



KICHEKO LIMITED

PROJECT TO SETUP A WIRELESS NETWORK
AT CHIPOLE IN TANZANIA

Site Survey Report

Moshi

27 December 2007

Section 1

Background

Sometime in September 2007, **Inveneo** received an enquiry from a community development program located at **Chipole** in southwestern Tanzania that provides education, health care, and community development services.

Chipole community lies exactly 45km from Songea town in Southern Tanzania. It is 21km off the main road from Songea to Mbinga. The community has reliable electricity thanks to a new dam and own mini hydro power generation.

The community has several computers. However, only a few of them have internet access for various reasons. Furthermore, the use of internet is mostly limited to email and occasional browsing.

According to the Client, the goal of the project is to establish a wireless system to connect the offices, dispensary, and schools to the internet and also to provide a community-based computer/internet services locale, possibly through the Trade School.

The Client's preferred approach is to utilize as much as possible existing computers and facilities by adding the wireless networking to them. The initial priority is to extend the internet connection from the Computer Room to the Community Development Program (CDP) office.

Kicheko Ltd was requested by Inveneo to investigate and analyze the Client's requirement and come forward with recommendations for implementation. A site survey was scheduled after the Client's agreement to its cost, but was delayed pending shipment of a GPSmap equipment. The survey went ahead after renting a GPSmap from a mobile operator.

The site survey covered the following main activities:

- Visiting and assessing the location, topology, and distances;
- Inspecting and assessing existing computers and equipment;
- Assessing the services to be delivered, their viability and interdependency;
- Analyzing and recommending power solutions;
- Analyzing and recommending connectivity solutions.

The site survey was conducted on 22nd December 2007.

Section 2

Observations

2.1 EXISTING INTERNET

One most notable general observation is the fact that the community has Ku-Band VSat internet connection which is usually reliable up to the satellite modem. The modem was supplied by Gilat of Israel but we could not establish who is the local provider.

It appears issues of internet reliability start from the satellite modem going inside to users and their computers. For example at the time of the survey we were told there is no internet and it had been like that for one week. We were also told that such problems are frequent. However, we found that there was internet up to the satellite modem but the firewall was switched off. When we switched it on internet was available. We gave them some simple instructions of what to do whenever they do not have internet and what to look for before seeking qualified technical intervention.

Another notable observation with regard to the internet is the fact that the VSat connection is limited to only four (4) users. This matches the monthly payments which are made to the provider. The four connections are to: The Computer Room#1 (1), The Superior's Office (1), The Father's Office (1), and the Computer Room#2 which is also the Computer Class (1).

All the above 4 points with internet connection are within a radius of 35 meters. There are more offices with computers, and sisters with laptops, who would like to have wireless internet access but such access is not possible at the moment due to restriction of 4 users and lack of cabling infrastructure to facilitate it. Extension of internet to CDP office is also not possible for same reason.

2.2 THE PROJECT AREA

Another notable general observation is that the project area is much wider than earlier thought. Earlier submissions omitted the Hydro Power Office and the Hydro Power Station, some 9kms away from the Convent, but these are very important and key in ensuring that the electricity power supply, and with it the entire economic life of the community, is running and maintained well.

Connection of the Power Station to the internet had been recommended several times by the suppliers of the power plant to enable its remote monitoring and troubleshooting directly from Switzerland. This has been on the priority list for quite some time now but hampered by lack of funding. On emergencies the

operators have to fax data to Switzerland for instructions on what to do. The plant is managed by a system computer which could be connected to the internet.

Another important place which needs to be included in the project is the Formation House, which is a further 3kms away from the Hydro Station. This is the place where young and prospective Sisters are being trained. This place has no electricity and the solar system in place is not working most probably due to worn out batteries which need replacement.

The project area therefore consists of the following sites:

- The Convent, which is a huge complex of interconnected buildings housing different functional departments, offices, utilities, service areas, workshop, residences, guest wings, etc. It is a typical German construction with huge walls and solid foundation. This is the hub of all activities. The Chipole Development Programme (CDP) offices are also situated in one of the interconnected outer buildings of the Convent, some 150 meters away from the internet source.
- Three buildings housing the Dispensary, Trade School and Orphanage are located about 100 meters in front of the Convent. These are temporary outfits as plans are underway and at advanced stage to construct new facilities about 500 meters away. The three buildings have excellent visibility from the Convent. The Dispensary and the Trade School have at least one PC each.
- The Primary School lies 300 meters (straight over the air distance) from the Convent on the same plane with clear visibility. The School was closed so we could not get in to see what they have in there and whether same could be used for wireless networking.
- The Secondary School is situated 1.78 kilometers from the Convent. The School is on the other side of the ridge with good clear visibility from the Convent. The Administration block with offices and a Computer Lab is still under construction but one classroom has been converted into a makeshift Computer Lab. There are several old PCs donated from abroad but only 2 or 3 are working normally – one with Windows XP and others Windows 98. Most of the remaining are missing something be it hard disk drive, memory, etc.
- The Hydro Power Office is situated 8.76 km from the Convent while the Hydro Power Station close by is 8.39km from the Convent. Both the Hydro Office and Hydro Power Station are neither visible from the Convent nor the Schools. There is therefore need to put a Repeater Station at a location 6.83km from the Convent. This point has good visibility to both the Convent on one side and the Hydro Office and Power Plant on the other. The Hydro Office is 1.94km and the Hydro Plant is 1.56km from the Repeater Station.
- The Formation House is a further 2.77km away from the Hydro Office. It is an important functional area for training young prospective sisters but isolated and without electricity supply from the Hydro Power Station. However, it has good visibility from the Repeater Station which is 3.13km away.

2.3 SERVICES TO BE DELIVERED

It was quite notable that communication is a big challenge to the community at Chipole both within the Convent and to distant outlying units. Within the Convent the intercom has been out of order for some time. Technical support from the Tanzania Telecommunications Company Ltd (TTCL) is not forthcoming. TTCL is a government owned parastatal with poor customer care record.

There is therefore need to introduce Voice over IP (VoIP) as an alternative means of internal communication which is free and very reliable. Internal communication does not require internet bandwidth which is expensive and inadequate in most cases. Communication Stations will facilitate availability of both internet and VoIP on selected locations.

2.4 EXISTING COMPUTERS AND EQUIPMENT

The Client had expressed desire to utilize the existing computers and equipment as much as possible. Unfortunately most of the existing computers are either not functioning for lack of replacement parts or components, and where they are working they have a very low capacity.

While the problem of capacity can be solved by installing Linux Operating System instead of Windows, the problem of missing parts and components do not have an easy cure except finding and replacing the missing parts.

For example out of the 10 or so computers in the Computer Room (which also doubles as the Computer Class) only 3 are working. The rest have a variety of problems ranging from hard disk failure, operating system failure, virus infection, memory failure, etc.

For the proposed wireless networking to work well and produce the envisaged impact for both the internet and VoIP services, it might be a good idea for each location to have at least one good computer from Inveneo, either a Computing Station or a Communication Station.

2.5 CONNECTIVITY OPTIONS

The entire community could be networked with a combination of wireless and wired networking. Wireless could be used to create a Wide Area Network (WAN) primarily for backhaul of the internet from the source location within the Convent to, on one hand, the various units like CDP Office and the Meat Factory which are located within the Convent but far off, and on the other to distant units like the Secondary School, Repeater station, Hydro Units and the Formation House.

Visibility for line of sight is good and the distances are relatively short according to WiFi networking standards. A hub station could be placed close to the internet source to facilitate connectivity and internal VoIP communication.

A Local Area Network (LAN) could be created within the units using wired networking. This will be implemented using UTP Cat5e structured cabling according to specific requirements of the units in question.

2.6 POWER OPTIONS

The electricity supply from the 400KW Mini Hydro Power Station is very reliable. The power is evacuated by underground armored cables to a transformer several kilometers away and then to the whole community. Apart from the Formation House and the Repeater Station, the rest of the community is adequately supplied with reliable electricity.

However, the Formation House which is 3 km on the other side of the Power Station is yet to be connected. Even before construction of the Power Station the Formation House had a solar system but it is now out of order. Our investigation points to a possible failure of the battery system due to old age. A further analysis and investigation might be needed to suggest appropriate repairs for the system to start to work again. The equipment to be placed at the Formation House will therefore need to be powered by Solar.

The proposed Repeater Station is on a location which does not have electricity. The underground cable passes nearby but the cost of taking a branch might be too high compared to a solar powering option. The Repeater Station will therefore need to be powered by solar.

Section 3

Recommendations

3.1 INTERNET SOLUTION

It is our considered opinion that the community can get better value by expanding and renegotiating better terms out of the existing VSat installation rather than invest into a new internet connection. The existing internet source could be expanded to facilitate more and wider connectivity to the CDP and other units. The community is currently paying about US\$ 300 per month for the 4 users.

The options for expansion are either to increase the number of users (which attracts proportionate discounts) which each new unit being considered as a user, or shift from payment per number of users to payment per bandwidth supplied with total freedom on number of users connected and amount of traffic.

We requested the name of the local service provider supplying the VSat so that we can discuss with them available options for expansion and the costs involved but up to the time of writing this report we did not received it.

3.2 PROJECT AREA

It is recommended to expand the project coverage area to also cover the Hydro Power Station, the Hydro Office and the Formation House.

The Hydro Power Station needs both internet connectivity for online technical support by the plant suppliers abroad, and VoIP communication to facilitate easy and free communication with the Convent and other units.

The Formation House is far and isolated without electricity. Communication is very difficult and therefore the VoIP system will make their life much easier. It is possible to install both a wireless system and computers which work entirely on solar system.

3.3 SERVICES

Apart from the internet, it is highly recommended to add more value to the wireless networking by implementing Voice over IP communication service. VoIP is a service, which facilitate voice communication by using the TCP/IP protocol which is also used by the internet.

A Hub Station linking the other computers usually come complete with the software to implement Voice over IP service already installed.

3.4 COMPUTERS

To take advantage of the wireless communication system, and to ensure that the service is available most of the time, it is recommended to complement the existing computers with at least one new computer from Inveneo at each site.

The new computers could either be a Computing Station or a Communication Station depending on the intended location and the proposed services to be delivered at that particular location. The list below is the recommended minimum:

S/No	Location	Equipment Type	Quantity	Remarks
1	Convent	Hub Station	1	Server Room
		Communication Station	1	Superior's Office
2	Dispensary	Communication Station	1	Reception
3	Trade School	Computing Station	1	
4	Orphanage	Computing Station	1	
5	Primary School	Computing Station	1	
6	Secondary School	Communication Station	1	Headmistress Office
7	Hydro Office	Communication Station	1	
8	Power Station	Communication Station	1	Additional to System PC
9	Formation Hse	Communication Station	1	

3.5 PROPOSED CONNECTIVITY SOLUTION

It is recommended to create a WAN by using a WiFi wireless system and a wired LAN within buildings to facilitate local connectivity.

The WAN will involve installation of one main Access Point (AP) at the Convent, one Repeater (CPE + AP) at the Repeater Station, and about ten Customer Premise Equipments (CPEs).

Several masts will have to be erected – two of 18 meters each (Convent, Power Station), five of 12 meters each (Primary + Secondary Schools, Repeater Station, Hydro Office, Formation House), and five of 6 meters for the rest (Dispensary, Trade School, Orphanage, CDP Office, Meat Factory).

It is recommended to erect the main AP mast close to the satellite dish and the server room for ease of access. There is ample ground space for that purpose.

3.6 PROPOSED POWER SOLUTION

The Repeater Station could be adequately powered by using one 64W solar panel, and one 70Ah maintenance free deep cycle battery.

The equipment at the Formation House could be adequately powered by using one 64W solar panel, and one 100Ah maintenance free deep cycle battery.

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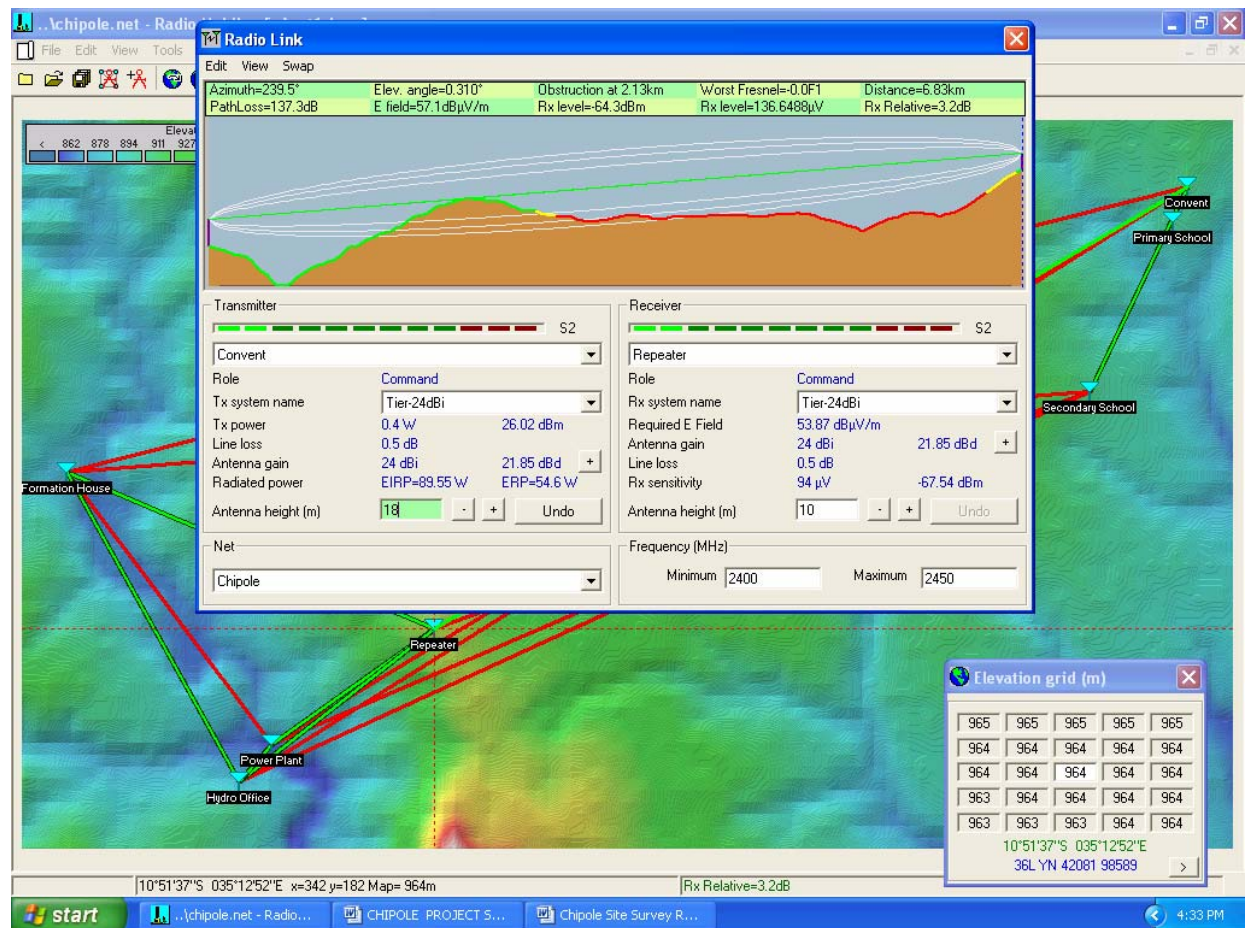
Annex 1

Waypoints

Following below is a table of coordinates and elevation of the Waypoints:

S/No.	Waypoint Name	Coordinates (ddd.dddd)		
1	Convent	S 10.82909	E 035.26837	903m
2	Primary School	S 10.83160	E 035.26726	921m
3	Secondary School	S 10.84353	E 035.26134	914m
4	Repeater Station	S 10.86027	E 035.21442	968m
5	Hydro Power Plant	S 10.86837	E 035.20270	864m
6	Hydro Office	S 10.87103	E 035.20039	877m
7	Formation House	S 10.84924	E 035.18802	873m

Radio Mobile



This Radio Mobile image shows a clear line of sight on the longest link between the Convent and the Repeater Station. The links between the Convent and the Primary and Secondary School are also green as well as the line between the Repeater Station and the Formation House, the Power Station and the Hydro Office.

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