ACTS Technology Program

Introduction

ACTS

> *The mission of ACTS is to foster cross-cultural understanding and to promote, with our Honduran partners, sustainable programs for health, education, agriculture and economic development.*

ACTS is a registered 501(c)3 non-profit organization based in Norwich, Vermont. Since 1986 ACTS has partnered with rural villages in the mountainous Yoro district of Honduras to focus on sustainable community development. During this time ACTS has built a medical clinic and bunkhouse in the village of El Rosario. Countless numbers of volunteers with various backgrounds, from doctors and dentists to teachers and students, have stayed in the bunkhouse and worked with the people of El Rosario and surrounding communities.

For over 25 years ACTS has worked with the people of El Rosario to improve their quality of life. The children of the community are no longer plagued with the consequences of contaminated water, and the men and women of the community have been given new opportunities to manage their community's growing infrastructure. More recently ACTS opened a regional library and education center, which the community dedicated to Dr. Dean Seibert a long standing ACTS volunteer that has been traveling to the area for over 20 years.

Partnerships

ACTS has partnered with a number of organizations to help address their core mission. These organizations bring domain-specific skills to address the needs of El Rosario and many of the surrounding communities.

Engineers Without Borders (EWB-USA): The Northeastern University student chapter of EWB-USA started working with ACTS and their partner communities in 2005. Since then, the chapter has worked with a number of communities to design and install water distributions systems.

Sustainable Harvest International (SHI): From a nearby field office SHI has worked with community members to implement sustainable agriculture techniques.

The Children's Initiative (TCI): ACTS introduced TCI to the community of El Rosario in 2009. Since then, TCI has partnered with the Bayan association to open a secondary school in El Rosario.

The Need

Access to educational opportunities in this region of Honduras are limited. While each village has a small one-room school and offers coursework through the sixth grade, when students graduate they often lack the skills necessary to pursue further education.

Students in the nearby communities that are able to graduate their local school can apply to attend the TCI school, which provides curriculum through the ninth grade. This school offers a computer laboratory and library for its students, but is generally not open to the public.

The regional library in El Rosario provides some additional resources for students, teachers, and community members. In some cases teachers from surrounding communities will walk with their class over an hour to visit the library. The goal of this public library is to cater to both students and adults by providing books for a wide range of audiences, with a specific focus on educational texts and books focusing on trade skills. In addition to books, the library offers access to as many as three computers and a printer. Since there is no Internet connection within the village, and cell coverage is extremely minimal, communication can be difficult. While many educational materials have been pre-loaded on the computers, the content available is limited due to the lack of telecommunications infrastructure.

The need in this area can be summarized into three main categories:

1. Improved educational resources
2. Extension of communication channels to be able to access information and communicate with the rest of the world
3. Organization and ownership of implemented systems

Technology Program

A major focus of the ACTS technology program is to provide educational materials to the communities we serve. Digital content can be easily replicated and is much easier to transport than volumes of old encyclopedias. Content can be pre-loaded on individual computers, or a central server which could be accessed by any Wi-Fi enabled device.

Usability will be an important factor in the design process, but even with this consideration, training local community members to operate and maintain their systems will be vital for the long-term success of this project. Throughout the design and implementation of this program training sessions will be held with interested community members, and feedback will be solicited as much as possible.

The foundation of this program aims to expand the offerings of the El Rosario education center to improve computer literacy while providing much needed educational materials. Similar installations will then be implemented in surrounding communities, where the schools in each community will provide a subset of resources. Later phases of this project will then build on this foundation to provide connectivity between the villages and the rest of the Internet.

Phases

Phase 1: El Rosario Community Center Pilot

The resources at El Rosario Education Center are currently used by a number of community members and students from the surrounding communities. ACTS organized the El Rosario Health and Education Committee to employ a dedicated librarian to maintain the books and computers.

The first phase of this program will aim to improve computer literacy. Trainings will be held with local community members and teachers from the surrounding communities. Trainings will introduce the basics of operating a computer and accessing educational materials.

Additional equipment will be piloted at the Education Center to understand community use-cases and preferences. A preference will be given to source equipment locally, but in certain circumstances equipment may be brought by ACTS teams.

Table 1: Estimated equipment needs for Phase 1

Name	Quantity	Description
Laptop	3	Laptops can be operated for a few hours on battery power. They are relatively easy to service and can be physically locked while charging.
Tablet	3	Tablets are more energy efficient than laptops. They are not as easy to service and they're more likely to disappear.
BRCK	1	A wireless access point that can be pre-loaded with educational materials. A BRCK could also eventually be used to connect to the Internet via a 3G data connection if cell service became available in the future. A BRCK also has a battery backup to continue serving data even when the power is out.
Network Equipment	N/A	In comparison with a BRCK, a router and wireless access point could be installed to allow computers to share content.
RACHEL-Pi	1	A Raspberry Pi, or similar small computer, would be connected to the network to serve educational content.
Storage Cabinet	1	A secure location is needed to lock the equipment while being charged when the library is closed.
Surge Protector Power Strip	1	Multiple electrical outlets will be needed to charge these devices.

Phase 2: El Rosario Educational Network

Expanding on the work done to improve computer literacy through the Education Center, additional computers and networking equipment will be introduced within the community of El Rosario. Initially, existing computers at the Education Center and El Rosario school will be connected through wireless networking. This network will also be expanding to include an additional computer at the ACTS medical clinic.

While these points are fairly close, roughly a 10 minute walk between buildings, the community's wireless network will be used to demonstrate and test possible use-cases for the network. Such use-cases could include sharing educational content between the library and school, communication over Voice over IP, broadcasting local news, live-streaming local soccer matches, and many other applications. Initial examples of uses for the network will be provided during trainings with the community, but community members will be the driving force behind identifying further applications.

The network in El Rosario will host educational content and provide a means for digital communications between keys points in the community, while still isolated from the rest of the Internet. To further expand the usefulness of this community network, a backbone network will also be introduced which will be used to connect the El Rosario system to the rest of the Internet. The purpose of the backbone network is to use wireless repeaters to connect El Rosario to existing an Internet Service Provider (ISP), such as the one used at the Internet cafe in Punta de Ocote.

Other design implementations will be researched during Phase 1 and an alternatives analysis will be conducted before the implementation of Phase 2. For the purpose of planning, the initial concept of wireless repeaters will be considered in this document, but future revisions may be introduced as more information becomes available.

Additional training will be designed to address the added complexity that comes with maintaining a wireless network. Similar wireless networks seem fairly common in other more populated regions of Honduras, so experts from these areas will be consulted to better understand local best practices. Basic trainings will be available to all community members, but a local committee will identify 1-3 individuals to pursue further training and assist in the design and installation of the network. It will also be recommended the local committee set aside funds to pay these individuals to conduct additional operations and maintenance procedures. ACTS will subsidize these funds for a set time with the understanding the individuals receiving the stipend will actively participate in the design, training , and installation of future network expansions in the surrounding communities.

An outline of the equipment needed for this phase is provided in Table 2.

Table 2. Estimated equipment needs for Phase 2

Name	**Quantity**	**Description**
El Rosario Network Antenna	4	Wireless antennas to connect three sites in El Rosario
El Rosario Network Equipment	N/A	Switches, power sources, indoor repeaters, cables
Laptop	4-8	Expand the availability of computers in the Educations Center. Also install a dedicated computer in the ACTS Clinic.
Backbone Antenna	4	Antennas used to repeat the Internet connection to El Rosario
Backbone Network Equipment	N/A	Switches, Solar UPS backup power sources, cables, tower materials

BRCK	4	Additional BRCK installations at the El Rosario school, ACTS clinic, school of community where backbone repeater will be installed, and a traveling BRCK that can be used for demonstrations.

Phase 3: Outreach Communities

The technology program in El Rosario will be open to both the local community and the surrounding villages. While having access to these resources could be very beneficial to the nearby communities, their access will still be limited by the distance they must travel to use it. ACTS plans to provide a means for villages to opt into the technology program.

Villages that are interested in connecting with the network will need to demonstrate their desire and initiative to move forward with the project. Volunteers from these communities will need to attend trainings hosted in El Rosario and assist with common maintenance tasks for a set period of time. Community members will also be required to be involve with the overall network design and ACTS will hold open forums regarding design options. Additionally, a community committee will need to be formed to oversee the implementation and operation of the community's technology program.

Deployments to each of these villages will be similar to the first two phases, where computer equipment is installed first, followed by networking equipment. The scope of these deployments will be smaller and limited to the community schools. ACTS aims to subsidize each of these deployments as funds are available. Within a set period of time ACTS will provide additional funds for needed repairs, but this support will be reduced over time and communities will be responsible for collecting the necessary funds to support their systems.

Monitoring and Evaluation

During the initial planning stages of Phase 1 community input will collected regarding community member's current use of technology and their priorities for this project. A focus group of teachers from the surrounding communities will also be gathered to better understand current needs in the classroom. Throughout each phase community sessions will be held to collect additional feedback. Information from these sessions will be collected so trends can be identified and used to help improve the overall program delivery.

In addition to community discussions, network monitoring tools can be used to understand common use-patterns. This information can be used to identify the demand for the system which can help dictate the need for further expansion. Specific monitoring of content will not be monitored or blocked by ACTS unless the community directly asks for assistance addressing an issue.

Security

Electronic equipment is often the target of theft. While it is nearly impossible to prevent a determined criminal, avoiding situations where equipment is openly visible and unprotected will be key. During transportation equipment will be broken down and carried in unmarked bags whenever possible. Local guides will travel with groups while transporting or installing system components. Advice from the local community will be followed regarding how to properly protect installations.

When possible, components will be equipped with features to remotely identify their location. In the event this equipment is stolen it will still have the ability to phone home and be remotely manipulated. While retrieving the equipment is unlikely due to the prevalence of organized crime in Honduras, the proper authorities could still be notified.

Wireless security will also need to be addressed during the implementation of the network. Various methods could be used to encrypt traffic and limit access to authorized users. These methods will be presented during community forums to build a consensus on the proper methods to implement.

Related Work

Internal

The El Rosario Education Center was started with by rehabilitating a section of the community center and through a number of book donations. Over the years it has grown to offer more services and has been the focal point for adult education. A few older computers were donated to the center, but they lacked word processing applications and educational content.

The Northeastern University student chapter of Engineers Without Borders has partnered with ACTS and a number of the nearby communities to design and implement a number of gravity-fed water distribution systems. These projects have greatly improved the quality of life in these communities.

The Children's Initiative (TCI) was introduced to the community of El Rosario by ACTS. Over the course of a few years TCI constructed a new school and has partnered with the Bayan Association to provide teachers and training. Students from the surrounding communities in grades 7-9 apply to the school, which will provide bicycles when needed. The school offers a small library and plans to increase computer offerings to their students.

External

The Riecken Foundation operates a number of community libraries in Central America. The closest such library is in Yorito, a little less than 2 hour drive from El Rosario. Some of the Riecken libraries have installed RACHEL-PI servers, which are small wireless computers that allow patrons to access pre-loaded content, such as Kahn Academy videos and wikipedia article.[1]

Mesh Sayada is a community run network in Tunisia. This network hosts a local copy of Open Street Maps and Wikipedia. Community members helped design and install this network.[2]

A mesh network using Commotion firmware was deployed at a school in Somaliland. This network uses open-source firmware to allow normal wireless hardware to create a mesh network, which is a type of network that can be "self-healing". The deployment did not require extensive expertise to install. [3]

Red Hook WiFi is a community-led effort to close the digital divide, generate economic opportunity, facilitate access to essential services and improve quality of life in Red Hook, Brooklyn via the deployment of a wireless Internet network.[4]

Budget and Funding Sources

Funding for this program will be provided through donations to ACTS. Additionally, ACTS members will write grant applications and solicit in-kind donations. The current budget for equipment for each phase is provided in the following sections. In addition to equipment costs there will also be costs associated with general operation and maintenance, which are detailed in Table 3. The total cost for the first two phases of this program is

estimated to be $12,500, with each additional community adding approximately $3,500 to this total. As with all ACTS projects, volunteers will be expected to raise their own funds to pay for travel and group expenses, which is roughly $1,000-$1,200 per person per trip.

Table 3. Estimated operational expenses

Item	Price (each)	Quantity	Total	Description
Data connectivity	$600	2	$1,200	Subsidized data connectivity for the first 2 years
Local training and maintenance	$750	2	$1,500	Subsidized maintenance costs for 2 years until local community members are properly trained
		Total	**$2,700**	

Phase 1

Table 4. Estimated equipment expenses for Phase 1

Item	Price (each)	Quantity	Total
Education Center Computer	$400	3	$1,200
Education Center Tablet	$300	2	$600
BRCK	$200	1	$200
Storage Cabinet	$75	1	$75
Surge Protector	$20	2	$40
Network Equipment	$300	1	$300
Raspberry Pi	$60	1	$60
		Phase 1 Total	**$2,475**

Phase 2

Table 5. Estimated equipment expenses for Phase 2

Item	Price (each)	Quantity	Total
Backbone Antennas	$75	4	$300
Tower materials	$60	3	$180
Outdoor UPS	$550	2	$1,100
Solar Panel	$200	2	$400
El Rosario Network Antennas	$250	2	$500
Switches	$100	4	$400
AirGateway	$40	5	$200
Cables, connectors, adapters	$365	1	$365
BRCK	$200	4	$800
Education Center Computer	$400	6	$2,400

Clinic Computer	$400	1	$400
UPS	$100	2	$200
Surge Protector	$20	2	$40
		Phase 2 Total	**$7,285**

Phase 3

Table 6. Estimated equipment expenses for Phase 3

Item	**Price (each)**	**Quantity**	**Total**
School Computer	$400	3	$1,200
BRCK	$200	1	$200
Storage Cabinet	$75	1	$75
Surge Protector	$20	2	$40
Antennas	$75	2	$150
Tower materials	$60	2	$120
Solar battery and components	$550	2	$1,100
Solar Panel	$200	2	$400
Cables, connectors, adapters	$200	1	$200
		Phase 3 Total (per community)	**$3,485**