

it⁺46

Guidelines for the deployment of the

Kachwekano CMC Community Wireless Network



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1. Introduction

This document includes a set of practical guidelines for the installation of the Kabale Community Wireless Network. As the Kabale network consists of far longer links than Lira and Nabweru networks required, the alignment of access point and clients units is more important now. Also, the antennas that will be used in Kabale are sectoral antennas in contrast to the omni-directional antennas that were used in Lira and Nabweru. This implies that the antennas needs careful alignment in order to serve the designated area.

Furthermore, the documents includes a section about the evaluation of the quality of a wireless link. While sending Ping packages between two wireless host only shows that the link is up, there are other means to determine the throughput of a link and its stability.

2. Preparations

2.1 *Testbed setup*

Setup the full network in your lab including the repeaters needed in Kabale town. Decide all IP addresses and subnetworks before the departure to the site.

Always bring extra equipment to the site in case that you experience problems with any of the units.

Regarding the choice of running the client units in *Routing* mode or *Client* mode, we suggest that CWRC continue using Client mode as in the cases of Lira and Nabweru. The advantages of a fully routable network is that you can apply traffic shaping and block services and stations per unit basis instead of on a NATed network basis. Using NAT implies one visible entity towards the router with independence of the number of units behind the NAT.

Since a NATed network is easier to install and run than a routable network, we suggest that you continue using NAT.

2.2 *Long Distance Parameters*

Study the documents that describes the advanced settings for long distance links that the SmartBridges equipment support.

The document is available at:

http://www.it46.se/projects/ug1/C2/wireless_performance_parameters

2.3 *Selection of partners for Phase 1*

We suggest that you start implementing the Lake side since it includes only a handful of partners and no repeaters are needed.

It is recommended that you start with the partner that is located closest to the tower (Kalebas, according to November 2006 survey). In that way, you can make sure that the sectoral antenna is correctly aligned vertically. If the access point in the tower is too little tilted, Kalebas will not be within the coverage area (see next section for more information).

3. Installation of tower equipment

3.1 *Antenna alignment*

In contrast to an omni-directional antenna, a sectoral antenna needs careful planning and preparations to achieve correct vertical and horizontal alignment in order to provide coverage to its intended clients.

3.1.1 Vertical alignment

When calculating the vertical alignment you must know the following:

1. Difference in height between access point and client units
2. Distance (horizontal) between access points and clients units

For the Lake Side of the Kabale Network, the following values are valid:

Client	Altitude [m]	Difference [m]*	Distance [km]**
Kachwekano CMC*	2142		
Bushara Island Camps	2012	130	4,1
Amagara Byoona	1980	162	5,1
Edirisa	1973	169	2,5
Kalebas	1958	184	1,5

Table 1: Altitude and distance to Kachwekano CMC for each client belonging to the Lake side.

* Difference in altitude In comparison to the Kachwekano CMC

** Horizontal distance between Kachwekano CMC and the client.

For the calculations, we have used an average value of the two last clients (Edirisa and Kalebas) which are located closest to the tower and also has the lowest altitude.

Average difference in altitude between Kachwekano and Lake side clients: 175 m.

Height of tower: 45 m

Total difference: 175m + 45m = 220m

In Table 1, we can see that the partners are located between 1,5 to 5,1 km away from the Kachwekano CMC. By tilting the antenna vertically, we must make sure that we obtain a coverage area that includes all partners.

The three images below show the coverage area for the *SmartBridges AirPoint Nexus PRO Total* (vertical beam width of 17°) with a vertical alignment of 0° (totally horizontally mounted), 5° and 10°.

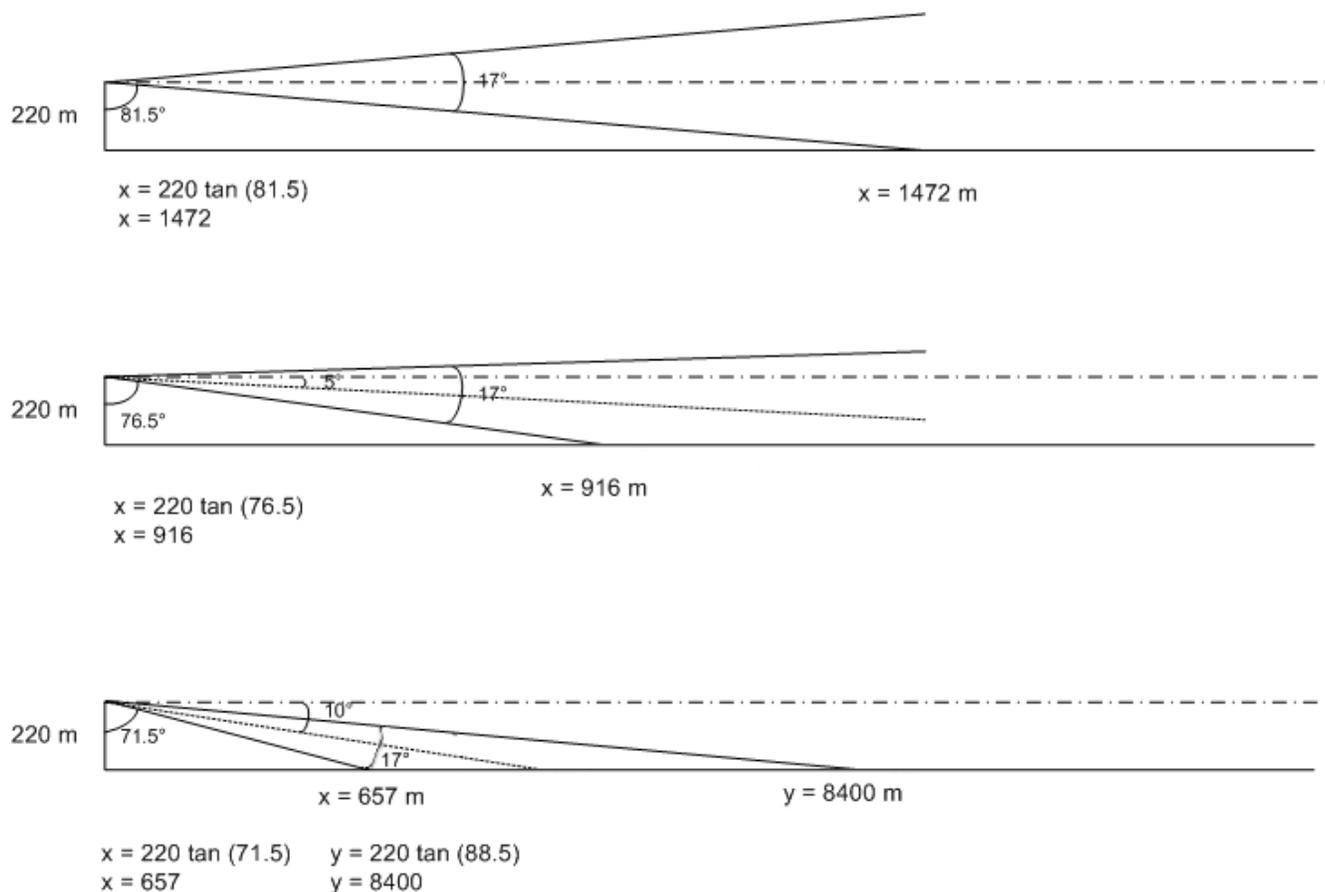


Image 1: Coverage area of a SmartBridges AirPoint Nexus Pro Total with a vertical tilt of 0, 5 and 10 degrees.

- The *dotted and dashed* line corresponds to the horizontal.
- The *fine dotted* line represents the vertical center of the beam.
- x is the shortest horizontal distance (from the tower to a partner) that the access point will provide coverage.
- y is the longest horizontal distance (from the tower to a partner) that the access point will provide coverage.

The first example with 0° alignment gives an x of 1472m which is too tight for Kalebas which is located 1500m from the tower.

The second and the third example (5° and 10° alignment) provides a coverage area that includes all potential partners.

In summary the access point in the tower should be mounted with a vertical tilt (facing down) of approx. 5-10°.

To facilitate the alignment of the access point while being up in the tower, a paper with the correct angle drawn should be prepared in advance.

3.1.2 Horizontal alignment

Furthermore, the access point needs to be aligned horizontally. To obtain the correct horizontal alignment the location of all clients must be known.

The image below shows that the center of the sector should be in the direction of Edirisa, slightly to the east of Edirisa to be exact. When installing the access point, it is important that the climber is familiar with the position of Edirisa in advance (with the help of local staff), so that the access point gets correctly aligned.

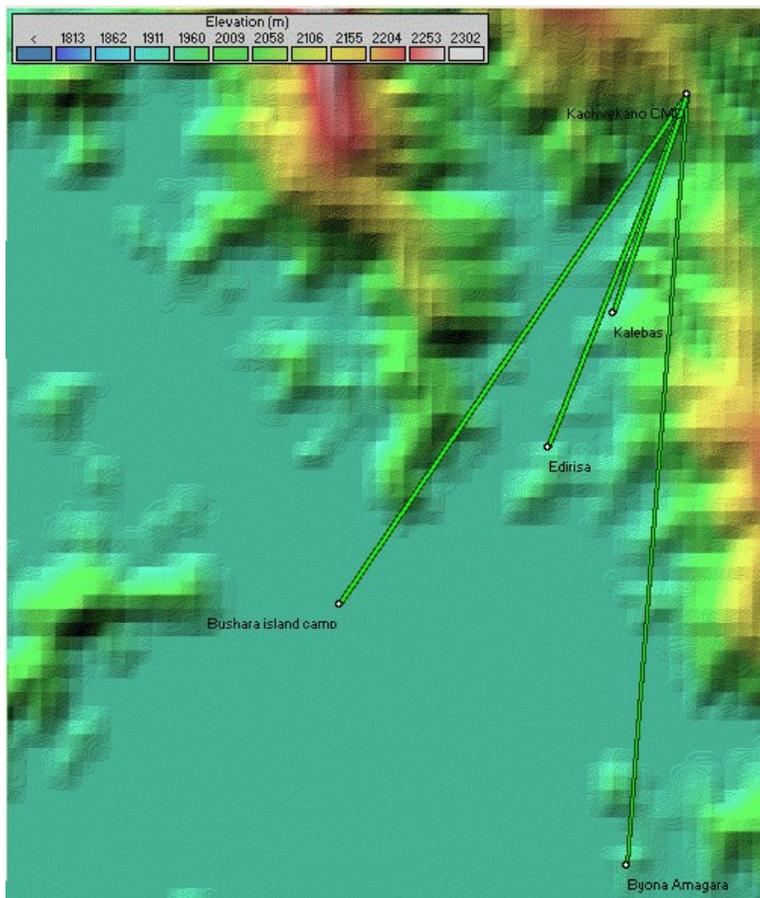


Image 2: Distribution of the Lake side clients. The center of the sector should be slightly east of Edirisa.

3.2 Practical tips

When preparing the Ethernet cable that should run between the Access point in the tower and the switch in the Kachwekano CMC, estimate carefully its required length (use measuring rod) and add some extra meters as a margin. Crimp both ends (aim for perfection here!) and test it before you pull it up in the tower.

Use cable ties to attach the cable to the tower structure in order to reduce the tension in the cable.

4. Client installation

When installing the client unit it is important to identify the optimal location for the equipment to provide a stable wireless link. When identifying the ideal location of client radio, start by using a laptop with an external antenna attached to it. Use *Netstumbler* or similar software to locate the spot with highest signal level.

Many wireless client units provide a built in "antenna alignment" utility that facilitates the alignment of the radio. However, Compex does not provide such a functionality and hence, we must find other means to achieve correct alignment.

The Smartbridges AirPoint unit monitors all associated client units and presents them with MAC address, RSSI and and bit rate for uploaded/downloaded data. By logging in to the AirPoint unit (can be done via a laptop connected to the client unit and remotely accessing the Access Point from a client's premises), the antenna can be aligned.

Association Table					
Index	MAC Address	RSSI (dBm)	Upload (Kbps)	Download (Kbps)	
1	00:30:1A:28:F9:EA	-35	30720	30720	Link Status

 Indicates WDS Link **Refresh**

(Data will refresh automatically after every 30 seconds)

Image 3: Association table in the AirPoint unit with signal level for each associated client.

When aligning the antenna, move the client unit slowly in horizontal and vertical direction to find the optimal position. To not move too fast as you need to refresh the association table to obtain a new value.

Take notes of signal level (RSSI) for each link. The recommended minimum RSSI is -75 or higher for a stable link.

To test the throughput, prepare the router at Kachwekano CMC with a large file and download it through the wireless link from the client's premises. Take notes of download rates.

5. General hints

- Ensure water tightness in general, especially for the Ethernet joint at the Access Point (in the tower) and the indoor client units.
- Make sure that all partners has a good protection for thunder as it was reported to be a big problem in the area.
- Always use a UPS connected to all active equipment.
- Be aware of the sensibility of the *SmartBridges* units during boot up session. Never interrupt a SmartBridges unit during a boot up sequence. This can lead to fatal damage of the unit.
- Take notes of client installations that you are experiencing problems with so that we can focus on them during the September workshop.