

ICT Update

a current awareness bulletin for ACP agriculture



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A **South African** project develops a cheap phone system for rural areas

A wireless network brings VoIP services to communities in **Nigeria**

Satellite payphones develop the telecommunications market in rural **Zambia**



Rural telephony

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Where there is no phone

However fast mobile phone coverage and internet access is spreading throughout the world, there are still millions of people in ACP countries who live beyond the reach of cellular coverage and who have no fixed-line telephones. Telecoms companies find it too expensive to extend their networks to rural areas where low population numbers means they are unlikely to see a quick return on their investment. But several initiatives are now making the prospect of telephone communication in rural communities a real possibility. And making it affordable.

The Village Telco project is made up of a broad partnership of organizations

The cost of satellite technology has dropped rapidly in recent years, making it possible to put together a system which can connect to the global communications network from almost anywhere on the planet. Often the only restriction is a reliable power supply, but the organization has managed to solve even that problem by coupling its payphones to low-cost, renewable energy sources.

Both this and the system developed by the Shuttleworth Foundation are aimed at bringing down the cost of introducing telecommunications to rural areas. They remove the need for the expensive base stations required for mobile phone networks and there are

It does not take a high level of literacy to make a phone call and telephones give people the chance to express themselves in their own language and dialect

and individuals, including the Shuttleworth Foundation and the South African telecommunications company, Dabba. Together, they have developed a package of software and hardware that costs under US\$5000 and delivers a village-scale telephone communication network.

They expect that small-scale entrepreneurs, institutions and even communities will invest in the technology. The big challenge for the project team, however, was to come up with a scheme that would also be affordable for customers, as the expense of a telephone is often beyond many people.

The Village Telco system gets round this problem by using traditional telephones, also known as POTS (plain old telephone service) phones, which are far less expensive than mobile phones and the commercially available phones that are designed to connect to the internet, such as wireless VoIP or SIP phones. The team developed a special piece of equipment, called a Mesh Potato. The device converts the analogue signal of an old phone to a digital signal then transmits over a wireless mesh network.

Connect Africa's method of bringing telecommunications to rural areas also takes a simple idea – the payphone – and combines it with some very sophisticated technology – satellites.

no costly cables as in fixed line services. Both organizations have also looked beyond the technology and developed systems that will be financially viable.

The Fantsuam Foundation delivers just such a service to a rural farming community in north-central Nigeria. Their wireless internet system covers an area of 15 km but they have discovered that most people want voice, rather than data services. Customers buy an all-in-one kit from Fantsuam which is easy to install in their own home or business and allows them to quickly connect to the network and start making calls. But the real advantage of this service is that calls within the network are free. The system has proved so successful and reliable that people from the nearby town of Kafanchan travel to Fantsuam's village offices to make a phone call.

Talking is, after all, the most natural and often the most effective way of communicating. Telephones make it possible to talk to other people over very large distances. And it does not take a high level of literacy to make a phone call. Telephones also give people the chance to express themselves in their own language and dialect. And sometimes, even those who can type and are experienced with email and internet, just like to give their fingers a rest. ■

ICT Update



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then a business that was previously marginal becomes viable. Operating expenses are also high. Diesel, for example, is often used to power the base stations that are not connected to the grid electricity system. Switching to renewable energy sources could help reduce those costs.

Another strategy would be to share infrastructure. A mobile phone operator could share a transmission tower with the local electricity company. But probably the best solution will be to

was still a substantial grey market operating.

Diaspora workers who live in one country and call their family back home, probably make the most use of VoIP services in developing countries. Many members of the large Asian community in South Africa, for example, who wish to keep in touch with their extended family in India, use services that are, strictly speaking, illegal. But they use these services because making calls through the mainstream telecoms company are too expensive.

The popularity of cheap telephone services demonstrates that there is a market for international calls, it's just that the market demands lower prices. This then raises the question of whether the volume of calls increases sufficiently as the price is reduced that call providers can maintain the same amount of revenue. I would say that in almost every instance I have looked at, lower prices have generated increased volumes of business to provide telecoms companies with at the least the same revenue.

And it is this model that could make VoIP over mobile phone sworth introducing to rural areas. The demand exists but people often don't have the money to pay the prices charged by mobile phone companies. The best hope, therefore, for providing cost effective telephone services in rural areas is to create micro-operators or franchises that will use VoIP along with mobile phones. This is similar to what Dabba is doing in South Africa with the Village Telco scheme (see page 4). The cost of providing such a service is coming down rapidly and entrepreneurs can easily buy the equipment off-the-shelf or, more likely, online.

At the moment, many of those who do have mobile phones have to walk to the top of a hill or to a tree outside the village to get access to the mobile network. But bringing the point of coverage to the centre of the village would ease that process. If one person takes the chance to set up such a service it would demonstrate that a market exists. This, in turn, will attract other companies who can extend coverage of their own networks and eventually, as competition increases, the prices would come down, making mobile telephones affordable to many more people. ■

Based on an interview with Russell Southwood

Making phones affordable

The only communication service that will really take off in rural areas of ACP countries is mobile telephony. Development organizations have put a lot of effort into building telecentres and providing internet access but internet use is marginal in many rural communities. What people really want is a mobile phone. There is a great demand for telephone services but so far the expense of introducing the technology into rural areas has proven too high for operators to be able to provide an affordable service to areas with low population density.

The main problem is the amount of money involved in setting up the base station to transmit the cellular signal. Prices can range from US\$90,000–120,000. If that cost can be reduced

devise a method of delivering mobile phone coverage that is cheaper than the standard cellular network. And this is where VoIP comes in.

Simply put, VoIP (voice over internet protocol) carries voice over the internet. There are several software applications available which covert sound into digital bits and bytes. Being able to travel in small data packets means the voice information can be carried by an IP (internet protocol) network rather than any other specially developed network.

Currently, it is mostly internet cafes that deliver VoIP services. Internet café owners offer phone calls, using VoIP, at substantially lower rates than the country's existing telecoms licence holder, often the state-owned telecommunications company. Many of the VoIP services are unlicensed but customers use them because they are cheaper and this leads to the so-called 'grey market'. The grey market provides a level of competition that is often not allowed under the terms of the existing telecommunications licensing agreements. In some countries that means making a VoIP call is illegal.

Phone home

In Ghana, Namibia and China, for example, the police have arrested people for providing VoIP services. Once every few months in Ethiopia the police go around arresting internet café owners, but it is my impression from visiting the country several times, that although the equipment is confiscated and the café is closed down, the owners reopen fairly quickly afterwards. Even in Egypt, where until recently the sentence for illegal VoIP calls was similar to that for drug dealing, there



ABBAS / MAGNUM PHOTOS / HH

Orange Farm, about 45 km south of Johannesburg, is the largest informal settlement in South Africa. More than 300,000 people live there, but access to water and a reliable electricity supply is difficult for many of them. There are a few internet cafés and there is mobile phone coverage, but the cost of these services makes them inaccessible to most of the residents. One company, however, has developed a local wireless network to make calls much cheaper and is developing the system to bring affordable telephone services to rural areas.

Dabba, a South African telecommunications company, initially based its system in Orange Farm, around an existing internet connection in a local community centre. The

Wi-Fi or SIP phones average at around US\$100). The investment needed to build up such a network is also considerable and requires specialist technical skills. This combination of factors means that installing a similar system would be beyond the reach of many communities.

Smart solutions

Dabba's basic business model attracted the attention of the Shuttleworth Foundation, a non-profit charitable organization, also based in South Africa. Working together with Dabba, and a broad partnership of international experts, the Foundation set up the Village Telco project to develop a telephone communication system that would be affordable for rural and other communities with

Extending the network, however, would mean adding more access points. This could be done by using wireless routers, similar to those used in a home wireless network, but a large number of routers would mean more expense. The cost would quickly rise above the project's limit of US\$5000. The team was left with two options: find some way to extend the reach of the phones while somehow also making them cheaper, or find a way to reduce the cost of adding the access points.

The latter option seemed the most likely, and mini-routers are already available for a reasonable price. As long as the customers were within range of one of these small routers they could connect to the network. But they would still need an expensive Wi-Fi or SIP phone.

The mesh potato network

A group of software experts, technical specialists and telecommunications entrepreneurs in South Africa is working to develop an inexpensive system to provide rural and under-served area with affordable telephone communication.

company installed a number of wireless routers that broadcasts the internet signal over a larger area. Anyone within range of the network can connect and call using either a Wi-Fi or SIP (session initiation protocol) telephone, which look similar to mobile phones but are designed to connect to wireless networks.

Calls made within the network are free, while customers who want to call mobile or fixed telephone numbers can buy pre-paid vouchers from Dabba. The cost of these calls is lower than those normally charged by the mobile phone operators or Telkom, South Africa's largest telecommunications company.

Although the system provides cheaper phone calls to the people of Orange Farm, it is still relatively expensive to buy a telephone capable of connecting to the network (prices of

limited telecommunications services, and which would require little technical knowledge to install.

The project team decided that the whole system should cost no more than US\$5000 to get started, an amount that a small-scale entrepreneur, someone who already owned an internet café, for example, would be able to afford. To minimize the financial risk, the team also had to come up with a business plan where investors could expect to break even within six months. Using this model, rural villages, and other areas with few alternative communications options, would have the opportunity to develop their own telecommunications company, or Village Telco.

Building a wireless network with a range of a few kilometres is fairly straightforward. The biggest problem for the project team was to overcome the need for Wi-Fi or SIP telephones. These telephones are expensive and usually have a very limited range, working only within 100 metres of an internet signal. This would restrict the coverage of the network and the number of people who could afford to buy a phone.

Traditional telephones, also called POTS (plain old telephone service) phones, are much cheaper but they cannot connect to a wireless network without an ATA (analogue telephone adaptor). This device converts the analogue signal from a standard phone into the digital signal needed to connect to the internet. But having these two extra pieces of equipment, the mini-router and the ATA, would only complicate what was supposed to be a simple system, and would add to the cost. What the team needed was an inexpensive router that could also convert a standard analogue telephone signal to digital. What they came up with was the 'Mesh Potato'.

Package deal

The type of wireless network used in Dabba's system, where the signal travels between several routers, or nodes, on its way to and from the original internet connection, is known as a mesh network. The Mesh Potato basically couples a wireless router with an ATA. It can convert the analogue signal from a standard telephone then connect to the network to transmit the

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CHARLES STURGE / ALAMY

new digital signal over the mesh network.

To keep costs low, the Mesh Potato runs on open source software, and has been developed so that it is easy to install and uses very little energy. All the necessary components are contained within a casing strong enough to be kept outdoors, if necessary, at a total cost of no more than US\$60 per unit.

The idea is that the Mesh Potato would be part of a subscription package, an initial one-off payment that would enable the customer to connect to the network and start making calls. The Mesh Potato would come with its own pre-programmed phone number, supplied by the Village Telco operator, in much the same way as a mobile operator sells mobile phones. The customer can then fit the Mesh Potato to the side of their building, or inside their home, and plug in a standard telephone.

But this is only part of the story. The internet signal still has to get to the Mesh Potato. The team quickly realized that in order to get started with the maximum impact, the system

would benefit from a single 'super node'. This is the first external access point where the wireless signal is taken from the original internet source, from an internet café, for example, and broadcast over a wider area – to the Mesh Potato in the customer's business or home.

One way to achieve this is to have special wireless routers, or access points, that can transmit the internet signal over a large distance and mount them on an antenna. Three such routers, pointing in different directions, would be able to transmit the signal for a radius of about 1 km, after which the signal is picked up by one Mesh Potato which, in turn, passes it to another Mesh Potato, then to the next, and so on. The more Mesh Potatoes there are in the system, the wider the coverage.

When put together, these pieces of equipment connect and form the mesh network that carries the internet signal as follows:

- The internet signal enters a computer server in the Village Telco office (perhaps an existing internet

café) via a broadband cable connection or satellite link.

- The signal is then carried to an antenna on the roof of the Village Telco premises, or other high place.
- The signal is then transmitted by the 'super node' – three external access points placed around the antenna providing 360° coverage.
- The Mesh Potato, placed in the customer's office or home, picks up the signal, which is carried throughout the network from one Mesh Potato to another.
- The customer plugs a standard telephone into the Mesh Potato and makes a call.
- The Mesh Potato converts the telephone signal from analogue to digital and transmits it back to the super node, or to another Mesh Potato on the network, which will keep passing the signal on until it reaches the super node.
- The signal then reaches the antenna and arrives back at the server computer in the Village Telco, connecting the caller with the internet and other telephone networks.

Related resources

Village Telco

The Village Telco website with regular updates on the project's development.

→ www.villagetelco.org

Many Possibilities

Steve Song's personal blog on telecommunications and technology for development.

→ <http://manypossibilities.net>

Dabba Telecom

Dabba Telecom develops community-owned affordable voice and data services for areas with little or no access to communication services.

→ www.dabba.co.za

Inveneo

Inveneo specializes in developing communications technology for rural areas of developing countries.

→ www.inveneo.org

Longer links

The biggest challenge of the Village Telco, however, is to connect the network to the rest of the world. Doing so can be a good source of income for the telco as other telecommunications companies pay a dividend for every connection made to their network. Dabba have invested in the technology to connect to the mobile and fixed-line operators in the rest of South Africa. But this process is expensive, time consuming and requires some expertise. Not all Village Telco operators would be able to set up these connections

The idea is that companies like Dabba would provide the wider network to the smaller Village Telcos, enabling them to connect to mobile and fixed-line services. Individual village operators therefore don't have to negotiate with multinational firms or invest in extra equipment, they just connect to the network already installed by larger telecommunications companies.

Some of the smaller Village Telco operators will have the time, skills and money to make their own connections with the larger providers. If they develop their own network, perhaps covering a particular region, then they could compete with Dabba and help to keep customer prices low. Having multiple operators also gives the smaller Village Telcos a choice of who to connect with, which may not always be based only on price but on who delivers the best service.

But the Village Telco system is being developed to give people living in rural areas the chance to communicate with each other, even over relatively large distances. And a connection to the wider, global internet is not necessary to provide voice services to a community. The network can operate independently, meaning that anyone living within range of the wireless signal can call anyone else within the same network. Customers just have to buy the Mesh Potato and a cheap telephone.

In rural areas, where the population is less concentrated, the business model would probably have to be slightly different, with perhaps one organization or institution carrying most of the initial cost. It is unlikely that they would see a return on their investment in such a short time as six months but they would be providing a useful service to the community.

Adaptable

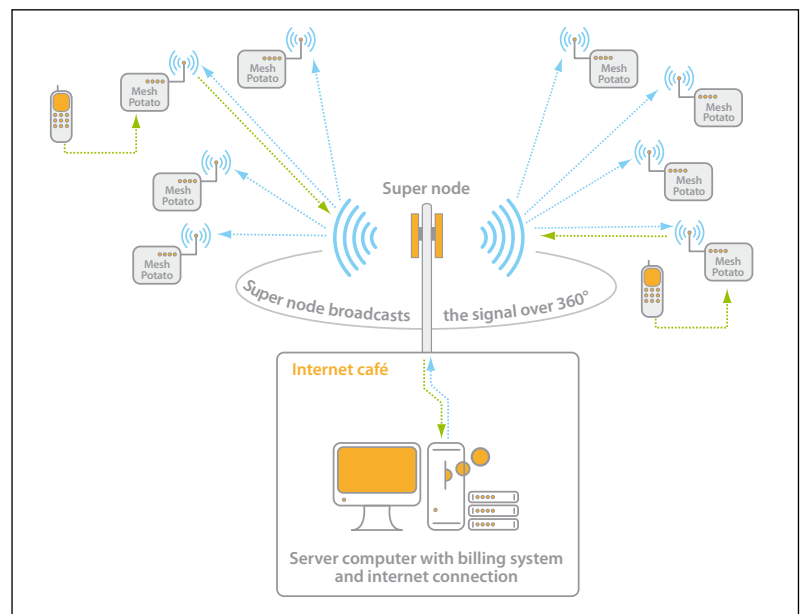
The Village Telco project team is deliberately designing the system to be flexible so that, in future, telco operators will be able to adapt the software to provide financial services, similar to the banking services provided by some mobile operators. Customers would be able to transfer credit from the pre-paid vouchers from one person to another to buy goods or contribute to a savings scheme.

The software, Asterisk, can also be customized to develop an interactive voice response system. A farmer could

call a number on the network, for example, which could even be a free call, and follow recorded instructions. Pressing 1 on the telephone could give a local weather forecast, number 2 might give market information, and 3 could provide pest control advice. These services could be easily updated according to local needs and conditions.

In the meantime, Dabba services in Orange Farm continue to grow. Members of the project team have had some discussions with entrepreneurs in Khayelitsha, another informal settlement near Cape Town, who are interested in the system. There is also some interest from manufacturers in China to produce the Mesh Potato and the project developers hope to have the software package ready to download by the end of 2008.

The Village Telco team are quick to point out that while the network might be innovative, they are not inventing anything new. The technology already exists, it just hasn't been put together in quite this way before. Even the Mesh Potato is an amalgamation of software and hardware that is readily available. And this is one major advantage of the system; the technology has already been tried and tested, the team are simply putting it all together to make it easy, affordable and flexible. It is now up to the communities and villages who will use the technology, to adapt and create a system that perfectly suits their needs. ■



The Village Telco system set up

VoIP in the wilderness

With no fixed-line service and mobile phone operators reluctant to invest in rural areas, the Fantsuam Foundation decided to provide VoIP to customers on its wireless network in northern Nigeria.



community,' says John Dada, programme director at the Fantsuam Foundation. 'We needed to communicate with the rest of the world, so we invested in a VSAT (very small aperture terminal) satellite internet system. But in order to pay for the system we had to find a way to share the bandwidth.'

Over the last few years Fantsuam has developed a wireless internet system, broadcasting their internet signal to communities up to 15 km away from their base, and covering a population of more than 100,000 people. Customers on the network, called ZittNet, now includes local education institutions, banks, hotels and guest houses. A nearby hospital and several clinics are also connected, opening up the possibility for them to access telemedicine facilities.

The VSAT internet signal is broadcast by a high-gain radio antenna, attached to the top of a 45-metre mast. Anyone living within sight of the mast can connect to the network via a receiver. But the organization discovered that their customers would rather have access to a phone service than to the internet. Mobile phone companies, however, are reluctant to invest in rural areas, so Fantsuam decided to introduce a VoIP (voice over internet protocol) service to its customers. Working together with the Africa Wireless alliance, the foundation supplies a simple plug-and-play system, also called 'VoIP in a box'. Users plug the device, which costs around US\$50, into their computer and connect to the network. They then use a telephone handset to dial the number and make calls.

A good mix

ZittNet customers can call each other for free, and this has proven to be a powerful incentive for individuals and businesses to sign up to the network. Also, with pre-paid vouchers from a local mobile phone company, users can connect to mobile and fixed-line phone networks with the same VoIP system. These calls cost the same as any other mobile phone call.

'We are encouraging our VoIP customers to use the service as a kind of micro-business and allow anyone to use

the system for a small fee,' says Dada. 'Having more phone access points means that people don't have to travel so far to make a call, they can just go to the nearest business or home with a connection to the network.'

Most people use the service to call family members, or for health and educational information. Increasingly, many farmers are using the system to obtain market information. This is especially important during the harvest season when farmers want to find out the latest prices and where the best place is to sell their produce.

'We are looking at how we can bring the costs down,' adds Dada. 'We are working with the Nigerian government to introduce inexpensive technology and subsidize the cost of the bandwidth. The government also has plans to bring broadband cable internet to the area in the near future, which would also help to reduce costs and provide an improved service to more people.'

The Nigerian government is looking for private sector investment and more organizations like Fantsuam to build wireless internet systems for rural areas. 'Our system is being used as a model to see if it could be replicated throughout the country, where small wireless networks would become like wholesalers of bandwidth. The fact that we already have the infrastructure in place makes our project very interesting for the government to invest in sooner, rather than later.'

Although Fantsuam's microfinance activities supported the development of ZittNet, the organization's ICT work is now starting to pay for itself. Since those early days of providing loans, Fantsuam now gives training courses on basic computer literacy, computer networking and maintenance, to build and improve the skills of people in the community. Many trainees have gone on to start their own businesses, taking advantage of Fantsuam's microfinance scheme. The combination of loans and ICTs works perfectly, says Dada.

'Reinvesting the profits back into projects to develop ICT skills and small businesses has given a real boost to the local economy and has given communities access to communication and information services they otherwise would not have had.' ■

Case study

The Fantsuam Foundation became involved in the telecommunications business almost by accident. The not-for-profit NGO started by providing small loans to women farmers in the area around the town of Kafanchan, in north central Nigeria. But their microfinance scheme proved so successful that the organization quickly needed a computer to keep track of all the payments. Customers were curious about how the new computers worked and started asking for training courses. The courses proved to be extremely popular, and to further develop the trainees' skills Fantsuam decided to install a satellite internet connection in 2002.

'We felt very isolated as a rural

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CHARLES STURGE / ALAMY

The community call box

A pilot project to introduce payphones, connected to satellite networks, is providing telephone services to remote communities and helping to develop the telecoms market in Zambia.

Case study

The unprecedented success of mobile phones across Africa is well documented and clear for anyone to see. But leave the cities and main roads, and the mobile phone is quickly transformed from an economic success-making tool into an interesting but essentially useless accessory. Cellular coverage is rapidly lost as the population density decreases and distances increase. So how do we ensure that the people in rural areas of ACP countries do not miss out on a service that is enhancing the lives of millions of people across the rest of the developing world?

For those of us fortunate enough to enjoy the latest mobile technology – 3G (third generation), soon to be 4G – it is easy to forget where telephone communication started – with the humble payphone. I'm sure many a billionaire today can recall the days he or she stood at a payphone with a handful of coins waiting to make that essential call that one day brought them success. But it is this simple payphone that could be the first step on the journey to 4G technology for rural Africa.

At the moment, only high-frequency, shortwave radio and satellite networks offer effective means of communication in much of rural Africa. Due to their high cost, however, these networks and products are the preserve of wealthy corporations and governments.

To provide an alternative, Connect Africa has teamed up with satellite telephone providers, Iridium Satellite and Thuraya, to test a series of payphones and Public Calling Offices (PCOs) in central Zambia. In an initial trial in eight rural areas currently managed by the Zambian Wildlife Authority, Connect Africa is monitoring the activity and the demand for information and communication services. This project follows the successful test of two Iridium public phones near Zambia's Kafue National Park.

Kafue is an area of mostly smallholder farmers, and was chosen because it is so remote and because the infrastructure is so poorly developed. We consulted three local chiefs, and they suggested locations for the trial phones and even people we could

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approach to operate them. We then trained two operators to manage the payphones, each of whom was assisted by a younger community manager responsible for their respective community centres. The community managers have regular contact with farmers as they also coordinate sales of their produce and provide general farming assistance.

One of these phones was solar powered and portable, which was useful on market days and special events when it could be used by people who wanted to do business. The other phone was fixed, and powered by zinc-air fuel cells. The price of a call was the same as that of pre-paid call from the national mobile phone operator and was readily accepted by community members. There was also a special discounted rate for calls relating to community affairs, which are mainly agricultural, and this was well received by the farmers. The local high school was also interested in the project as a permanent PCO installation would ultimately provide an internet connection – a key requirement for the school to be able to teach the higher classes.

Support

For the scheme to succeed there has to be a reliable, continuous service, maintenance and good cash management. To provide the necessary support, teams of trained technicians, working in specially equipped vans, routinely visit each payphone or PCO and their operators. The technicians monitor, assess and service the equipment and provide any assistance the local operator requires. They are also responsible for the cash management of the phones and handle microfinance and moneygram transactions for the farmers and other people in the region.

The telephones were used a lot and consistently over the course of the trial period, a clear indication that there was a demand for a telephone service. This was one of the main purposes of the trial, but we also wanted to identify local markets and discover which services each community required. As the scheme expands it is essential that communities decide on which additional services will be useful to them and what can they afford. They could, for instance, decide that they require internet and fax services, or voice may be sufficient. Through further trials and regular monitoring

we hope to get an accurate feel for what people in rural communities really want. With more information we can then tailor our services to suit their demands.

For example, the community centres in the Kafue area already collect agricultural produce, such as eggs, from many farmers and sell them in bulk to traders from the town of Mumbwa. With an affordable communication service the community manager will be able to negotiate with several different traders over a wider area to get the best prices. This would increase the overall income for the community and will be particularly welcome in regions where the lack of a communication infrastructure means that farmers are limited to local buyers.

Initially, the scheme will generate revenue by charging community members a fair, affordable rate for the service. A fair rate means that they will continue to use the service. Second, Connect Africa will charge a fee to corporate and government service providers for coordinating and managing their services in new rural markets. Securing multiple revenue streams in this way will ensure that the rural service network can continue over the long term.

Power

Another important factor that will determine the success of the project is the energy supply needed to power the payphones. We have been using an innovative alternative energy source, zinc-air fuel cells, to power the Thuraya PCOs. Each 12 V fuel cell costs slightly less than a lead-acid battery, and can power four LED light clusters (which provide enough light for a typical home) for four hours a day for four weeks or more.

Recharging a zinc-air battery costs

Related links

- www.iridium.com
- www.thuraya.com
- www.aedc.co.za
- www.southernafricatrust.org

less than the price of candles for a month, and the power can be used and sold to charge other electronic equipment such as mobile phones, hair clippers, radios and low-power computers. These fuel cells are safe, environmentally friendly, efficient and, unlike lead-acid batteries, do not run down when they are not being used.

An added bonus of providing power in this way is that it gives the communities the opportunity to establish local micro-enterprises offering recharging services for the fuel cells. The project's mobile support units deliver the materials needed by the recharging service centres, saving the fuel cell owner from having to pay the multiple costs of taking a battery to a recharging facility that may be far from the community.

We are currently forging partnerships with the satellite communication industry and exploring opportunities with mobile phone companies. The Connect Africa system helps to build up the local market and provide the knowledge and expertise needed to develop a rural network of satellite payphones. By working closely with Zambia's Communication Authority we will also use the results from this pilot project to contribute to a policy and regulatory framework to help deliver ICTs throughout the country. Our plan is to then use this model to connect the rest of rural Africa, and other regions where connectivity is still low but very much in demand. ■



Connect Africa's mobile support unit

Using BGAN to talk

Using a VoIP conference call feature on a portable satellite connection, remote communities can express their opinions in their own language, and organizations can reduce travel costs.

Case study

Many organizations, research institutes and government departments have staff members who travel regularly to remote areas. If there is no mobile phone network in the communities where they work, and no fixed telephones, then communicating with colleagues back at head office can be extremely difficult, if not impossible. Field workers who travel for extended periods to rural areas can often feel disconnected. When they leave, the communities will have to wait until their next visit for answers to their questions. In these situations BGAN could provide a useful solution.

Portable BGAN (broadband global area network) terminals connect to a system of three communication satellites to transfer data and voice. Together, the satellites cover almost 98% of the Earth's surface, which means that the terminal can be used almost anywhere and will connect to one of the satellites via its own built-in antenna. A wide variety of broadband terminals is now available, from different manufacturers, but they can all be linked up to a computer using a USB connection.

Once the BGAN is connected to the satellite network, users can surf the web, send emails and make telephone calls. The price of a single terminal starts at around US\$1000, with higher-end units costing more than US\$2500. On top of that, users pay a monthly service fee of around US\$40–50, and then a charge for every megabyte downloaded, at roughly US\$7 per megabyte.

Gregg Swanson, executive director of HumaniNet, a non-profit organization that specializes in providing ICT assistance to humanitarian and aid organizations, has conducted several tests with BGAN and its forerunner, RBGAN (regional global area network). 'The popularity of mobile phones is a testament to the value of voice communication,' says Swanson. 'For the staff of humanitarian, environmental or



GREGG SWANSON / HUMANNET

agricultural organizations working in remote areas, BGAN could be useful to give them email and internet access. Someone working in a remote part of Papua New Guinea, for example, can call a partner organization or head office in Europe or the United States, or could get in touch with a colleague at the university in the capital for a quick response to an urgent problem.'

Teamwork

Most BGAN terminals have a separate handset for phone calls, removing the need for expensive data downloads and reducing the cost to around US\$1 per minute for an international call. Using a VoIP application, such as Skype, on a computer connected to the BGAN terminal then allows users to make conference calls, a feature that could be useful for agricultural and other extension workers in remote areas. 'You can attach a microphone to the computer and let villagers have their say over a conference call using Skype,' suggests Swanson. 'You would only need one extension worker or interpreter to travel to the village, with some training on how to set up the equipment.'

Although a conference call using VoIP over the BGAN network would mean expensive download costs, Swanson believes that organizations whose staff travel regularly to remote communities could still save on transport costs. One extension worker

Team training using the Hughes BGAN in rural Nepal.

with a BGAN terminal and a laptop computer could hold a conference call with community members and colleagues back at head office, or with experts and donor agencies in other countries. An interpreter could also be part of the conference call, working in a different location, but giving community members the opportunity to communicate in their own language.

For many organizations, making cheap conference calls could reduce the need for international experts to take expensive flights or for teams of researchers to travel long distances by car. The community would still have the opportunity to have their say but many NGOs could make significant savings.

While BGAN offers flexibility to make calls or access the internet from just about anywhere on the planet, the system does have its limitations. 'BGAN is just one more tool in the ICT toolkit,' says Swanson. 'It should be considered as a solution in specific situations, but it is certainly not for general use. It is, however, difficult to imagine a time when mobile phone networks, as they are now, will cover the entire planet. I think there will always be a market for portable satellite equipment for voice and data. For people who work in areas where there is no alternative, BGAN can be an affordable and effective solution.' ■

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Make podcasts from Skype calls

Podcasts can be a useful addition to a website. Visitors can download files, store them on a portable audio player, and then play back the recording anywhere, at any time. But producing podcasts can be expensive if you have to buy microphones and recording equipment. Also, while guest speakers can make a podcast more interesting, it can be difficult to organize interviews and travel to meet them. But with some simple equipment and a little technical knowledge it is possible to record interviews over Skype to produce good quality podcasts.

What you need?

Computer (laptop or PC).
USB microphone with headphone headset, available from around US\$20. A headset with a USB connection will give a better-quality recording.
Internet connection.

Software

You need three programs: **Skype** (www.skype.com) to make the VoIP calls, **Callburner**, to record the conversation and **Audacity** to edit the final audio file.

Download and install Skype onto your computer. The program is free and lets you make VoIP calls that are free to other Skype users. To call standard telephone numbers you have to pay in advance for the SkypeOut service. Follow the instructions to set up your username and password.

To record VoIP calls you will need a separate program such as Callburner (www.callburner.com). This is free to try for 30 days, and US\$49.95 to buy. When you install Callburner it will ask if it can connect with Skype. Click 'yes'. Mac users

To make a call using Skype

Start Skype, then click 'Search for Skype users'. Type in the Skype name of the person you want to call and click 'Find'. When the name appears in the results, click 'Add to Skype contacts'. Close the search box. In the 'Contacts' window you should now see the name of the person you want to call. To make the call double click the name or on the red telephone symbol.

should try AudioHijack Pro (<http://rogueamoeba.com/audiahijackpro>), which costs US\$32, and has a similar set up. After recording a call you will need to edit the audio file using Audacity (<http://audacity.sourceforge.net>) a free and easy to use open source program.

Set up

Open Callburner, and go to 'Options', 'Configure' and 'Recording'. Select 'Record all voices' for 'Skype to Skype' and 'Skype Out and Skype In'. Then select 'Audio encoding ACM'. Browse your computer to find a convenient place to store the recorded files. To make your podcast easy for other people to download you could choose an audio format such as PCM 12,000 kHz, 16 bit, mono or PCM 12,000 kHz, 8 bit, stereo, which will keep the audio file small. If your podcast contains only voices, then this quality will be good enough to playback on a portable MP3 player. You can select 'Start recording automatically' if you want to record all Skype calls

Record

Plug your headset into a USB port on the computer. Position the microphone at about nose height to prevent it from picking up the sound of your breathing.

Close all other programs running on your computer – this will help give better results as most of your computer's performance will go into the recording.

Start Callburner. This should automatically start Skype too. Call the person you want to interview (see box). When he or she answers, or after you have introduced yourself, click 'Record', unless you selected Callburner to start recording automatically, in which case the recording will be running already.

At the end of the conversation, click 'Stop'. Callburner will automatically save the audio file to the selected folder.

NOTE: In some countries it is illegal to record a telephone (even VoIP) conversation without the consent of the other person. Always make your interviewee aware that the call is being recorded.

Edit

Editing your podcasts will ensure that you provide only the information your

audience needs. Also, try to keep your podcast short – no longer than 15 minutes. Open Audacity. Click 'File' and 'Open' to search for the folder where Callburner stored the audio file. You will then see a graphic where the audio is represented as a wave. Press the 'play' button or the space bar to listen to the audio.

When you get to a piece you do not need, press 'stop' and click the mouse at the start of the first sound in the section. At the end of the unwanted section, hold down the 'shift' button and click the mouse at the end of the last sound, or hold down the left mouse button and drag the mouse to highlight the section you wish to cut. Playback the selection to make sure you have highlighted only the part you don't need, and if so, press delete.



The process works very much like highlighting and deleting words in a word processing program, but can take some practice to identify the correct sounds on the wave pattern.

When you have deleted all of the unnecessary parts of the interview click 'Save as ...' and save your file for uploading to the website.

- Blogarithms video guide to using Skype to record broadcast-quality interviews. www.blogarithms.com/index.php/archives/2007/12/23/skype-for-interviews ■



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turns your old phone into an IP phone. ATAs are available from about US\$30.

Is a broadband connection essential for carrying a telephone conversation over the internet?

→ No. In fact, the bandwidth requirements for VoIP are as little of 15–20 kbps per call. The main challenge is the 'stability' of the network connection, and the fluctuations in quality (known as jitter).

accessing weather and market information services, voicemail, messaging, interactive voice services and even developing call centres.

- Sustainability: relying on third-party solutions means that local knowledge is not created. To ensure that the phone network continues to operate long term it is better that the infrastructure is designed, built and maintained locally.

After the initial investment and installation of the hardware and software, is every phone call free afterwards? Are there any 'hidden' costs?

→ It depends on the business model that you want to use. Internet, electricity and the wireless network have to be created, all of which cost money. This infrastructure also implies people; there needs to be personnel to bill the customers, manage the cash and maintain the system. Calls within the network could be free, but linking beyond that to the traditional telephone network also means you would need to pay connection costs to the telephone company. Calls can definitely be cheaper, and a possible business model is to make local calls free.

What still needs to be done to make VoIP more widely available, especially to rural communities?

→ Training is the most important. And we need to learn from each other. Anyone using the technology should document their experiences and tell others what problems they came across and how they were solved. Improvements in local infrastructure would also help, of course. That means providing better access to electricity, building more local wireless and cable networks and improving tools and support to communities and individuals to help them develop workable business models.

How is VoIP likely to develop in the future?

→ VoIP is set to become more widely available and easier to use. Most telephone networks run 'IP' already. But many regulators are still cautious about VoIP, with some governments restricting access to equipment and knowledge and even making it illegal to make VoIP phone calls in their country. This is simply because VoIP allows more players into a market that has been traditionally controlled by just a few, often state-owned telecoms companies. It is no surprise that governments do not want other people to have access to that revenue. ■

Putting voice into the net

Do you need a computer to make VoIP (voice over internet protocol) phone calls?

→ No, you don't need a computer. An analogue phone connected to an ATA (analogue telephone adaptor) is the minimum hardware required. An ATA is a small piece of equipment that can convert the signal from a traditional analogue phone into the digital signal needed to transfer data over the internet. So you still need an internet connection but the ATA

How useful is VoIP for a rural community with only limited internet bandwidth?

→ Local telephony is always possible. It is simple to build a local wireless network that could carry several hundred calls and would act like a local telephone service. For non-local calls it is possible to use a satellite connection with 32 kbps guaranteed bandwidth. Satellite connections, however, can become quickly oversold, meaning that many users end up sharing the limited bandwidth. If a lot of people make calls at the same time the quality of the connection, and the calls, could suffer.

There are several well known brands of software that are free to download and use to talk with someone over the internet (Skype, Google Talk, etc.). What are the restrictions and disadvantages with this type of software?

→ Open source solutions, such as Asterisk and OpenSIPS, provide greater flexibility as they can be adapted to local needs. These are software applications that let you set up your own PBX (private branch exchange), which is basically a telephone exchange that serves a small network such as an office. The four main reasons to use an open source technology for local VoIP calls are:

- Flexibility: you do not need to be connected to the internet to run your local telephone system. Such a local network could range in size from a single house, to a village or a region.
- Ownership: local business models can be created instead of using a third-party solution where the community has to adapt to the product rather than adapting the product to suit the community's needs.
- Opportunity: it allows the creation of new added value services, such as



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