universities hosting AVU facilities have integrated AVU into their systems. In short, universities have not bought in to the AVU, either institutionally or financially.

AVU hopes to shift its focus from the north to the south. It will relocate to Nairobi and is preparing to introduce a diploma course in computer science in 2002 at a few pilot institutions. It also plans to upgrade the technology at member universities—starting first with the diploma course universities. Equally important is that AVU wants to move away from continued reliance on content coming from outside of Africa. AVU's operational budget includes funding to equip the Nairobi office with a multimedia training classroom, from which African teaching staff will learn how to deliver their courses over the AVU network. Many of the ICT techniques that these instructors will learn could be applied equally well to altering the current "talk and chalk" method of teaching that prevails at residential campuses.

All of these innovations are still in the planning stages, however. Full implementation will take time and more funding. It is too soon to tell whether AVU will succeed in its ambitious agenda.

Perhaps less well known, but nonetheless exciting, is the work that is underway at the University of Namibia (UNAM). A campus in Oshakati has been established with the aim of promoting development in the north of the country, where over 45 percent of the country's population resides. Although the concept as a whole is significant to those of us interested in providing more resources for poor and rural communities, UNAM's use of ICT in this initiative is most relevant for the purposes of this chapter. Many of the courses provided at the Oshakati campus are offered through distance education delivery modes. For example, students have at their disposal video-conferencing technology—the first such system installed in Namibia. Thus, a lecturer in Windhoek can teach students in Windhoek and Oshakati simultaneously. In addition, the Oshakati campus has its own library, which is connected to the Internet. (The line is frequently slow and congested, but it works.) Library users can access the UNAM Online Public Access Catalogue (OPAC), which includes the holdings of all of the university's libraries; they can also obtain the tables of contents of their favorite journals and full-text articles, electronically in a variety of ways. Moreover, local Oshakati residents can use the library to carry out Internet searches for a small fee (about US $1.50 per hour). Finally, a new library resource center for the Northern Campus is being constructed, for joint use by the university and the broader community. It will have many computer access points, two 15-computer laboratories and a sizeable print collection.

African Content

It is clear to anyone who has conducted a literature search that it is hard to locate information *about* Africa and it is even more difficult to find information coming *from* Africa. African scholars carry out research, but the results of that research are not disseminated as widely as they should be. Careful utilization of ICT can make it easier for Africans to circulate scholarly work, thus making Africa more visible.

There are a few important initiatives underway that are worth highlighting, even though so much more needs to be done. Not every activity mentioned below takes place in a university, but all of them affect the ability of African academics to share their research findings.

- An INASP initiative, *African Journals Online*, mounts the tables of contents and abstracts to more than 50 scholarly journals on its Web site, with links to full text where available.[17] The INASP activity is particularly noteworthy because it involves working with African publishers to help them understand the potential (and perils) of using the Internet to publish and market their journals.

- There are two noteworthy activities that involve using ICT to preserve and make accessible Africa's culture and heritage. Mali's National Centre for Scientific and Technological Research is responsible for an ambitious project to create an electronic archive of Arabic manuscripts in the Timbuktu region. In East Africa, the Archives of Zanzibar received funding in 2001 to begin the process of digitizing the rare manuscripts and photographs in its collection. (Both of these activities are supported by the Ford Foundation.)

- At Eduardo Mondlane University, two units with strong ICT champions are also mobilizing ICT to produce "African content." In 1999, the Centre for African Studies (CEA) produced a full-text multimedia CD-ROM of the proceedings of an international conference on Lusophone social science research. The Faculty of Agronomy then followed suit with a CD-ROM containing the full proceedings of two international workshops on river basin management and natural resource management. At this writing, CEA is now nearing completion of a CD-ROM of two Mozambican bibliographies.

- In 1997-98, PIAC organized a feasibility study for the creation of a *Database of African Theses and Dissertations* (DATAD), in which the Association of African Universities (AAU) was an active partner. The underlying premise, in the words of AAU Research Director Akilagpa Sawyerr, was that "The absence of systematic compilation and indexing of postgraduate theses and dissertations in most African universities often

means that the countries for which such research is primarily undertaken are not able to benefit fully from it."[18] Our goal was to use the feasibility study results to provide the basis for a viable and sustainable effort by African universities to demonstrate the creativity, excellence and potential of African scholarship. The feasibility study was completed in February 1999, and AAU is now implementing DATAD, with start-up support from the Ford and Rockefeller foundations.[19]

Last Points

Rather than focus on the obvious issues of inadequate funding or infrastructure, or on the technical issues of nuts, bolts and cables, I want to hone in on a few key qualitative issues relating to ICT applications:

- The first time I heard the term "information famine" was in reference to Africa, particularly its lack of access to current journals. No African library (or any library elsewhere in the world) can subscribe to enough journals, but anyone with e-mail can keep up-to-date with current developments in his or her discipline—by receiving table-of-contents information from major scholarly journals, participating in discussion groups, etc. Full-fledged Internet access is even better, of course, and better still would be a dedicated campus connection; but a minimal dial-up connection can accomplish a lot. Moreover, many universities already have or could have CD-ROM capacity and subscriptions to a few bibliographic and abstracting databases. The technology might seem "old-fashioned," but it does not require a telephone or incur ancillary charges. We still need to order full-text articles, but many African scholars have adopted appropriate coping strategies—mainly asking friends and colleagues in other parts of the world for required literature, when inter-library loans are not a viable option. Thus, in the year 2001, no academic with even minimal access to the ICT tools described in this chapter can plead lack of access to current journals as an excuse for ignorance. The "information famine" is becoming an attitude, not a fact.

- Internet is a marvelous tool, but it cannot replace teachers, libraries or librarians. Because it is still so new in Africa, many African university administrators have misconceptions about the place of Internet on their campus. Internet cannot replace libraries—although I have heard vice chancellors postulate that libraries were becoming superfluous. Nor can we do without print media. At the December 2000 workshop referred to above, participants devoted considerable attention to information management issues and the need to access information—both print and electronic—in a variety of ways.

- Internet may be fairly new on the continent, but there is growing expertise that should be tapped. As discussed above, several African universities have considerable experience with ICT planning and implementation. I have been tracking a subset of African Web sites and am pleased to say that they are getting better.[20] Internet training is improving too. INASP has conducted a series of traveling Internet workshops at African universities for African university librarians. Perhaps most important, although the first workshop was carried out entirely by INASP, a training-of-trainers component has been built into the series, with the African coordinator of one workshop responsible for the training at the subsequent workshop. Thus, a trainer from the University of Dar es Salaam went to train librarians in Ghana, a Kenyan librarian went to train counterparts in Ethiopia, etc.

What, then, is the verdict—how much water is in the glass? While the glass may not be exactly half full, the situation is not as bad as it is often portrayed. I believe that African university leaders are increasingly cognizant of the need to implement ICT at their institutions, even if some of them do not quite understand how to get from here to there. Toward that end, the participants of the December 2000 meeting mentioned above have recommended to the Working Group on Higher Education that the WGHE fund an ICT strategic planning workshop for African universities, which would result in the publication of a checklist and manual. More work needs to be done to sensitize senior administrators,

teaching staff and instructors to ICT applications in order to ensure that technology is harnessed creatively, rather than used as an adjunct to a boring lecture. But we are well beyond the starting point.

Finally, my experience over the years is that students are quick to grasp the potential of ICT for their studies and research. In 1995, I helped organize an evaluation of CD-ROM databases, which was carried out in seven African universities. Malawi's Bunda College of Agriculture was responsible for the assessment of agricultural databases, and I'll never forget the comment of one of the students who participated in the project: "…then I realized that I could do research…and have it published!"[21] If that enthusiasm can be maintained by ensuring good infrastructure and a hospitable environment for intelligent utilization of ICT, then we might have to worry about whether the glass is going to overflow rather than whether it is half empty.

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1 Fidonet employs a hop, skip and jump approach to e-mail transmission. Basically, e-mail messages are transferred from one computer to another in a series of steps whereby one computer "dials up" another computer with a modem over a phone line, usually at regular intervals during the day. The first major "hop" in the Africa cycle is to an international gateway—most commonly South Africa, London or France. Calls to the gateway are kept to the minimum necessary, which results in lower costs. Today, very few African users are still using Fidonet, but it was indispensable in the early days.

2 See "AISI-Connect National ICT Profile—Zambia." Africa Information Society Initiative (AISI)-Connect Online Database: Information and Communication Infrastructure in Africa at http://www2.sn.apc.org/africa/countdet.CFM?countries__ISO_Code=ZM

3 Of the universities mentioned in this chapter, the Ford Foundation has provided major institutional support to Eduardo Mondlane University (particularly to the Centre for African Studies and the Faculty of Agronomy) and to the University of Namibia. Project support is indicated in the text as appropriate.

4 The case studies were commissioned by a partnership of four US foundations collaborating to improve their grantmaking in support of higher education in Africa. These include the Carnegie Corporation of New York, the Ford Foundation, the MacArthur Foundation and the Rockefeller Foundation. More case studies are underway, and a monograph series is planned.

5 Although it was pressure from donors that brought many universities to the "strategic planning table," these exercises have yielded some very good plans and innovations. The university case studies mentioned above describe and assess strategic planning in detail.

6 Mwenechanya, J. M. Former Deputy-Vice Chancellor, University of Zambia. Comments presented at "The Challenge to Africa of Globalization and the Information Age." African Development Forum. Addis Ababa, October 28, 1999.

7 Annex to the 1998 Academic Audit Report. University of Dar es Salaam; March 1999: 6.

8 More information on ICT planning at Makerere University and Eduardo Mondlane University can be found on their respective Web sites at http://www.makerere.ac.ug/makict/index.htm and http://www.uem.mz/ictproj/ictsarec/introduc.htm

9 Makerere University now has funding from the Swedish, US and Norwegian governments and the African Development Bank for the campus backbone, some local area networks, and computer labs for staff and students. For further information, see Makerere University's ICT Web site: http://www.makerere.ac.ug/makict/index.htm

10 In South Africa, two $1 million grants—one from the Andrew W. Mellon Foundation and one from the Atlantic Philanthropies—support enhanced access to the Internet and the use of the Internet by Tertiary Educational Institutions in South Africa and neighboring countries. See http://www.tenet.ac.za for more information about the Internet Access Development Program (IADP).

11 See the UEM home page for more details: http://www.uem.mz/ictproj/

12 The workshop, which was hosted by the Makerere University Library, brought together administrators, teaching staff and students from nine African universities. The AAU was also represented, as were the Organization for the Social Science Research in Africa (OSSREA) and the Inter-University

Council for East Africa (IUCEA). The workshop report is available from INASP: inasp@inasp.info. Not surprisingly, the very complex issues of management and human resource needs took up the bulk of workshop.

13 INASP is now collaborating with not-for-profit and commercial publishers to make subscriptions to scholarly journals available at low cost in sub-Saharan Africa. See the INASP Web site for more information about the Programme for the Enhancement of Research Information (PERI): http://www.inasp.org.uk/

14 In Chapter Seven, "Untold Stories."

15 EDDI funding for Mozambique will support servers in Beira, Nampula, Quelimane, Chokwe and Cuamba, with subsidized broadband capability to selected institutions for one year. Catholic University will receive a 64 Kbps line. It is important to note, however, that this support does not include purchase of equipment or installation of local area networks. Moreover, after one year, recipient institutions will be required to pay for Internet access themselves.

16 Kenyatta University has invested heavily in AVU, using its own funds and profits from the AVU courses it offers to purchase computers. Nevertheless, the university has experienced its own e-mail vicissitudes. In September 2000, students rioted, in part over a KSh 500 fee (about US$6) that they were required to pay for "internet services." They complained that the charge was instituted without their consent. Perhaps equally significant is the fact that, at the time, Kenyatta University did not have enough computers or bandwidth to satisfy demand. See the Daily Nation on the Web at http://www.nationaudio.com/News/DailyNation/30092000/News/News33.html for a version of the story.

17 See http://www.inasp.org.uk/ajol/index.html.

18 Sawyerr, Akilagpa. Statement at DATAD Feasibility Study Planning Meeting. Nairobi, Kenya. January 1998.

19 Further information on DATAD is available from the AAU Web site: http://www.aau.org/datad

Other efforts to manage and disseminate information about African theses and dissertations are also underway. In Kenya, for example, the National Microfilming Society is collaborating with Kenyan universities to compile a union list of theses and dissertations that are held in both public and private universities. This project started in June 2000 and is intended to be ongoing. The initial 2,000 records are now being edited.

20 See da Costa, Peter, "African Content on the Web" (Chapter Three of this book). See also: Levey, Lisbeth. Africa Goes Digital: African Content on CD-ROM and the Web. Nairobi: Project for Information Access and Connectivity, November 2000. www.piac.org/digital/

21 Ngwira, Margaret. "CD-ROM Databases in the Agricultural Sciences." CD-ROM for African Research Needs. Washington, DC: American Association for the Advancement of Science, 1996: 23.

Rowing Upstream

Snapshots of Pioneers of the
Information Age in Africa

Go to ...
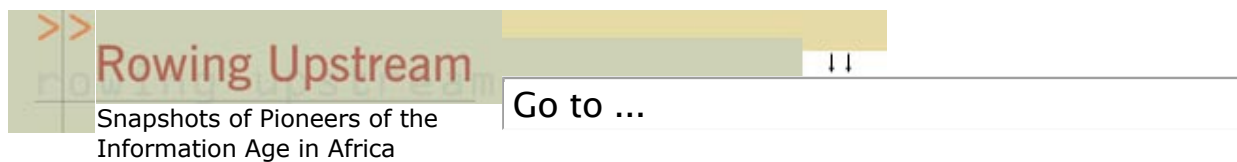
Chapter Seven

Untold Stories: The Beginning of ICT in Africa

Introduction

At the *Rowing Upstream* advisory committee meeting in June 2001, we began to reminisce, sharing stories with each other about the early days of ICT in Africa. We decided that these stories needed to be told, and added an extra chapter to the book for that purpose.

Following the meeting, I wrote to about twenty people, asking each for a short anecdote for the chapter, and offering absolutely no guidance about content. I received responses from almost everyone. Some sent personal anecdotes; others described and assessed ICT implementation at a particular institution or in a particular country. Taken together, these stories give us a context for those far-off days—really just about ten or eleven years ago—when ICT was beginning to take root on the continent. Not surprisingly, all of the authors stressed the importance of ICT in their lives, despite numerous obstacles that included lack of funding, bad phone lines and pitifully slow modems. As these stories indicate, despite Africa's poor infrastructure, e-mail was immediately seen as an essential means of communication, a recognition that came more decisively than it did overseas, where mail does not take years to reach its destination (see Nancy Hafkin's story).

The stories are presented in alphabetical order by author, but readers may want to start with David Balson's contribution, for David writes about early IDRC support for networking in Africa. Several of the stories refer to this funding, and many of us believe that IDRC's belief in the viability of e-mail for Africa got us all started.

For me, compiling this chapter was an immense pleasure, because I began to remember my own stories. When I read about Mike Jensen smuggling modems into Zambia, I recalled how I helped several African university libraries go online by bringing them their first modems. I first met Lishan Adam in 1990, when he came to Washington to learn about Bitnet (an early e-mail protocol). Just think: UNECA wanted to use e-mail, and I was still relying on faxes and telexes! And I have a vivid memory of my first meeting with Narciso Matos: it was in 1992, at the Eighth General Conference of the Association of African Universities in Accra, Ghana. I was responsible for a CD-ROM seminar and demonstration for AAU meeting participants. This was Narciso's introduction to CD-ROM, and he was intent on carrying out as many literature searches as he could.

I will stop here and let the stories come from the ICT pioneers themselves.

Lisbeth Levey

Women Encountering Technology

Fatma Alloo

In 1987, the Tanzania Media Women's Association (TAMWA) was born in the wake of economic liberalization in Tanzania. As founder of TAMWA, I soon realized that we had to either take information technology on board or remain in toil to typewriters for our publication *Sauti Ya Siti*.

At that time, the Canadian Organization for Development Education (CODE) was interested in funding our magazine. We said: give us the means of production—i.e., desktop publishing and training for seven of our members—and we shall produce our own magazine. They agreed. This empowerment had a marked effect on the psychology of the organization.

APC then supported the installation of a modem for e-mail. Those were the years of the UN conferences, when women were mobilizing around issues of development, violence and

reproductive health. At that time, the telephone infrastructure was poor. Nonetheless, we decided to download messages, get them translated into Swahili, and let women know what was happening and how to mobilize around issues of concern before going to these UN conferences. The exercise proved highly innovative and had tremendous impact nationally and globally.

Today, with the cyberage in full swing in Tanzania, we find cybercafés on every street corner in Dar es Salaam and Zanzibar. In Zanzibar, it is refreshing to see young people organizing around ICT issues, and conducting projects in schools to mobilize students to use ICT through the Zanzibar Information Technology Education Centre (ZITeC). Women are using ICT to market their products and access information useful for their careers and life experiences through Zanzibar Women on the Net (ZaWoN). Women who have to stay home after childbirth can continue to work, using e-mail and their computers. Networking is a driving force, and permits massive mobilization around common issues.

"Rowing Upstream," certainly—how far, we have yet to see.

IDRC's Telematics Program: The Early Days

David Balson

In recognition of a growing South-North disparity in access to information and communication capacities, IDRC organized a week-long workshop in 1981 entitled "Computer-Based Conferencing Systems for Developing Countries." The aim of the workshop was to explore the state of the art and receive advice on the role of donors in addressing this disparity. Two individuals with great foresight initiated this exploration: Carl-Goran Heden of the Karolinska Institute in Stockholm and a Governor of IDRC; and John Woolston, the initiator and first Director of IDRC's Information Sciences Division. The recommendations that emerged from that workshop led to the creation of IDRC's Telematics Program.

Throughout the 1980s, this program supported and promoted initiatives to facilitate more informed decision making by developing-country institutions concerning the transfer, adaptation and utilization of data communication techniques. Examples of the type of initiatives supported include:

- organization in 1983 of one of the first international computer conferences involving developing-country institutions

- support of a feasibility study and pilot project concerning the implementation of a data transfer network for the CGIAR institutions (these small investments in 1982 led to the creation and continuing growth of the CGNET, which brought ILCA in Addis Ababa, IITA in Ibadan and ILRAD in Nairobi online in the 1985-87 period)

- software development in North Africa involving protocols and Arabization

- research concerning the use of low-earth-orbit (LEO) satellites to solve last-mile communications problems.

The early years of this program could be characterized as years of promotion and sensitization, since there was almost no recognition of the importance of information and communication technologies in the development process. I traveled to many institutions and conferences to demonstrate and promote online access and communication using a Radio Shack Model 100 portable computer with an acoustic coupler for insertion of the telephone handset. I encountered intense skepticism at institutions in both the North and the South.

Not only did they believe that I was talking nonsense; very few even saw a role for computers in development, and this was especially true of Northern stakeholders! While the program began by exploring the application to development work of computer conferencing, it soon became evident that the more essential need was to address both basic understanding of and access to *any* reliable and affordable technique for communication.

Toward the end of the 1980s, the program's emphasis came to focus geographically on Africa, where the needs were greatest and progress was minimal. A number of interrelated networking projects were developed to achieve program objectives in this region, including:

- NGONET Africa: linking four nodes and many NGO end users in Nairobi, Harare, Dakar and Tunis for information exchange in the lead-up to UNCED

- ESAnet: linking five universities in Kenya, Zambia, Tanzania, Uganda and Zimbabwe to experiment with different data communication topologies

- HealthNet: linking health institutions in Africa, including medical faculties, hospitals and medical researchers, using packet radio and LEO-satellite technology

- ARSONET: linking standardization offices in Nairobi, Addis Ababa, Dakar, Tunis and Cairo

- PADISnet: a regional pilot effort in utilizing a variety of data communications technologies to link development institutions in Africa, designed as a "networking of networks" project and coordinated by PADIS/ECA in Addis Ababa.

Some of the early pioneers in these IDRC-supported projects included Doug Rigby of ELCI in Nairobi; Moussa Fall of ENDA in Dakar; Tony Rodrigues and Bill Okello of the University of Nairobi; Charles Musisi of Makerere University; Rob Borland and John Shepherd of the University of Zimbabwe; Bill Sangiwa of the University of Dar es Salaam; Mark Bennett of the University of Zambia; Makane Faye of ARSO in Nairobi; Nancy Hafkin of ECA in Addis Ababa; Charlie Clements of SatelLife in Boston; and Mike Jensen of everywhere.

As these projects evolved, collaboration and connections with the emerging Association for Progressive Communications (APC) and some of its partners (MANGO in Harare) and nodes (WorkNet in Johannesburg and GreenNet in London) were essential.

In the early 1990s, in response to the lessons learned through the constellation of projects supported in Africa, IDRC developed a major networking capacity-building project: Capacity Building in Electronic Communications for Development in Africa (CABECA). The project, coordinated by PADIS/ECA and built on the experiences, capacities and approaches of the above-mentioned projects, used Fido-like software technology and dial-up communication over the existing telephonic infrastructure to build national nodes in sub-Saharan African countries. Some of these lessons included recognition of:

- the fact that it makes more economic sense to invest once in building sufficient networking capacity that can be used by a collection of user groups and substantive networks within a country than to duplicate efforts by building networking capacity for each individual organization

- the need to address networking at the national level with interconnections between countries

- the need to develop systems in which users are able to purchase services with local currencies

- the need to develop a comprehensive, ongoing training and trouble-shooting regime, first at the sub-regional level, but later at the national level, with readily-available technical support

- the importance of developing local capacity in relevant skills such as networking, implementation, systems operation and training

- the value of involving national user groups representing both service providers and users in setting policies related to network operations

- the importance of collaborating and sharing resources.

It was striking to note that many Southern organizations, especially NGOs, were online and effective computer-based networkers long before their counterparts in the North were. Where the needs were greatest and where the stakeholders recognized those needs, the environment was receptive. Working collaboratively with users, intermediaries, technical experts, policy makers and donors to address real needs with commitment, we were able to lay the foundation for sustainable networking in many countries in Africa.

Coming in from the Cold in Zambia

Mark Bennett

The year was 1992: the early days. We were Fidonetters busy running delicate and ever-changing DOS batch programs many times each day on computers that needed watching and nursing like small children. As a result of the IDRC-funded work that we were doing with academics and NGOs, we had been invited to a series of meetings in Canada. The month was February, the snow was thick on the ground and temperatures were down to minus 25 degrees Centigrade. This was definitely not Zambia.

The delegates came from all over Africa, but we never saw many of them from start to finish. They were there at the meetings and we had long and earnest discussions, but everyone had been met at the airport with parkas, scarves, gloves and hats into which they disappeared for the entire week, to re-emerge only for the safety of their plane journey home.

On the first day in Toronto, we were all introduced to the famous Randy Bush and were soon to realize that, in the structured and socialist Fidonet world, all the e-mail traffic for Africa actually passed through the front room of his house. Not really bomb-proof, as per the original Internet concept, but a great service that is unlikely to be repeated now that the dam has burst and the bitstream has become a tidal wave.

By 1993, we had decided that we wanted "the real thing": we wanted full Internet access, even though in its modern form it was in its infancy. There were plenty of people who said that Africa had other priorities—after all, wasn't Fidonet working?—or that Africa needed its own systems of communication. But we needed to come in from the cold, and in the warmer climes of Lusaka in November 1994, we got our first full, permanently open Internet link, operating at a magnificent 19200 bps. We had more loss of signal on the circuit on the 8 km from the university into the center of Lusaka than all the way from there to Cape Town, but with the relevant bits of string and sticky tape (and hopes that it didn't rain too often and cut off the phone lines), we finally had a connection, and ZamNet was born.

That same link is now running at over 2 Mbps with multiple VSATs, operated by a large team of Zambian experts. The continent has gone from Zambia being one of the only countries with a connection to no country being without.

It really is warming up in Africa.

Information Wants to be Free, But It's Got to Fight for Its Rights

Rob Borland

When HealthNet and ESAnet were started some ten years ago in Zimbabwe, it very quickly became clear that wide-area networking was a subversive activity. In many respects it still is today.

Then, it was illegal just to connect a modem to the telephone network without approval from the state telecommunications authority, a monopoly operator. Obtaining approval was tedious and uncertain, so we just connected the modems up regardless. Users became accustomed to concealing their modems whenever official telecommunications technicians were called to attend to line faults. One unfortunate doctor in a small town actually spent a very uncomfortable night in the local jail after neglecting this precaution.

Connected users also subverted the bureaucracy of their own workplaces. Some CEOs forbade this altogether (so modems had to be concealed from them as well). Others allowed their subordinates to join the system, but insisted on vetting all their e-mail. Even more obstructive were those CEOs who appropriated the precious computers allocated for e-mailing and placed them on their own desks, from which no e-mail would ever be sent.

All that has changed, of course. Now government ministers and CEOs proclaim the wonders of the Internet and the ways that ICT is going to leverage economic development and ensure success in the global marketplace—especially when the official meetings are held in attractive venues in distant countries which qualify for large per diems, and the delegates have never actually accessed the Net themselves.

But if things change very quickly in the world of ICT, it means, of course, that they stay the same the more resolutely.

Official suspicion of the medium remains high. Recently approved legislation privatizing the state telecommunications authority and providing for rival services includes deliberately prohibitive fee structures that run to billions of dollars. This legislation also prescribes stringent regulations for registering ISPs, with conditions that include the interception of users' communications at the President's pleasure, and with Draconian penalties for systems administrators who refuse to implement such directives or even reveal that they have received them.

A member of the regulatory authority created to enforce these regulations, whom one would assume was appointed more for his technical competence than his political correctness, blandly stated at a public meeting that ordinary users had nothing to fear from these regulations since they would only ever be exercised in the pursuit of criminals and human rights activists!

Information wants to be free, but it's got to fight for its rights.

How E-mail Ended My Intimate Affair with the Telex Machine

Peter da Costa

It was sometime in 1989, in one of the smallest countries in Africa, known for its beaches and for virtually nothing else. Not the most media-friendly place for a young journalist to start his career as a foreign correspondent in Africa. Nevertheless, armed with a pre-industrial Tandy, a precursor to the laptop, I was determined to build a career.

UK media outlets had recommended the Tandy for filing electronically. However, its acoustic couplers were worthless over an international line, and its only use was as a souped-up typewriter with back-up capacity when connected to a tape recorder. With no way of sending data electronically, though it existed in bytes, filing stories required the utmost innovation. One method was to read the text from the Tandy over the phone, though this only worked for voiced radio reports, as no one was willing to take dictation of 1,000 words. Another was to send the stories by fax, which again required someone to re-type the story to facilitate editing and typesetting.

I resorted to trudging down to the local government-run telecommunications service center, and soon developed a very tactile and intimate relationship with…a telex machine. Luckily, the machine was not of the ticker-tape variety. It had a screen and some primitive software that allowed one to type the story in caps and watch as it chugged the data into cyberspace. It took an average of 30 minutes to type a feature of 1,000 words, and another full hour to send it. It was hard work to re-type an article that I had already painstakingly created on the Tandy, in a cramped booth where advanced negotiation skills were required to persuade Isatou, the young telex operator, to let an upstart journalist occupy her position from 9:00 to 10:30 every morning. And some days I had two or three features to file. Lunch was often eaten with one hand while the other stroked the telex keyboard. This symbiosis of man and machine did not come cheap. Monthly bills ran into several hundred US dollars. Thank God for the ITU, which issued a kind of telex credit card that allowed the bearer to charge all costs to the news agency that had issued the card.

A brilliant young Senegalese techie who worked for Inter Press Service, an alternative news agency that I had begun to file for on a regular basis in 1991, saved my life. In addition to pioneering a new approach to writing about development, IPS developed solutions to overcome the profound challenges of networking information in Africa and elsewhere. IPS joined forces with GreenNet, a member of the Association for Progressive Communications, to develop an automated solution for sending data over a telephone line. My Senegalese friend wrote a script and put it in a tiny Compaq laptop that was assigned to me. I cried the day I took delivery of that miracle machine. I could now write a story, plug a phone line into the machine, dial a number in London, and dump the story in a matter of seconds. I could also receive the cast from the day's wire output, giving me almost real-time access to a wealth of information, including material I had written that same day.

As e-mail became a way of life, the world changed forever. I gave the Tandy, the tape recorder and the acoustic couplers to a teenaged cousin and told him to go away and figure out how to make good use of them. I received a barrage of calls from my friend Isatou asking why I had abandoned her and her telex machine. And it took me quite some time to explain to my mother that I could send data over her telephone line in a few seconds, and at a fraction of the cost of filing by telex.

Mango Chutney or Mango Achar?
How Public E-mail Got Started in Zimbabwe

Colin Darch

One of the first bulletin board services to be set up in Zimbabwe in 1987 or 1988 was called MANGO. Based initially in the SARDC offices in Deary Avenue, it was, I think, the first permanent system—and I was its first "sysop" (systems operator). MANGO stood for Microcomputer Access for Non-Governmental Organizations, and we all thought it was a very clever and appropriate acronym.

Although MANGO was first established experimentally at SARDC, its management was soon taken over by a loose coalition of Harare progressive NGOs, including SARDC, EDICESA, ZISA, PHT and some others. People like Mike Jensen, Brian Murphy and Derek Hanekom were all involved; we had no funds but a lot of energy. MANGO rapidly started connecting to similar services around the world and learning from their experiences. I attended at least two Interdoc conferences in the Netherlands at this time, on behalf of Zimbabwean NGOs. The APC network played an important part in these meetings, and local services such as WorkNet (South Africa), Alternex (Brazil) and GeoNet (England) were all represented.

The MANGO service was originally run on a clunky old IBM workstation, one of the original 1980 generation of personal computers, connected by modem to the main SARDC telephone number, and was only available after six o'clock at night, and then only for about an hour or so. Later, we were allowed by management to leave the computer on all night. The main technical problem in those days was that the telephone lines in Harare all went through an ancient mechanical exchange from the pre-UDI era, and there was an amazing amount of interference from other lines, so data transfer was often quite difficult.

Data packets would get corrupted, and occasionally an operator would come on the line to ask why nobody was talking. The other problem was finding a line that the owner was willing to dedicate to data transfer—you could not get a new line in Harare in those days for love or money. We had much less difficulty with the software or hardware side of things.

Some of the local journalists used MANGO to file stories. They would ring me up and we would set up the parameters manually for a file transfer, and I would then watch the data streaming in. The idea was that the newspaper or agency would call in from New York or London and pick up the copy as a computer file from the BBS. On one such occasion, I recall a freelancer filing copy after visiting Cuito Cuanavale in Angola. Her eyewitness story from a southern African hotspot was subsequently syndicated all over the United States.

After a while, we decided to upgrade MANGO from being a simple standalone BBS to becoming part of the Fido network, with full e-mail functionality. An American called Ron Braithwaite, who was teaching ICT at the university at the time, paid for the OPUS system for us with his own credit card and helped us to set it up. I remember sitting up all night with him on a couple of occasions, trying to install the software—we even got locked into the campus. The Africa node for Fidonet was in Grahamstown, South Africa, which made us all suspicious, but after a while we began connecting instead to GreenNet in London to upload and download messages. It frequently didn't work correctly, mainly because of the poor quality of the data lines, and because of lingering software problems.

By 1990 or so, MANGO had about thirty or forty subscribers, and we were looking at more sophisticated end-user software such as Frontdoor, which used a script to enable a user to dial up, download and upload messages automatically, and ring off again as quickly as possible. BBS functionality was largely forgotten. In mid-1991, I went to work in Brazil, and my involvement in MANGO came to an end. But I know that it still flourishes today.

Locating the Pioneers

Riff Fullan

Although I had heard of such things before, my direct exposure to e-mail and the Internet began in the early 1990s, when I discovered an interconnected global electronic bulletin board and e-mail network supported by the Association for Progressive Communications (APC). This network linked a number of organizations, mostly in North America and Europe, using e-mail and electronic conferences to share information, strategize, collaborate and network. These organizations were primarily NGOs in the environmental and international development sectors.

After becoming a staff member of Web Networks in Canada, I was all set to support, in whatever modest way I could, the broadening of this movement to include Africans in Africa (which was my first interest, having just finished several years of study focused on Central/Southern Africa). I was pleasantly surprised to find that although the vast majority of the people and organizations I knew in Canada in those days had at best only vaguely heard about e-mail, let alone used it, there were already communities of users and e-mail service providers in a number of African countries. As an example, by 1992, publicly accessible e-mail service providers were connecting users in Africa with others throughout the world, through Internet gateways using store-and-forward e-mail software in at least ten African countries (Ethiopia, Ghana, Kenya, Senegal, South Africa, Tanzania, Tunisia, Uganda, Zambia and Zimbabwe). In addition, a number of sub-regional bulletin board systems were active on the continent.

By 1994—still a time when many of my Canadian acquaintances had neither sent nor received a single e-mail message—the number of e-mail users and hosts had increased significantly. About half of the countries in Africa had reliable daily e-mail links to the Internet, and half a dozen countries had full, interactive Internet connectivity. While those of us in the North (especially in North America) enjoyed relatively inexpensive access, many African e-mail hosts were connecting to GreenNet in England using high-cost long-distance telephone links, and also encountering problems associated with noisy and dropped connections. In addition, rates charged to end-users in Africa were generally much higher than in the North. Still, this did not stem an explosive growth of e-mail and Internet connectivity throughout the 1990s.

What this bit of history tells us is that, although a number of network developments in African countries relied on expatriate assistance for their establishment (and, in some cases, their maintenance), the fact of the matter is that a core group of African innovators, largely within NGOs, were pioneers not just in their own countries, or on the African continent, but in the global sphere as well. In a context in which international development activity and assistance has generally assumed that Internet-related information and communication technologies have only very recently been introduced to Africa, we should stop to recognize that, in many cases, such technologies—and much expertise related to their use—have existed on the continent for over a decade.

Send a Letter? The Rise and Fall of PADISnet

Nancy Hafkin

The coming of the Internet transformed communications for the Economic Commission for Africa (ECA), whose Pan African Development Information System (PADIS) operated a centralized database of information on development issues. Users of this database typically transmitted their search requests by mail, as other means of communication were very costly. Invitations to conferences, seminars and workshops were also generally sent through the postal services, with often dismal results. The mail delays between the ECA headquarters in Addis Ababa and other African destinations were legendary. Service to and from South Africa was regular: it regularly took a year and a half for letters to pass in either direction. In the case of Morocco, it was two years each way. The delay champion, however, was Niger.

PADIS sent out the result of a database search in 1990. It was returned to PADIS in 1999, marked "recipient unknown" (in French, of course).

With the advent of electronic communications in 1992, searches could be sent and results returned the same day. Correspondence related to meetings benefited immensely as well.

Then in 1993, PADIS built on its early e-mail experience and set up the first public access e-mail node in Ethiopia under the rubric of the IDRC-supported Capacity Building for Electronic Communications for Africa (CABECA) project. Subscriptions were open to anyone with a computer, access to a telephone line and the $50 enrollment fee (payable in US dollars or local currency). Most subscribers paid between $10 and $25/month for messages sent and received. The system was Fidonet, with mail sent and received several times a day through APC's GreenNet node in London. At its peak, the system had 1500 subscribers, and sometimes as many as 10 users per subscription.

The PADISnet node was extremely popular with non-governmental organizations, the university, and even embassies (of which Addis Ababa hosted nearly 100), despite its lack of secure communications. Private Ethiopians who owned businesses or had friends or relatives in North America and Europe were eager subscribers. The service transformed many old ways of doing things. Academics and researchers on Ethiopia and Ethiopian studies were thrilled with the possibility of communication between counterparts in Ethiopia, Europe and North America that were both fast and cheap (which is not to say easy: the use of early Fidonet e-mail systems was not exactly intuitive). Ethiopians in the Diaspora began getting and staying in touch with friends and family back home. Many things that were previously constrained by the high cost and slow pace of communications were now possible.

However, the Ethiopian Telecommunications Corporation, which itself offered no e-mail services, held a monopoly on all telecommunications services in Ethiopia. The sole exception was the United Nations, of which PADIS was a part, and which enjoyed the status of a sovereign state when it came to telecommunications. The Ethiopian Telecommunications Corporation ordered the PADISnet node to shut down because of its "illegal status." PADIS referred these orders to the UN legal advisor, who argued for the continuation of the node on the basis of both the public service it offered and the United Nations' sovereign status with regard to telecommunications. In response, ETC argued that the UN's sovereignty applied only to intra-UN communications and did not extend to offering a public service. Not wishing to endanger further relations with the host country, PADIS and ECA discontinued the public e-mail service in 1996. For the next year, until ETC started its own service, there was no locally-available public e-mail for the 65 million people in Ethiopia.

The problems this situation created were only partially resolved when ETC finally established its Internet service in 1997. ETC's service is considerably more expensive than PADIS's was. To date, private ISPs, as well as cybercafés, remain illegal in Ethiopia. No ISPs operate other than that run by the government. Cybercafés spring up, but they run the risk of being shut down at any time. And few in Ethiopia can afford the expense of Internet connectivity there: the annual cost of 20 hours' access a month (a bare-bones minimum of service), on slow dial-up connections that frequently break down, is equal to 8.4 times the Ethiopian average per capita GDP.

Modem Operandi: A Southern African Safari

Mike Jensen

As the customs officer stared disdainfully into my beat-up old post office van and asked me if I had anything to declare, I wondered if he'd even know what a modem was. The import duty on computer hardware in Zambia was excessive; we hadn't budgeted for this expense and I had a dozen modems with me to install in the offices of various independent newspapers scattered through Zambia, Zimbabwe, Swaziland, Mozambique and Botswana. Lusaka was to

be the first stop on a trek around the sub-continent for the Media Institute of Southern Africa (MISA), a small NGO based in Windhoek, Namibia that had managed to raise funds to link up its members in an electronic network for sharing news.

It was getting late and I was becoming increasingly worried about being on the road in the dark with my rather fragile vehicle, which had been protesting the last few hundred kilometers to the Livingstone/Victoria Falls border with Zimbabwe. So I chanced it, saying "nothing to declare" as convincingly as I could, and barely managed to hide my smirk as the officer waved me through. Cruising along the road to Lusaka, nursing the engine and watching out for potholes, I tried to work out how long the whole trip might take and whether I'd be so lucky at the remaining border posts.

Astute readers might well wonder why I was engaged in this expensive and possibly risky international door-to-door modem delivery service. Well, this was 1993 and the Net hadn't taken off yet, so modems were not easily available in most African countries, and even where they were, the prices charged were outrageous compared to those in North America. Shipping modems to the MISA members was an option, but we knew many would be held up for weeks in customs and excessive duties would still be levied. Then we couldn't be sure the members would know how to use e-mail, let alone how to connect the modem to the phone line and computer. So my mission was to kickstart the network by doing a round of modem deliveries, installations and basic e-mail training.

The budget was already stretched in order to bring on as many members as possible, so there wasn't much time to spend at each site. Carrying as many varieties of phone adapters and computer cables as I thought I would need, and with the e-mail accounts already set up at the local providers, I figured a half-day per site should do it. My first test would be at *The Post* in Lusaka where its intrepid editor, Fred Membe, was waiting for me. *The Post* was a thoroughly independent newspaper, often strongly critical of the government, and Fred had frequently been intimidated and charged with everything from libel to sedition.

After showing me to his office, Fred left to talk to some of his reporters while I got to work hooking up his computer. Tracing back the phone cable from the handset, I discovered it was hard-wired into the wall socket. It took some time to splice cables and figure out which of the wires were live. Finding me under his desk re-wiring his phone didn't seem to phase Fred, and soon we were absorbed in going over the e-mail software. But as Fred leaned over the computer, his waistcoat flapped open, exposing a hefty pistol strapped to his belt. "For our protection," he said, noticing my surprise with a wry smile.

Smuggling modems and hooking up gun-toting editors: serious stuff, and quite a start to the trip, I thought, as I left his office a short while later. But I had passed my self-imposed test, the car was still doing fine, and I figured in a week we'd have the whole network up.

Bringing E-mail to Ghana

Christine Kisiedu

It is often said that once ICT development gets underway, it is unstoppable. This was certainly the case in Ghana. When a workshop on Electronic Networking for West African Universities (sponsored by the Association of African Universities and the American Association for the Advancement of Science) took place in Accra in December 1993, Ghana was not counted among the Internet savvy countries of the sub-region. Two years later, in 1995, a nationwide store-and-forward e-mail system had been established, and the first professional ISP in Ghana appeared on the scene and introduced Internet access to an interested but cautious Ghanaian public. In another year, development and patronage had reached such a level that Ghana could be said to be on the verge of an Internet explosion! Yet coming to grips with the new technology was not without its ups and downs.

On the "up" side, the University's chief executive at the time was most information conscious and, therefore, highly supportive of the library and documentation system and services. He therefore sited the project in the Balme Library as a matter of course. The librarians were delighted: the decision would boost the image of the university libraries, which had hit an all-time low, due to the dearth of resources that made them unable to deliver information support.

On the "down" side, learning to use the system proved more difficult than anticipated. I had just completed my second year as University Librarian at the Balme Library when we acquired e-mail. The library's systems analyst, Barfi Adomako-Owusu, was away on a mission abroad when the IDRC/PADIS consultant arrived to install the equipment. Nobody on the library staff had a clue as to how to operate this technology, much less how it worked. I submitted myself to a brief half hour's explanatory session, which I must now publicly admit went in one ear and out the other. The consultant took too much for granted!

One staff member, Gamel Apalayine, had just graduated from the African Regional Centre for Information Science (ARCIS) at the University of Ibadan. Determined to demystify the system, and he spent much time studying how to operate it.

In the meantime, the Council for Scientific and Industrial Research (CSIR) continued to send and collect mail for the Balme Library from the GreenNet gateway in London. GreenNet had given us step–by–step instructions over the phone for sending and retrieving e-mail—instructions that I had carefully written down, and to which I had to refer countless times afterward. Apalayine and I would compare notes, and we discovered we were doing fine.

Shortly after the system analyst's return, and only three months into the project, Apalayine died. Though we now had the technical support we needed, we were nonetheless stunned, and bereft of a loyal colleague.

Our next difficult challenge was to ensure that we could meet the rapidly-growing demand for connectivity. The project came with a donation of ten modems for the host site and the main nodes. At that time, modems were generally in short supply on the open market, but as host, the Balme Library was responsible for connecting anyone who applied to join the network. This included providing a modem at cost, or showing the subscriber where to get one. We did not have nearly enough modems, and the growing number of subscribers combined with the frequent breakdown of the few modems we had to create a near-crisis.

Luckily, Liz Levey, then coordinator of the AAAS Sub-Saharan African Program's CD-ROM project, was able to provide a modem, and the CABECA project donated a few more. But these extra modems were needed as a backup for the host site.

Just when we began to lose hope that we would ever be able to meet the needs of our subscribers, an opportunity arose for us to make a direct request to the Vice Chancellor, and to do so in a context in which it would be difficult for him to refuse. The occasion was a meeting with a World Bank mission, to which I was invited. Those were the days of the Educational Reform Programme, and it was not easy to obtain foreign currency from local institutions.

My request at the meeting for funds to order several modems was direct and unexpected. Surprise and setting were on our side; the strategy yielded the prompt and positive reply, "Let us discuss it after this meeting." Within a week, the order went out.

After this consignment, clients were advised to obtain modems on the open market.

Simple Copper Connections

Mike Lawrie

The Internet in South Africa started at a small university in a small town in one of the poorest areas of the country. There is no real answer as to why this was so, but my theory is that the key factor that got us started was our discovery of a very low-cost way to connect the networking staff to the campus LAN from their homes.

This connection was important, because it would allow ICT staff to access the Net after hours. Given the time-zone difference between South Africa and the USA, it was very convenient to exchange e-mail in the South African evening, because this would find the folk at their desks in the USA, and there would typically be a very quick reply, and several exchanges of messages in a short time. This was of course very productive. Also, the networking staff were themselves very hooked on using the Net for their own personal development, and thus if the Net was not working, or not reliable enough, they would detect the problem themselves and act quickly to rectify it. This made for a very reliable system.

Connecting to homes at low cost was a necessity, because we did not have the funds for anything else—but how to do it? In a sense, our remoteness worked to our advantage: in the small town of Grahamstown, where all this took place, there was no heavy industry, and so the general electromagnetic noise of welders, transformers, trains and so forth associated with larger towns was non-existent here. Thus the ground potential was more or less constant throughout the town. Our innocence helped us as well: not knowing any better, we simply hired a set of local leads—i.e., a pair of copper wires. This was very cheap because it involved no transmission equipment. The circuit ran directly from the computer room to each home. At the computer room, we connected one end of the pair to the RS232 port of the network processor, on pins 2 and 3 (i.e., Tx and Rx); and at the home end, we connected as a cross-over to the serial port on a PC/VT100 terminal (i.e., to pins 3 and 2). On each port, we jumpered pins 4 and 5 together, and 6, 8 and 20 together. Pin 7 (ground) simply went to a convenient local earth connection.

To our amazement, this system worked pretty well. At the time, 1200 bps was considered moderately fast, and we achieved this on the longest of the circuits—about 2 km, or 1¼ miles. The transmission was almost error-free. In due course, we developed line-driver units using RS422 technology on 4 wires, and ran at speeds of 9600 bps or faster.

Sometime after we got our system operating, I happened to read the formal specification of the IC chips that generated the RS232 signals. These were rated for distances of up to 50 feet (15 meters). In other words, anyone who knew better than we did at the time could have proved "beyond doubt" that our method could not possibly work—in which case, the Internet would have arrived in South Africa several years later than it did.

The First Chapter of Networking...

Lishan Adam

You can connect two machines using a modem, I was told in 1989. I knew about serial cables that connect computers with printers, but not about modems. Modems looked like match boxes. At the time, there were experiments elsewhere in the developing world, particularly in Latin America, to connect scientists to one another using these "matchbox-like machines." A network that was called Bitnet was around to connect researchers; experiments were underway in Cote d'Ivoire and Egypt, I was told.

In 1990, I was given an opportunity to see and feel how these "matchbox-like machines" worked. I flew from Addis Ababa to Ottawa, where it was cold and the networking jargon was as overwhelming as the weather. I remember my instructor whispering that I was "absorbing everything." That was the beginning of my absorption with networks and their challenges. Before leaving Ottawa, I read a report produced by a group at the Department of Sociology of Carleton University about their experiments in Latin America. I learned that they faced the same problems that haunted researchers in Africa: lack of equipment, lack of money, lack of knowledge, high telephone costs, lack of someone who can do the "hand-holding," lack of….

I left Ottawa and headed to Washington, where the American Association for the Advancement of Science (AAAS) had arranged a meeting for me with Bitnet. I remember receiving a huge manual about "how Bitnet works," which I took back to Addis Ababa and pored over in order to learn how to start our first piggy-back connection through Carleton University. It took some time to get a telephone line to begin the experiment. (Amazingly little has changed since then—I am still waiting for my home telephone line 12 years after applying for one!)

The experiment began with a 1200 bps modem working on 300 bps rate. It was not easy. I received handholding from a colleague, and using Procomm, we started calling, calling and calling. The error correction was bad, noise was high, the protocol was not robust. We failed half of the time, and restarted again and again, changing one parameter at a time. We eventually succeeded but incurred a huge telephone bill, for an amount that could connect hundreds of school children today. I still remember how nervous I felt upon seeing that telephone bill. We badly needed a different approach, one that could cut our telephone costs, and a more robust protocol to correct for errors. Fidonet arrived to rescue us, and a second chapter in African networking began.

Building in Poverty

Venancio Massingue

In the mid-1980s, Mozambique was in the most critical phase of its history. So many bad things were happening, and the news was always the same: stories about people killed by bandits, people attacked while traveling by bus, pictures of children with swollen stomachs and no clothes, captioned "No rain—more hunger." This seemed to be the destiny of Mozambique.

Although good things were reported very little, if at all, the truth is that in the midst of these tragedies, some positive developments were also taking place. The story of how Eduardo Mondlane University went online is one such instance.

At the University at that time, very few up-to-date books were available. Yet we knew that a lot of literature was produced for students in other parts of the world. We started thinking: Why couldn't we get access to real information, and make it available to others? Why should it take two months to send a message from one province to another, and three months to send a letter to Europe? Why couldn't we use other means of communication?

In 1985, I undertook my first small project using these other means: I installed a 300-1200 bps modem to connect Dr. Ricardo Teixeira and his colleagues from the Archaeology Department with our PDP11/34A, an old Digital Equipment Corporation computer now found only on computer "museum" Web sites. This system was a good platform to offer shared facilities. In addition to a system disk, we had two users' disks: one held most of the academic staff programs, and one was used for university applications, such as the payroll system.

Our computer center was small, but our challenge was big: to provide facilities for academic and non-academic staff, and to plan for future expansion. In order to do these things well, we needed a connection to the outside world.

Under the cooperation program between UEM and the Delft University of Technology, Hans Drost was sent from Holland in 1987 as a technical expert on computers. My department of the university computer center (the Computer Maintenance Department, or CMD) was making careful attempts to "solve" the communications issue. Hans suggested that CMD should get a telephone line, which would be paid for by the project, so communication would be easy. I learned at that time that TDM was selling telephone lines with access to international circuits to those who could pay in hard currency. Strong justification—and, it turned out, a good deal of patience—was needed to get authorization. We applied and waited.

In the meantime, in 1988, I learned of GreenNet in the UK, which offered connectivity to access databases worldwide. When my wife traveled there in 1989, I asked her to visit the organization and pay the 20 pounds sterling subscription fee. But in order to access GreenNet, I needed to dial up from Maputo to London. This was not without its obstacles. To connect to a telephone line outside of the university (but inside Maputo), you had to dial 0 and negotiate with the switchboard operator, who would then ask you to replace the receiver and wait. Sometimes you could wait until the following day. If the call was international, a second negotiation was required, this one with the Telecommunications Company operator. At that time, an international call cost the country hard currency, so you needed to get permission from your superiors, both inside and outside the university. You also had to give your reasons for such call. For a (then) young man like me, it was difficult to "prove" that such a request was justified.

Finally, in 1990, we received the line we had applied for, with its magic number: 741557. I am not sure if Hans Drost understood what I wanted to achieve, but he allowed me to use this number to call GreenNet, with strict limitations on the length of calls. The rest I had to do from home, mainly on Sundays. My late brother had a girlfriend working as an operator at TDM. She was always kind enough to allow me to make a connection for the maximum 15 minutes, though of course I had to pay a lot of money. Twice a month, I made these 15-minute calls. Using a Compaq 286 portable computer and a 1200 bps modem, I accessed GreenNet, and from there navigated to other databases, using an early search engine called Gopher.

As a result of my visits to academic database sites, I was able to tell my colleagues and friends about some of my findings. One of my friends was the Rector, Professor Narciso Matos, who asked me why I didn't make "all this" available to the rest of the university. This was 1990 or 1991, and I could not just do as I wanted. Though we had 741557, it was paid for by the project, and the project would not accept unplanned expenditures.

By 1992, I had become Director of the Computer Center, and my influence was no longer confined to CMD. One day, a Finnish colleague at the center named Maarit showed me a cutting from the magazine *Computers in Africa* about a man named Mike Lawrie, who was providing connections for sub-Saharan African countries to and from Rhodes University in Grahamstown, South Africa. Maarit said that by working with him I could realize my dream of enabling more people to benefit from what I was doing with GreenNet. We were both aware, however, that this was no straightforward matter. When I received my education with Digital Equipment Corporation in the early 1980s, I was asked to sign a piece of paper stating that I would work neither in communist countries (they were named), nor in South Africa. Contact with the apartheid regime was forbidden.

Luckily, it was later that same year that the constituent laws of apartheid were rescinded, leaving South Africa free to rule itself, and leaving me free to travel there. After consultation with Professor Matos, Hans Drost arranged a trip for himself and me to Pretoria, Cape Town, and finally Grahamstown. I was impressed with the connectivity I saw. I was also impressed by the fact that Mike Lawrie insisted that I should sleep in his house instead of going to a

hotel: he had a room for me and one for Hans Drost, and he organized a dinner with 12 colleagues and friends. By the time I left Grahamstown, I had registered the domain MZ with Mike. UEM became the administrator of the MZ domain.

I was unable, however, to bring the necessary software back to Maputo: I did not have enough diskettes with me, and besides, we preferred to load the software onto a hard disk, to ensure that the configurations were correct. We eventually accomplished this with a hard disk that TUDelft acquired in Holland and sent to us via diplomatic bag. Two weeks after we received the disk, I sent it with Americo Muchanga to Rhodes. A week later, we installed the loaded disk into our 386 computer, and began calling Mike Lawrie's computer every six hours. We started with just 30 users, but within six months there were 300. The single 741557 phone line was used by us to call Mike's computer, by our users to call our computer, for our normal voice calls, and for our incoming and outgoing fax messages! This went on until 1994, when we managed to get a four-wire leased line.

Even so, not everyone was convinced of the value of what we were doing. In 1994, a high-level delegation from abroad visited me and asked what help I wanted. I requested a 486 computer and a 9600 bps modem, which I estimated would cost US$5,000. I was told that with this money, 10 beds and sheets could be acquired for a hospital. My request was denied.

Fortunately for us, traditional methods of communication still worked well locally. When the first two concept papers I wrote for Professor Matos, who wanted to finance our activities to make "all this" available to the rest of the university, failed to reach him through the formal university channels, I was able to hand deliver them to his house without delay.

It Takes a Few Champions

Narciso Matos

The year was 1983, and the journey from Berlin to visit a friend in The Hague was uneventful. When I purchased my train ticket, the process, though efficient, was manual.

John, my host, was a former colleague from the Chemistry Department at the University Eduardo Mondlane in Maputo. Like dozens of expatriates, he had come in 1977 to help rebuild the university in newly-independent Mozambique. As soon as he arrived, enthusiastic and creative, he started to write textbooks—then, as now, a precious and rare commodity. Somewhere in the Department he discovered an old IBM typewriter, one with a rotating ball and some broken keys. He had a new ball imported from Holland, and for several years, the IBM was our most advanced typewriter.

Now, in 1983, John was back in his country, still producing educational materials, but now for television broadcast. He and his team translated complex notions of science into popular language, demystifying science for the understanding of the average person. I was therefore not surprised to see John's newest acquisition: a personal computer. Was it an IBM? Or a Macintosh? A Laser? My earlier experience with a computer had been in 1971, as part of my first-year numeric analysis course. Along with languages like Fortran and COBOL, we learned to write computer programs, and had them perforated onto paper ribbons that we brought to the computer laboratory. The laboratory's computer, best described as several cabinet-sized machines, took up an entire floor of the building that housed it and was operated by technicians who transformed our ribbons into computer solutions. For us students, the computer equipment, operated by these experts, was way beyond our reach.

Over a telephone line, John's computer could also send text from his home studio to the business office. What a fascinating revelation! This was a time when computers that size were nowhere to be seen. There were none in the faculty and libraries in Berlin that I used up until

1985; my dissertation had to be typed by a professional, at the cost of my monthly scholarship!

Back home in 1985, the IBM typewriter was still the star. It wasn't until 1987 that a colleague and friend at the Faculty of Engineering introduced perhaps the first word processor to the university. With a research grant from the Swedish Agency for Research Cooperation, he had bought a "mini-computer." Soon thereafter, I had a word processor, a rare commodity accessible to only a few deans and staff. Learning word-processing was a weeks-long odyssey of nights spent reading instructions in a user's manual. Basic computer courses were still some years away.

By 1990, typewriters were still the norm, and telex was the most advanced means of communication. Airmailed letters, the main means of international communication, took at least fifteen days to reach their destination. The first facsimile to equip my office in my position as Vice Chancellor at UEM was offered by the Executive Secretary of the Association of Commonwealth Universities. He might have been frustrated with waiting so long for mail. Little did I know that facsimile would accelerate our university's communications and relations with "overseas" institutions. Ironically, it suddenly became faster to communicate with London than with faculties within a 7-kilometer radius of our university.

There were, however, pockets of advanced use of ICT. Björn Lundgren, the former Director of the International Foundation for Science in Stockholm, tells the following story: In 1993, he commissioned an external evaluation of the organization. I was a member of the evaluation team. He recalls that I asked him for the IFS e-mail address to which I would send my reports. Electronic mail, he asked? We don't have e-mail here! His story goes that I offered to send my staff from Maputo to Stockholm to help install their new e-mail system. This was never necessary, but the story is telling.

How did UEM achieve its place at the cutting edge of ICT in the region? I remember visiting the university's Center for Informatics in early 1990. The center had a visionary team and was partnering with the Technical University of Delft in the Netherlands and with Rhodes University in South Africa. One of the center's preferred projects was the development of electronic communications throughout UEM. The center already had an e-mail system that used long-distance telephone calls to Rhodes University. The center's plans to establish electronic communications throughout the university and beyond sounded futuristic, but staff presented them with such coherence and enthusiasm, I could not but affirm my support for the project. Few of us clearly grasped the revolution that we were embracing. But the promise of positive developments was patent in the eyes of Venancio Massingue and his core staff.

The early years of the 1990s saw the introduction of e-mail capacity, and much later of Internet, within UEM and gradually in the city of Maputo and beyond. The first decisive factor in this pioneering work was the skill and determination of the personnel at the Center for Informatics. Against all the odds, with unreliable and costly telephone communications and virtually no government or university financial support, they ventured successfully into an unknown domain. Other key factors included financial and technical support from partners in the Netherlands and South Africa; the key role designated to the center in developing the university's strategic plan for information technologies; and the autonomy accorded to the center to generate and reinvest its income without interference. Thus the center was able to attract and retain skilled personnel.

By 1995, the university was only beginning to extend e-mail capacity to faculties and departments, while at the same time it provided services to users in and around Maputo. Computers were hardly used beyond word-processing and e-mail communications. Internet, if available, was slow, unreliable and prohibitively expensive. Few sectors used computers and there was hardly any computer use for educational or research purposes. The average faculty and students did not have access to computers; university libraries were almost fully manual.

With the notorious exception of South Africa, the rest of sub-Saharan Africa was generally even less advanced. When I joined the Association of African Universities (AAU) in 1995, its headquarters in Ghana had a dial-up e-mail system and an office computer network, but no Internet capacity. During the previous three years, the AAU had been helping selected universities in West Africa establish e-mail systems. As in Mozambique, the high cost of international phone calls made even the use of e-mail prohibitive. By 1997, the AAU had transformed itself into a small, local e-mail provider, with a few dozen local subscribers. Private ISPs were almost non-existent. But the market changed rapidly, and by 1999, Internet service providers were springing up in a growing number of countries. The e-mail service we provided to customers depended upon the enthusiasm of our technicians, Kofi Arthiabah and Ben Eshun. During this time, the AAU designed and produced its first Web site.

Despite continuous expansion, for most universities in Africa, e-mail access is still problematic. Not surprisingly, during a 1998 conference of university vice chancellors in Arusha, the notion that it takes little more than good leadership and willingness, a telephone line and a computer to get started was still dismissed. Many people continue to view the use of computers and electronic communications as costly and beyond reach.

To date, Internet and even e-mail access remain privileges accessible to a selected few. The majority of students and faculty within African universities still do not use computers. We are still at the beginning of a long but promising journey.

The MUKLA Story

Charles Musisi

The MUKLA Node at Makerere University's Institute of Computer Science began as an experiment to demonstrate the viability of electronic communications over telephone lines and personal computers. This was done within the auspices of what was then the East and Southern African Network (ESAnet), a network among the leading universities in five countries in the East and Southern Africa region that was funded by Canada's International Development Research Council (IDRC).

MUKLA's short-term goal was to build a self-sustaining operation, beginning with the research and university communities, and later adding the NGO and business sectors and government. Besides the core funding from IDRC, MUKLA received assistance from the UK branch of the Association for Progressive Communications (APC), in the form of support and technical hand-holding in the early years of this experiment. In 1995, at the end of four years of operations, MUKLA had attained self-sustenance through user fees.

The project's long-term goals were:

- to experiment with an alternative technique for data communication at five sites in five countries

- to evaluate the technical, economic, sociological and management aspects of this mode of communication

- to disseminate the results to researchers and academics, the development and business communities, and government, with the aim of increasing awareness and stimulating wider use and application of the technology.

The activities at MUKLA and two other collaborating networks—HealthNet and NGOnet—spurred the use of electronic mail among NGOs, government departments and the business community. We used two forms of e-mail transmission in the early days: a long-distance dial-up system, using Fidonet, for MUKLA; and a Low-Earth Orbit (LEO) satellite system for HealthNet.

Using Fidonet required a modem (often a 2400 bps modem), a PC running DOS, and the willingness to persevere! Messages were accumulated via dial-up and then sent to a central computer, called a node, which in turn forwarded mail via a long-distance call to GreenNet in London. This mode of communication was not without its pitfalls. Chief among these was the unreliability of both the local phone connections within Uganda and the uplink connection to GreenNet's GNFido node in London. Often calls failed for several days, resulting in accumulated and undelivered mail, and frustration on the part of the clients.

Meeting the challenge of building a grassroots network like MUKLA required a lot of innovation, given that the operation was situated within an academic institution unaccustomed to providing services to the broader communities of the business, NGO and government sectors. The main hurdles were:

- managing installation and ongoing support for users of this new technology

- building a billing system to recover costs, and maintaining accountability in accordance with the university's tight financial regulations

- preparing for the transition to full Internet, with all of the associated technical, financial and operational challenges.

Notable among MUKLA's impacts and achievements were that it:

- introduced the idea of electronic communication to all sectors in Uganda

- created awareness about the use of electronic communications mailing and discussion lists

- prepared the broader community for the range of Internet services such as the Web

- spurred growth in the PC market as more users needed computers to make use of the new technology

- provided an inexpensive mode of communication compared to fax or telephone

- demonstrated the viability of electronic communication services as a business, leading to the establishment of several ISPs

- drew the government's attention to the benefits of a deregulated telecommunications market

- highlighted the deficiencies of the telecommunications infrastructure in Uganda.

On the human resource level, the activities at MUKLA inspired several young people to start careers in electronic communications. Many have since become very skilled managers of

system networks, new ISPs, and other enterprises in all sectors of society in Uganda.

To the donor community, MUKLA's experience within the framework of ESAnet yielded the recommendation that funding for national communication networks as a component of development be increased as a way to promote effective delivery and monitoring of donor funds.

Many of the earlier pioneers have since moved on to flourishing careers in managing ICT enterprises in the business sector. My own career since I left MUKLA, for example, has included work with Computer Frontiers International and Uganda OnLine.

CD-ROM: The Answer to a Librarian's Prayer?

Helga Patrikios

This is the story of how we in Harare first got connected to the world's premier medical database, MEDLINE, and at last felt part of the Real World of health information.

MEDLINE is the computerized version of the printed *Index Medicus.* In the mid-1960s, the US National Library of Medicine (NLM) made its computerized databases, including MEDLINE, available to users in the US and throughout the North, and in a couple of semi-industrialized countries in the South, by telephone and Telnet. We tried to get dial-up access to MEDLINE in 1986, but we could not meet the technical and financial demands of connectivity with the NLM databases.

In 1987, I was traveling in the North, visiting medical libraries and finding out what was new in medical information. That was when I first heard my Northern colleagues discussing CD-ROM and MEDLINE in the same breath. I first saw the two in action together in the library of a London teaching hospital. I was instantly smitten with what seemed like a miracle—MEDLINE *in situ*. On the spot. Standalone. Uninterruptable. Independent of vulnerable and archaic telephone lines. All of that, plus an amazingly user-friendly interface. In a couple of minutes, you could search all the segments (twenty or thirty years' worth) of MEDLINE, and winkle out four or forty perfect hits, with abstracts, from among the seven (now 13) million other citations.

It was almost indescribable. Comparing a search of the printed *Index Medicus*—the hours of often unrewarding toil, and not an abstract in sight—with a search of MEDLINE on CD-ROM is like comparing a ride on a cranky donkey up a rocky hillside with a flight on the Concorde from New York to Paris. In other words: no comparison.

We knew we had to have CD-ROM. A colleague in Pediatrics suggested we write to the Carnegie Corporation of New York. In no time, we received a positive response to our request that they fund a pilot study of CD-ROM, and within weeks we had the first-ever microcomputer in the Library system, with a set of four drives and a dot-matrix printer. Response to the availability of this new service was gradual: for a brief period, we conducted only about 80 searches a month. But it wasn't long before word of the power of CD-ROM spread around the medical community. Within a year or two, we and our users were doing hundreds of searches each month; renewed projects with Carnegie provided the work stations we needed for the rapidly-growing number of searches we were conducting. Early on, with the US National Research Council and the American Association for the Advancement of Science, we negotiated with two MEDLINE publishers—Ovid and Silver Platter—for African countries to be granted very generously-discounted subscription rates. These rates remain in place to this day.

Now that we have Internet access in the Library, we can access MEDLINE online, but many of

us still prefer CD-ROM, with its dependable, lightning-fast response. (Internet response times here sometimes remind me of that donkey.) I know of at least one medical school in Washington, DC that has fine, fast Internet facilities for its staff and users, but also continues to subscribe to the CD-ROM version of MEDLINE, for the same reasons.

Most libraries in Africa have suffered acutely from the continent's prevailing economic decline; few have access to current journals or textbooks. In Zimbabwe, too, we now have very few current textbooks, and our collection of journals is constantly shrinking. A 1995 survey I made of the use of MEDLINE on CD-ROM at our library shows the great extent to which our users depend on those MEDLINE abstracts. This situation is far from satisfactory, from the point of view of researchers and clinicians, but it certainly beats having no access at all to current information on specific topics—which is often the only other option.

Given the difficulties for most institutions in Africa of providing reliable and plentiful access to the Internet, it's unsurprising to see that CD-ROM has a growing role as an intermediate information technology. Many NGOs concerned with the dissemination of health information increasingly place their trust and their information in CD-ROM—a reliable, low-cost way to store, transport, copy and distribute information, and one that will support the development process in poor countries for years to come.

Bringing the Bush to the Bargaining Table

Mercy Wambui

I started using e-mail back in 1992, while working as an electronic networking program officer for *EcoNews Africa*, a Nairobi-based NGO. During this time, transmitting data over telephone lines was tolerated by the Kenyan government, but it was not legal. Technically, one would have been arrested for breaching internal security laws. However, the only way to keep abreast of the UN Conference on Development and Environment (UNCED) that was taking place in Rio de Janeiro that year was to download documents from list-servs set up by APC.

Looking back, it's almost unimaginable how advanced it felt to use Fido, a DOS-based e-mail client transmitting data at 2400 bps over a dial-up connection. I would download and summarize issues relevant to Africa for "Environment and Development Briefs" and disseminate them by hand weekly to the local media and to the NGO community in the sub-region. Given the shortage of e-mail support in the sub-region, and my own lack of familiarity with ICT, I learned by trial and error, with a lot of support from APC network members. I eventually went from being a complete novice to conducting issues-based training, performing trouble-shooting, and providing much-needed support to the NGO community.

This initial start-up evolved into a broader program that helped to kickstart the merging of old and new technologies among community-based media in East Africa. We received funding from a number of partners, including IDRC, to support e-mail over HF (high-frequency) Radio for Pastoralists in the Simaanjiro district in Tanzania. Computers used in the project were run on solar power.

The most interesting aspect of this work was the link we made between the natural resource management issues articulated by pastoralists and the Convention to Combat Desertification (UNCCD), a process that required the input of local communities. We downloaded updates on the negotiation process and published them in the *EcoNews Africa* bi-weekly. The Maasai community in Simaanjiro translated the key issues relevant to their concerns into Ki-maasai for wider discussion. They then provided feedback, which was transmitted to the negotiation table.

The benefits of a negotiation document to local communities were far-reaching: the

communities could take the government of Tanzania to court for violating land rights and local community rights enshrined in the document. In a couple of instances, communities won the court cases. After all, the government had ratified the Convention.

Through this work, we helped shape the ICT policy debate with regard to applications for communities working in development. We were the first to bring stakeholders together in meetings to generate public debate on the Kenya Communication Bill that has, several years later, shaped an emerging conducive regulatory framework to support the use of ICT in development.