

# IT +46 Final Report

Community Wireless Research Center  
Makerere University, Uganda

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## Executive summary

This document summarizes the activities that IT +46<sup>1</sup> has performed for the Community Wireless Resource Center project in Uganda during June 2007- December 2007.

The document also discusses the methodology used by IT +46 to support the CWRC team in order to fulfill the overall goals of the project.

These last seven months of the CWRC project has mainly focused on implementation and troubleshooting of wireless networks. During June-August 2007, the CWRC team implemented three Wireless Community Networks in Lira, Nabweru and Kabale. IT +46 has been providing the team with logistical planning and technical advice during this period.

In September 2007, IT +46 conducted the second training workshop with CWRC which mainly targeted issues that has caused trouble during the implementation phase (Internet routing, wireless networking) and network services such as traffic management and web proxy.

The last three months of the project (October- December 2007) has been spent troubleshooting and improving the existing networks and supporting the establishment of local user groups around the Community Wireless Networks.

IT +46 has supported the CWRC project by providing 18 months of online remote support. This has been done by email and chat with very short response time. During these 18 months, IT +46 has lead two training workshops in Uganda during a total of four weeks.

The combination of remote online support together with a few intense training workshops has worked well for this kind of project. Due to occasional poor connectivity at the Makerere University, other means of remote communication would have been favorable to keep up the pace of the project.

We can conclude that the overall objectives of the CWRC project has been archived and the fact that three Community Wireless Networks has been established by the CWRC team is a good proof of that. Although the Community Wireless Networks are not quite completed yet, the hardest work has been done and some polishing is left to be done.

We kindly encourage IDRC to support the completion of the Community Wireless Networks by supplying the CWRC with the supplementary funding requested to complete the task.

If the networks are not finalized with the basic network services installed, proper lightning protection provided and solutions to existing shortcomings provided, the overall impression and reputation of the project from the general public will be damaged.

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1 All documents associated with IT46 activities are available at:

[http://www.it46.se/projects/2006/idrc/CA\\_makerere/deliverables/](http://www.it46.se/projects/2006/idrc/CA_makerere/deliverables/) (internal area)

<http://cwrc.it46.se/> (public area)

## Table of Contents

1. Introduction.....	1
2. Phase D: Implementation and External Training.....	2
2.1 Deliverable D2: Implementation Infrastructure.....	2
2.2 Deliverable D3: Implementation Plan (Services).....	2
2.3 Deliverable D4-D5: Workshop Kampala I & II.....	2
3. Phase E. Internal Training and Quality Assurance.....	3
3.1 E1: Advanced CWRC Training.....	3
3.2 E2: Quality Assurance.....	5
3.3 E3-E4: Implementation Services I-II.....	5
4. Ongoing activities (X).....	7
4.1 X2: Curricula Development.....	7
4.2 X3: Documentation.....	7
4.3 X5: Final report.....	7
5. Methodology.....	8
5.1 Online remote technical and strategical advice.....	8
5.2 On-site training workshops.....	8
6. Conclusions and Way Forward.....	9

## 1. Introduction

This document is the final report of the work performed by IT +46 in the CWRC project in Uganda during 2006-2008. This report takes the initial project proposal as a guideline and targets the activities performed and/or supported by IT +46 in Phase D, E and X.

The section “Additional work”, describes work performed by IT +46 outside of the contractual activities of the project. These initiatives has been initiated by IT +46 in order to support the CWRC project where weaknesses have been identified.

The methodology used by IT +46 to support the CWRC in order to fulfill the projects overall goals is presented, discussed and evaluated.

Finally, the report concludes with our own personal conclusions of the project and a suggestions for future work.

## 2. Phase D: Implementation and External Training

### 2.1 Deliverable D2: Implementation Infrastructure

During the implementation phase of the wireless networks (June-August), IT +46 provided online remote support to the CWRC team for technical, practical and logistical questions.

Furthermore, a document containing detailed guidelines for the Kabale network implementation was provided due to the complexity of the network compared to the previous two networks.

#### **Document: Guidelines for the Kabale Implementation**

File: [http://cwrc.it46.se/files/D/D2\\_IT46\\_CWRC\\_Kabale\\_Guidelines.pdf](http://cwrc.it46.se/files/D/D2_IT46_CWRC_Kabale_Guidelines.pdf)

### 2.2 Deliverable D3: Implementation Plan (Services)

All Telecentres acting as a “local ISP” are in great need to bandwidth management and bandwidth saving measures such as web caching.

For that reason, IT +46 has provided the CWRC with a detailed installation guide for:

1. Bandwidth management with MasterShaper
2. Web proxy and access control with Squid

The guide includes a detailed step-by-step guide in terms of hardware requirement, hardware setup, installation and configuration based on one of the Community Networks built by CWRC.

#### **Document: Service Installation Guide**

File: [http://cwrc.it46.se/files/D/D3\\_IT46\\_CWRC\\_Service\\_Installation\\_Guide.pdf](http://cwrc.it46.se/files/D/D3_IT46_CWRC_Service_Installation_Guide.pdf)

### 2.3 Deliverable D4-D5: Workshop Kampala I & II

It was initially planned that CWRC would host, facilitate and provide training during two local workshops (in addition to the two workshops trained by IT +46), targeting local partners on the topic of community wireless network.

Instead of organizing a total of 4 workshops, it was decided to merge them into 2 by inviting a wider audience to the IT +46 training.

The four days of workload budget for this activities have been reallocated to activity E1 (Advanced CWRC Training) and E2 (Quality Assurance).

The reallocation of time allowed IT46 to offer a wider and deeper curricula for the advanced training workshop.

### **3. Phase E. Internal Training and Quality Assurance**

#### **3.1 E1: Advanced CWRC Training**

The advanced training workshop targeted the following theoretical areas:

##### **Theoretical**

- How to reduce the use of international bandwidth?
- Traffic management with MasterShaper
- Basic Internet Concepts
- Troubleshooting a wireless network
- Point of failure in wireless installations
- Critical reading of ISP contracts

##### **Documents (1) : Theoretical presentations**

[http://www.it46.se/projects/2006/idrc/CA\\_makerere/deliverables/Workshop-2/](http://www.it46.se/projects/2006/idrc/CA_makerere/deliverables/Workshop-2/)

A set of practical exercises were conducted in teams of two in the computer lab of the Electrical Engineering Department.

##### **Practical**

- How to reduce the use of international bandwidth?
- Traffic management with MasterShaper
- How to set up a fully routable wireless network with repeaters.

## Documents (2) : Practical exercises

### 1) How to Minimize the Use of International Bandwidth

File:

[http://www.it46.se/projects/2006/idrc/CA\\_makerere/deliverables/Workshop-2/U2\\_Minimize\\_Bandwidth\\_Usage/IT46\\_minimize\\_bandwidth\\_exercise.pdf](http://www.it46.se/projects/2006/idrc/CA_makerere/deliverables/Workshop-2/U2_Minimize_Bandwidth_Usage/IT46_minimize_bandwidth_exercise.pdf)

### 2) Installation of MasterShaper on Ubuntu Feisty Fawn

File:

[http://www.it46.se/projects/2006/idrc/CA\\_makerere/deliverables/Workshop-2/U3\\_Mastershaper\\_Installation/IT46\\_mastershaper\\_installation.pdf](http://www.it46.se/projects/2006/idrc/CA_makerere/deliverables/Workshop-2/U3_Mastershaper_Installation/IT46_mastershaper_installation.pdf)

### 3) An example Setup of MasterShaper for a Community Wireless Network

File:

[http://www.it46.se/projects/2006/idrc/CA\\_makerere/deliverables/Workshop-2/U4\\_MasterShaper\\_Setup/IT46\\_mastershaper\\_intro\\_exercise.pdf](http://www.it46.se/projects/2006/idrc/CA_makerere/deliverables/Workshop-2/U4_MasterShaper_Setup/IT46_mastershaper_intro_exercise.pdf) (intro to exercise)

File:

[http://www.it46.se/projects/2006/idrc/CA\\_makerere/deliverables/Workshop-2/U4\\_MasterShaper\\_Setup/IT46\\_mastershaper\\_setup.pdf](http://www.it46.se/projects/2006/idrc/CA_makerere/deliverables/Workshop-2/U4_MasterShaper_Setup/IT46_mastershaper_setup.pdf) (exercise)

### 4) How to set up a routing wireless network in Kabale

File:

[http://www.it46.se/projects/2006/idrc/CA\\_makerere/deliverables/Workshop-2/U7\\_Kabale\\_Topology/topology/after/IT46\\_Kabale.png](http://www.it46.se/projects/2006/idrc/CA_makerere/deliverables/Workshop-2/U7_Kabale_Topology/topology/after/IT46_Kabale.png)

## Field Work

During September 2007, IT46 spent four full days in Nabweru and Kabale. Each client site was visited, a review of the wireless and electrical installation was done and corrections were implemented.

- 1 day field visit to Naberu Telecenter inspection of wireless installations
- 3 days field visit to Kabale, troubleshooting and configuration of wireless installation

The outcome of the field work is presented in the following document:

## Documents (3): Outcomes from field work

### 1) Kabale

File:

[http://www.it46.se/projects/2006/idrc/CA\\_makerere/deliverables/Workshop-2/FW\\_Kabale\\_Installation\\_Review/](http://www.it46.se/projects/2006/idrc/CA_makerere/deliverables/Workshop-2/FW_Kabale_Installation_Review/)

## 2) Nabweru

File:

[http://www.it46.se/projects/2006/idrc/CA\\_makerere/deliverables/Workshop-2/FW\\_Nabweru\\_Installation\\_Review/](http://www.it46.se/projects/2006/idrc/CA_makerere/deliverables/Workshop-2/FW_Nabweru_Installation_Review/)

## Additional material

Due to time constraints and the decision to focus on areas that the team was experiencing problems with during the implementation phase, there were a number of topics that needed to be dropped from the training agenda. The materials of those topics is available in the following website.

### Documents (4) : Other training material

File:

[http://www.it46.se/projects/2006/idrc/CA\\_makerere/deliverables/Workshop-2/not\\_delivered/](http://www.it46.se/projects/2006/idrc/CA_makerere/deliverables/Workshop-2/not_delivered/)

## 3.2 E2: Quality Assurance

The quality assurance of the wireless implementations were carried out during the field trips of the Advanced Training Workshop. A total of 4 days (1 day in Nabweru and 3 days in Kabale) were spent on Quality Assurance. Each and every client and node installation were visited (except one site in Kabale due to heavy rain and storm) and both the wireless and the electrical installation were reviewed.

After each field visit, a presentation fully based on pictures taken during the field visit was shown the participants where mistakes and shortcomings together with good practices were discussed within the group.

The outcomes of the quality assurance can be found under the *Field Work* section (see Section 3.1).

## 3.3 E3-E4: Implementation Services I-II

At the time of writing, the Implementation of the Basic Network services has still not taken place. The reasons are several, but the main cause is lack of funding since other budget items were under-budgeted and several unexpected expenses were overlooked.

A request for supplementary funds has been submitted to IDRC (by CWRC) in fall 2007, which will include the procurement of the necessary hardware, configuration and on site installation of the services.

For this reason, IT +46 has put more effort into documenting the service installation than initially planned (D3) and has also kept the remote support during the implementation phase outside of the existing contractual obligations.

## 4. Ongoing activities (X)

### 4.1 X2: Curricula Development

A curricula for academic training in the topic of Community Wireless Networks have been developed. The curricula are based on the training material from the two training workshops held by IT +46 for CWRC staff and Telecentre representatives.

**Document: Academic curricula for “Community Wireless Networks”**

File: [http://cwrc.it46.se/files/X/X2\\_IT46\\_CWRC\\_Curricula.pdf](http://cwrc.it46.se/files/X/X2_IT46_CWRC_Curricula.pdf)

### 4.2 X3: Documentation

IT +46 has documented the progress on a project-specific web site. Minutes for each team meeting has been published (Status Report) and the main activities of each project phase (A-E) has been published with text, documents and images.

**Document: IT46 Project Website**

File: <http://cwrc.it46.se>

### 4.3 X5: Final report

This document is available online:

**Document: Final Report**

File: [http://www.it46.se/projects/ug1/files/X/X5\\_IT46\\_final\\_report.pdf](http://www.it46.se/projects/ug1/files/X/X5_IT46_final_report.pdf)

## 5. Methodology

IT +46 main objectives in this project have been to provide the CWRC team with the necessary information and knowledge to carry out the work needed to:

1. establish a Community Wireless Resource Center (CWRC) at the Makerere University
2. establish a number of Community Wireless Networks across Uganda with Telecenter representatives.

IT +46 have used two main methodologies in order to reach these goals:

### 5.1 Online remote technical and strategical advice

IT +46 has provided 18 months of online remote support in terms of planning, procurement, strategic and technical advice. During intense periods, IT +46 has also lead or participated in weekly online meetings with the Uganda team in order to steer the project in the right direction and keep a good pace.

The online remote support has worked satisfactory most of the time. During certain periods, the Internet access has been restricted at the Makerere University and the communication between IT +46 and CWRC has been poor.

However, the methodology itself of using remote support has worked well for many tasks that has not required IT +46 to be on site in Uganda.

### 5.2 On-site training workshops

During the 18 months, IT +46 has provided a total of 4 weeks on-site training to CWRC staff and Telecentre representatives. The training has included both theoretical and practical training with a focus on the final implementation of the Community Wireless Networks.

The mix of remote support and on-site training has been a good combination for this kind of project. Monthly conference calls with the team would have been favorable to keep the pace which sometimes dropped during certain academic periods or when connectivity was poor.

## **6. Conclusions and Way Forward**

We can conclude that the overall objectives of the CWRC project has been achieved and the fact that three Community Wireless Networks has been established by the CWRC team is a good proof of that. Although the Community Wireless Networks are not quite completed yet, the hardest work has been done and some polishing is left to be done.

We kindly encourage IDRC to support the completion of the Community Wireless Networks by supplying the CWRC with the supplementary funding requested to complete the final task and support the formal establishment of a Community Wireless Resource Center.

If the networks are not finalized with the basic network services installed, proper lightening protection provided and solutions to existing shortcomings provided, the overall impression and reputation of the project from the general public will be damaged.