

# **College of Medicine Campus Network and Wireless Project for Research and Educational Networking in Malawi**

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# Internet Services at CoM

- Internet Connection is through MALICO VSATs
- Academic institutions consortium was formed to buy aggregate bandwidth to mitigate high prices
- Internet provider is Taide Networks AS in Norway



# MALICO VSAT SITES

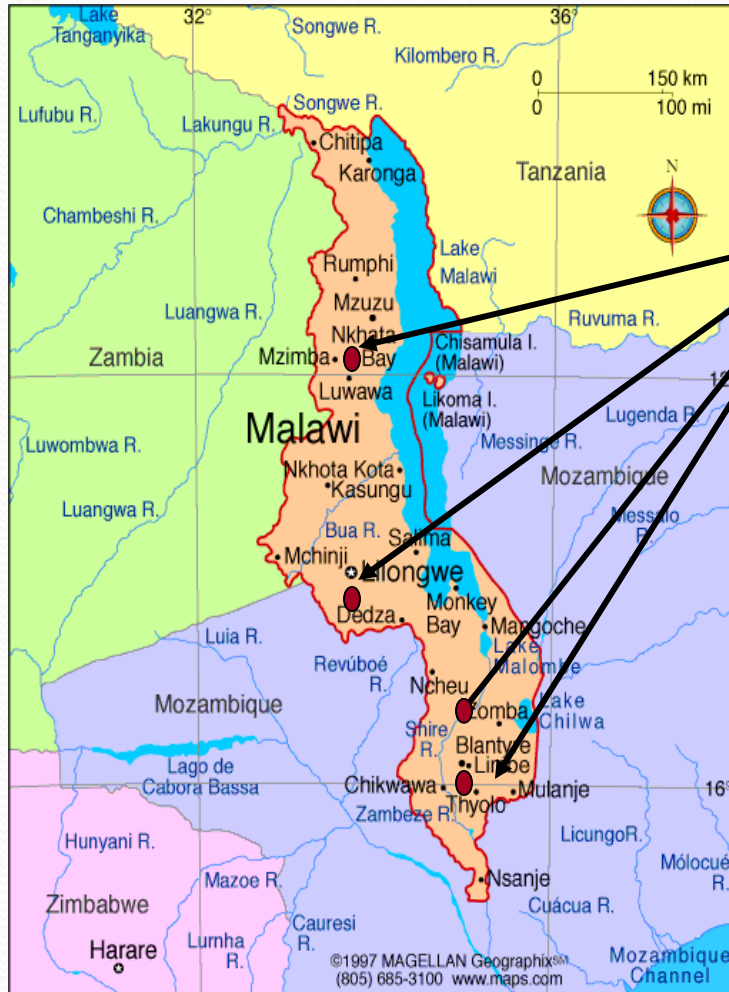


Image by CSIR

**Mzuzu University**

**University of Malawi:**

**Bunda College of  
Agriculture**

**Chancellor College**

**College of Medicine**

# Internet charges

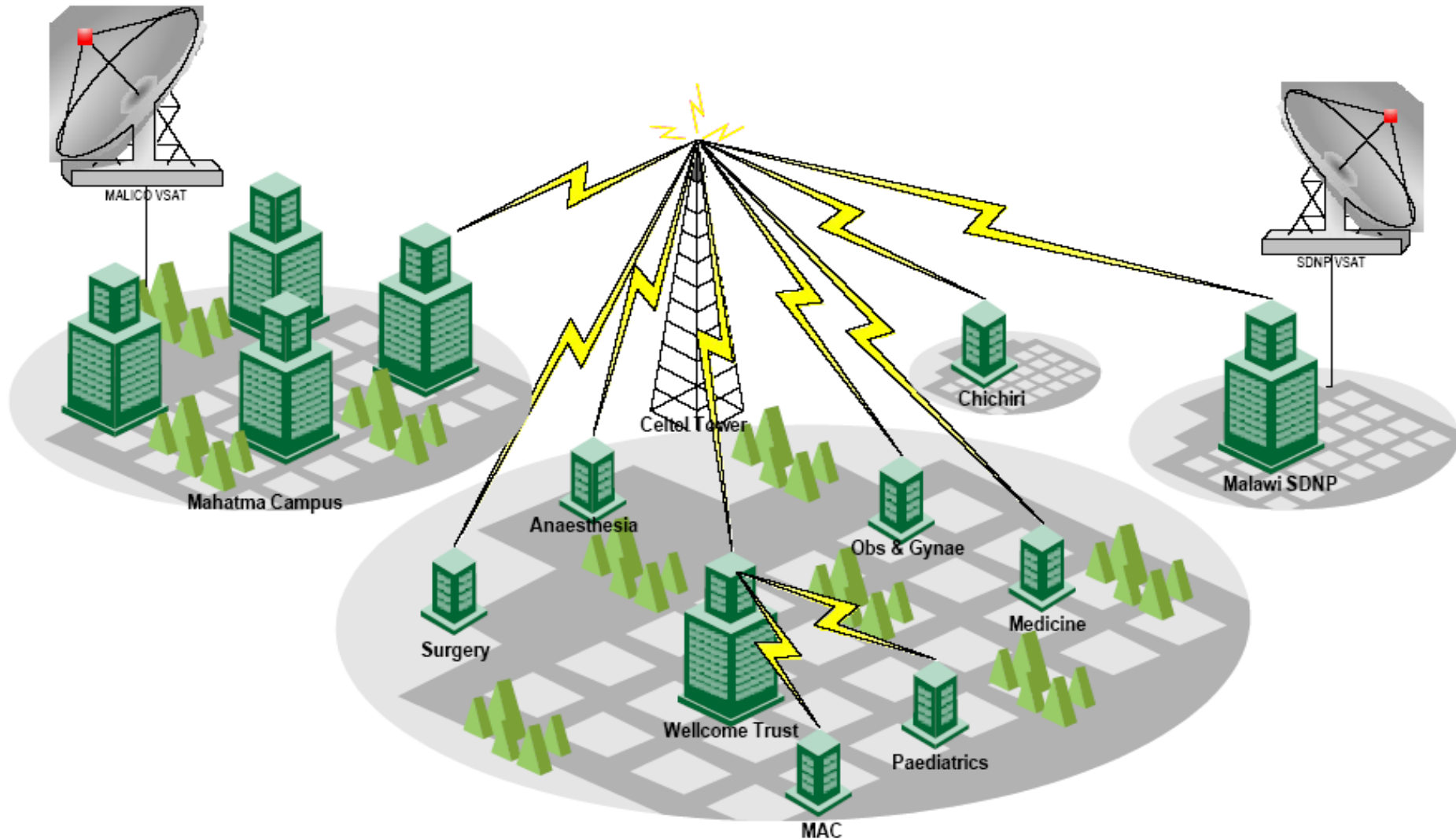
- Internet charges are at \$3000/MB and \$4000/MB for downlink and uplink respectively
- Currently the overall bandwidth capacity of internet via the VSAT link 1.5MB down and 0.5MB up
- Optimised downlink, 3:1 ratio to uplink
- This capacity is serving a community of over 1200 people, which includes faculty, researchers, students and staff.



# Network Design

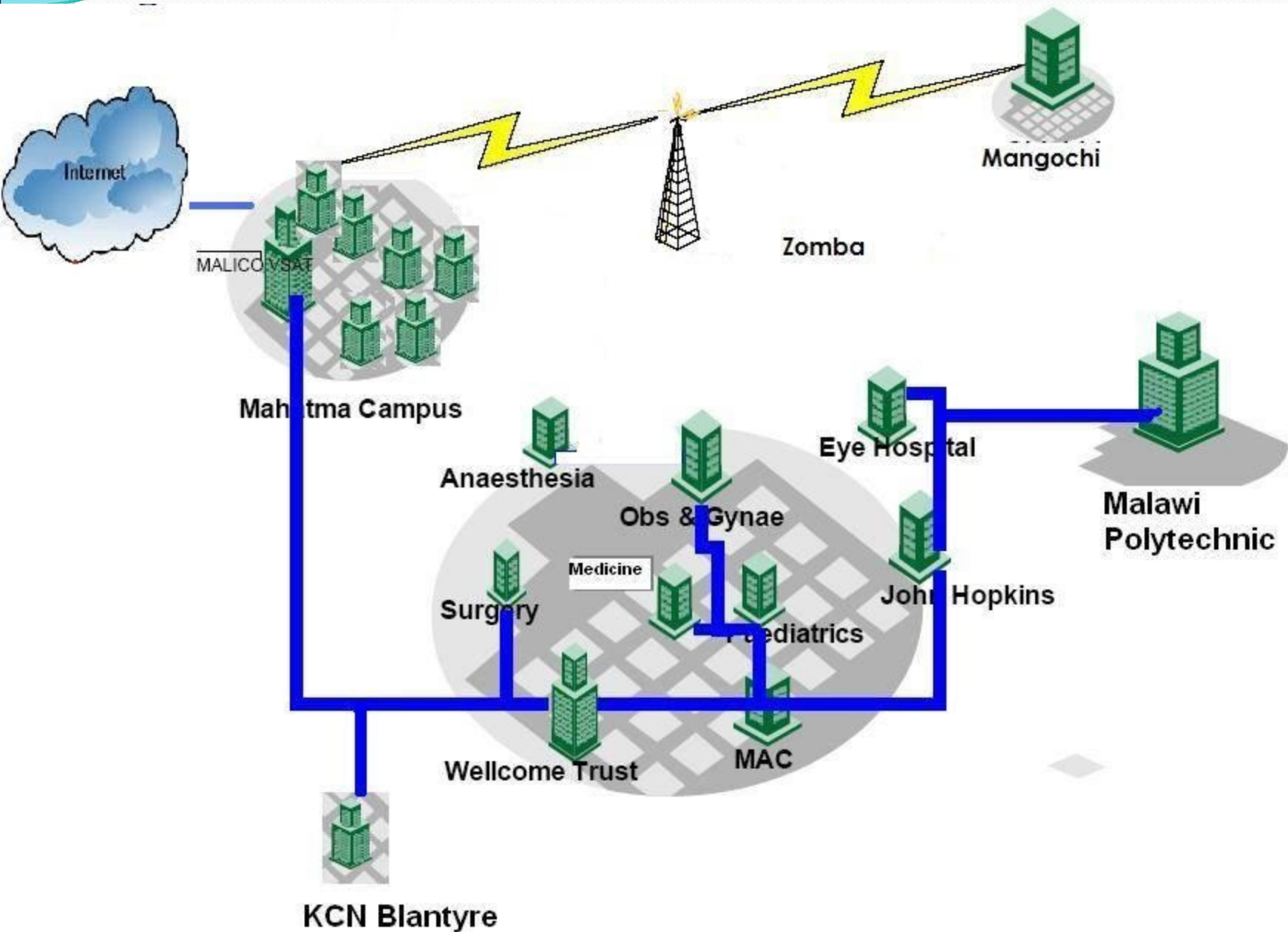
- Actively switched daisy fiber chain, (redesign and implementation in progress)
- Each site node has an active node, and requires a switch, a fibre distribution frame and a transceiver for each fibre cable that connects the node
- Traffic not destined at each switch is relayed to next.

# Network Setup



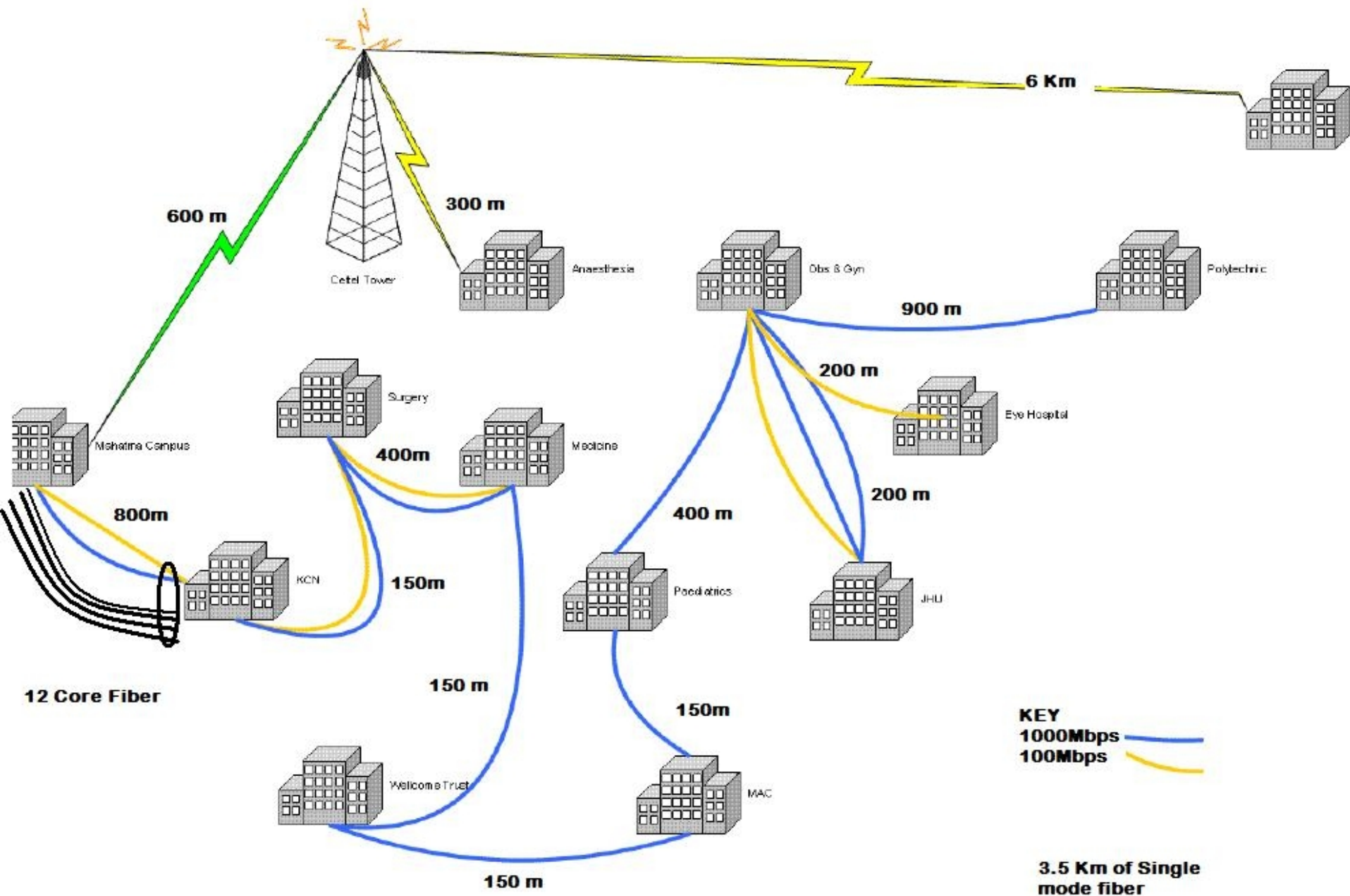
The Tower acts as the base station for the COM wireless network. There is one 18 dbi omni-directional antenna covering the Hospital area at 4.5 Mbps.

# INSTALLED NETWORK

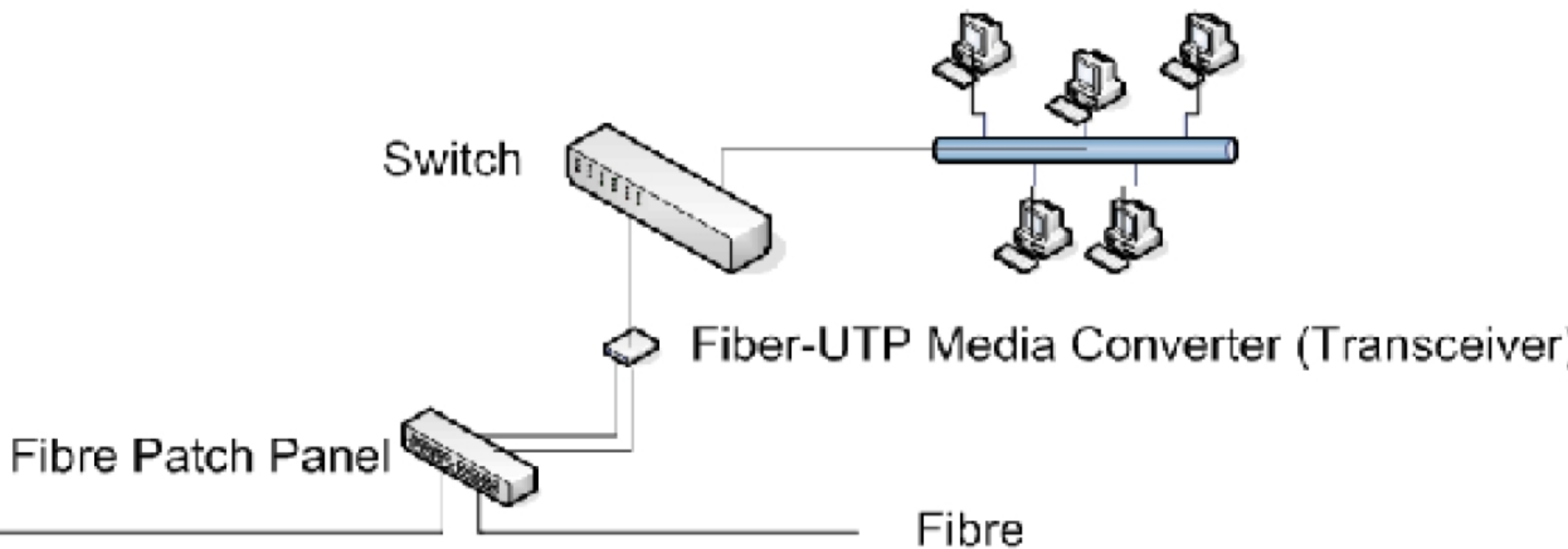


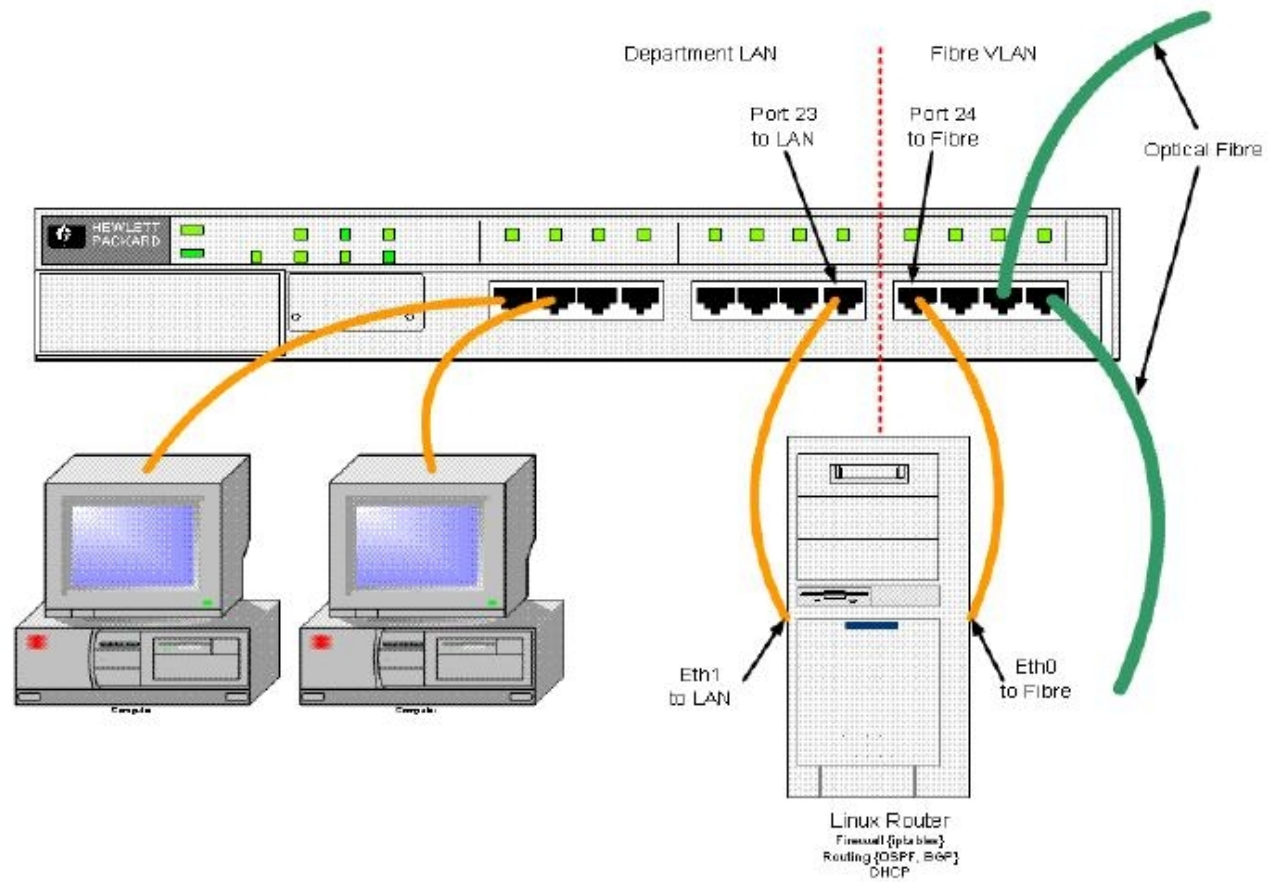


# CoM Fiber Map





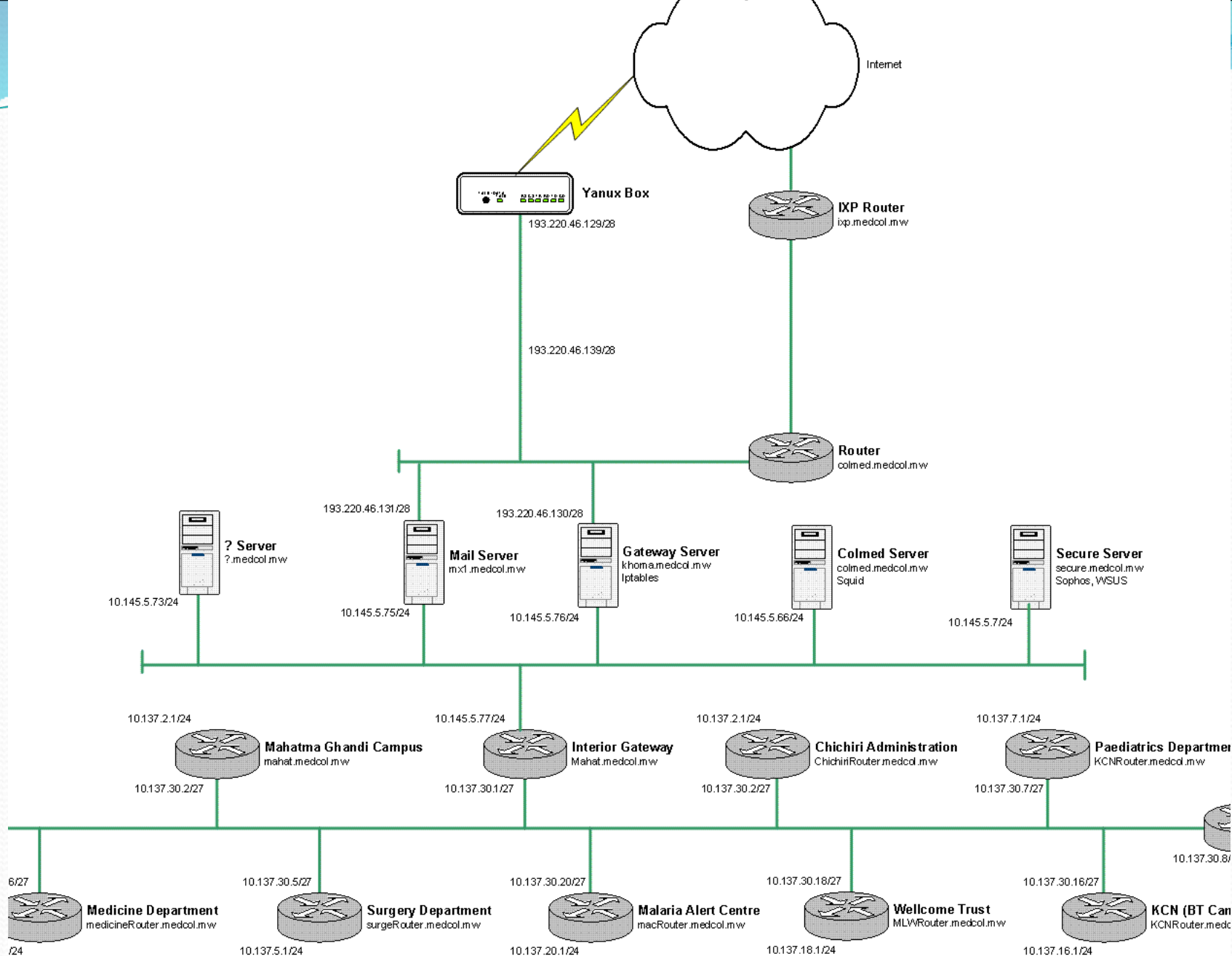








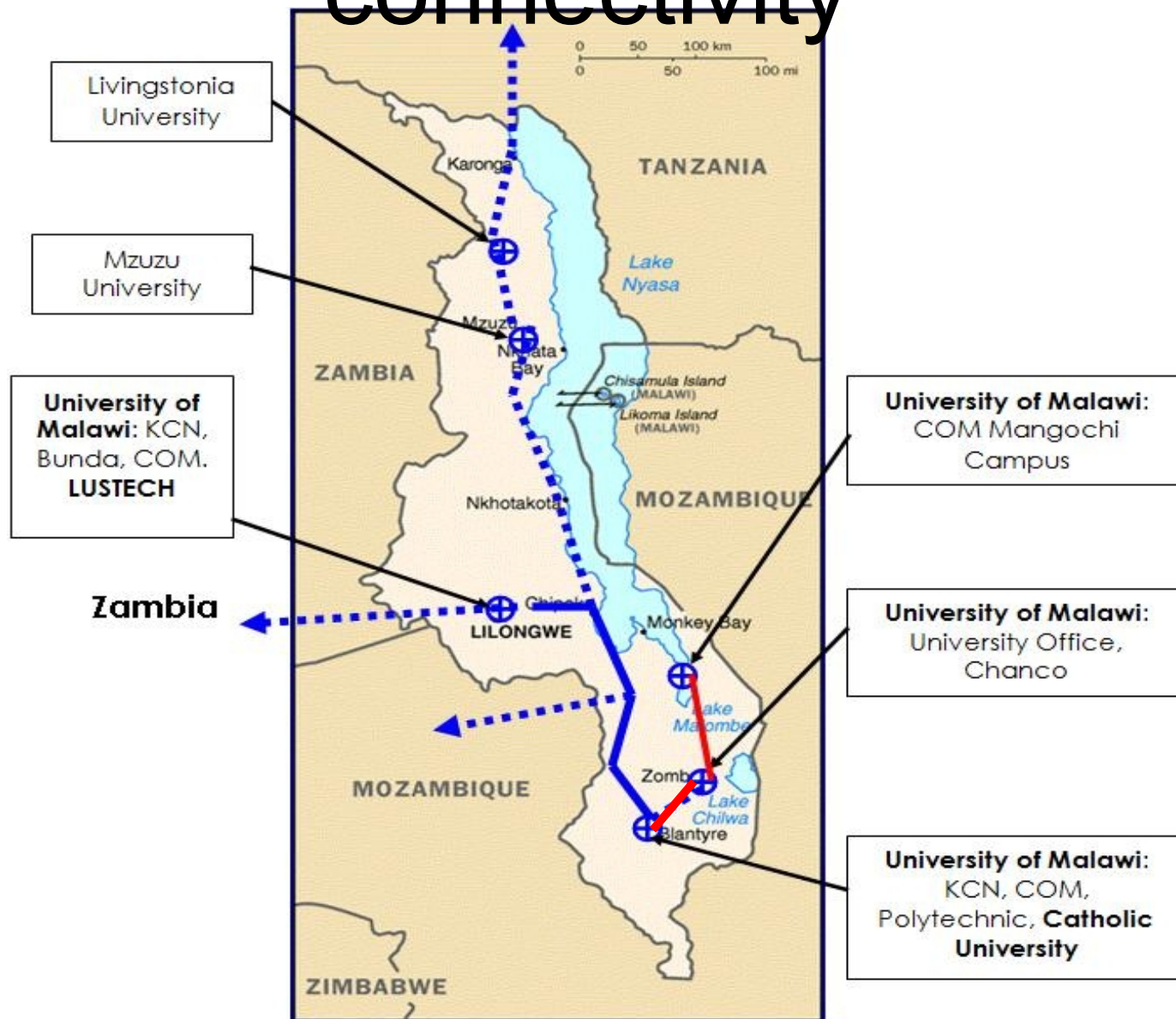




# Long Distant Wi-Fi To Mangochi

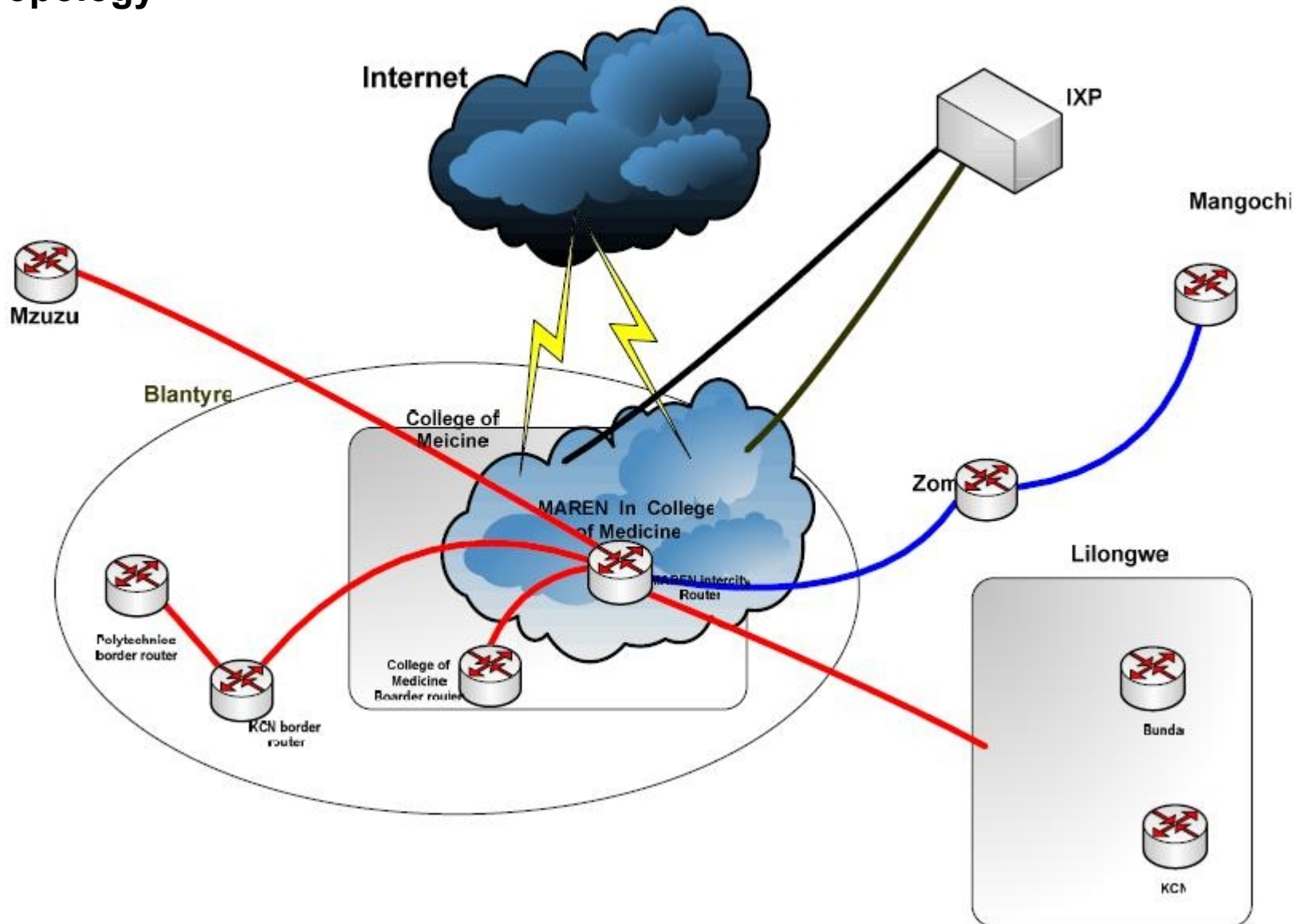
- Limited connectivity through telephone lines, intermittent availability between sites for the delivery of medical education and other bandwidth intensive applications.
- Fiber not widely deployed at moment and years to come
- Rural areas are under-served
- WiFi Costs are generally low
- Less susceptible to theft, flash floods, and low environmental impact
- WiFi has quick deployment

# WiFi solution Inter-institutional connectivity





# Research & Education Network Topology



# Necessary Ingredients

- Conducive regulatory environment - Working with **MACRA**, for harmonious regulatory conditions for academic connectivity

**MACRA**

**MALAWI COMMUNICATIONS REGULATORY AUTHORITY**

Ref.: ICS - 04 Licence No. 010875

**International Connectivity Services (ICS) Licence**  
for International Gateway Services

This Licence is issued subject to the provisions of the Communications Act No. 41 of 1998, Regulations and Guidelines made thereunder.

This Registration is issued by the Malawi Communications Regulatory Authority to:

**MALAWI RESEARCH AND EDUCATION NETWORK (MAREN)** ( the Licensee )  
University Office  
University of Malawi  
Box 278  
Zomba

for the purpose of

carrying educational and research data as an International Gateway Licensee.

This licence permits MAREN, represented by the University of Malawi, to set up, own, maintain and operate the International Gateway by engaging in the activities to connect non-profit Academic Research and Tertiary Education entities in Malawi with high capacity communication services including the right to internationally connect to corresponding National Research and Education Networks (NREN's) in other countries.

Valid for the period of: Five (5) Years

Licence fees: 0.00 (exempt)

Effective Date:

Expiry Date:

This licence comes into effect on the date that it is published in the Gazette and is valid for a period of five (5) years from that date.

The Licensee shall at all times display the Licence in a conspicuous place at the Licensee's offices.

Issued at Blantyre, this \_\_\_\_\_ day of \_\_\_\_\_ 2007

**Mrs. N.H. NSEULA**  
Board Chairperson

**Dr. A. CHIWAYA**  
Director General



# Necessary Ingredients



International Collaboration with ICTP  
for financial support for  
equipment and technical  
expertise

*The Abdus Salam*  
**International Centre**  
**for Theoretical Physics**

- The project received funding from the Regional Government of Regione Friuli Venezia Giulia (Italy) and the Abdus Salam International Centre for Theoretical Physics – ICTP (Italy).

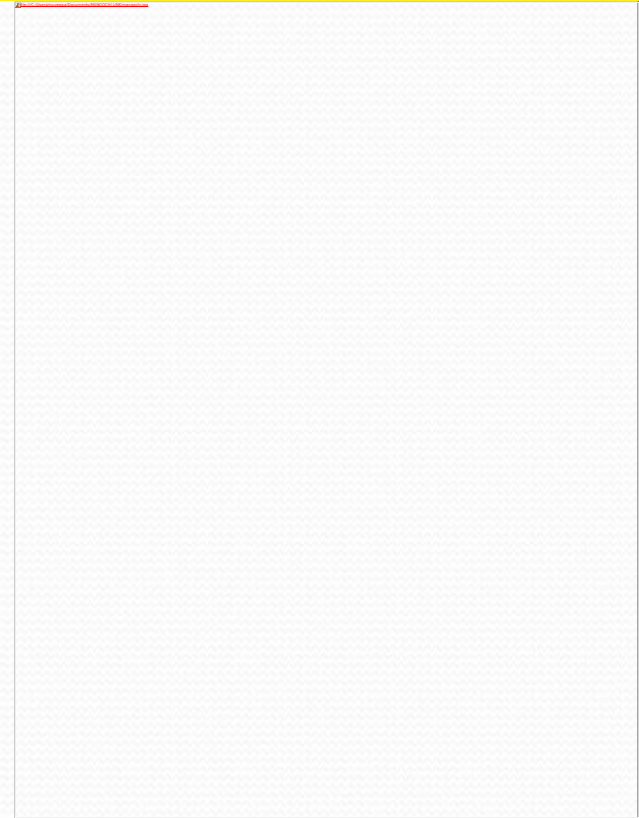


# Necessary Ingredients



Malawi Telecommunications Limited

- Negotiation with MTL to access metro fibre, towers, and ducts in a symbiotic relationship
- Availability of local enthusiastic and committed human capacity to support the link via ICTP training
- Local support from the host institution



# Necessary Ingredients

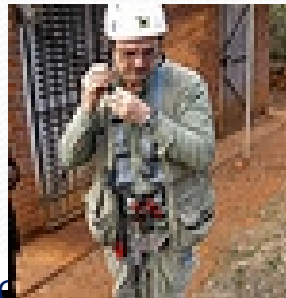
- Working with Malawi Revenue Authorities to obtain a waiver of custom duty for the project equipment
- Similar waivers were given for the VSAT equipment





# Activities Lined Up

- Site survey: all the sites, data collection, interferences, GPS coordinates, antenna heights for simulation





# Work Begins









# Unpacking and Getting started

## CoM Lab



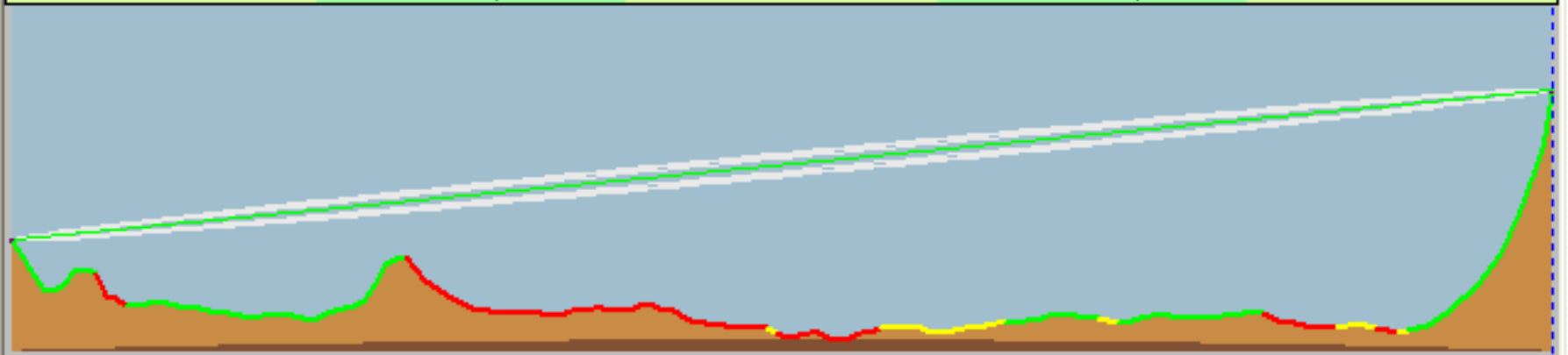


# Arial View of sites



Edit View Swap

Azimuth=21.5°	Elev. angle=0.396°	Clearance at 13.98km	Worst Fresnel=9.3F1	Distance=54.81km
PathLoss=152.2dB	E field=63.2dBμV/m	Rx level=-65.2dBm	Rx level=123.03μV	Rx Relative=41.8dB



#### Transmitter

S9+20

Mpingwe Hill

Role	Master		
Tx system name	System 1		
Tx power	10 W	40 dBm	
Line loss	0.5 dB		
Antenna gain	24 dBi	21.85 dBd	+
Radiated power	EIRP=2.24 kW	ERP=1.37 kW	
Antenna height (m)	10	Apply	

#### Receiver

S9+20

Zomba Peak

Role	Slave		
Rx system name	System 1		
Required E Field	21.44 dBμV/m		
Antenna gain	24 dBi	21.85 dBd	+
Line loss	0.5 dB		
Rx sensitivity	1 μV	-107 dBm	
Antenna height (m)	10	Apply	

#### Net

Mpingwe - Zomba

#### Frequency (MHz)

Minimum	Maximum	Apply
5100	5800	



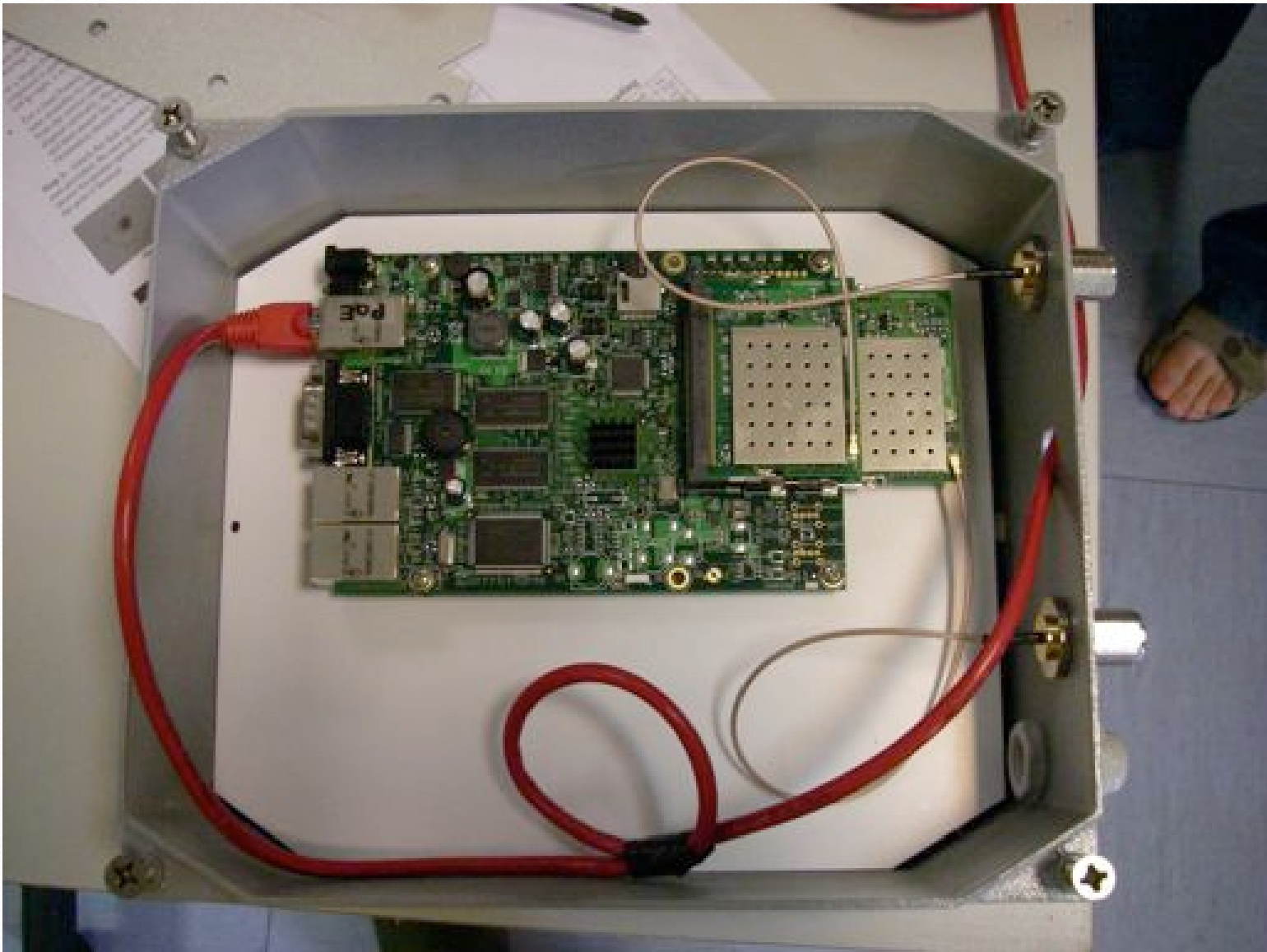
# Dual Polarity Parabolic High Performance Dish Antennas - 4000 to 5875 MHz Operation



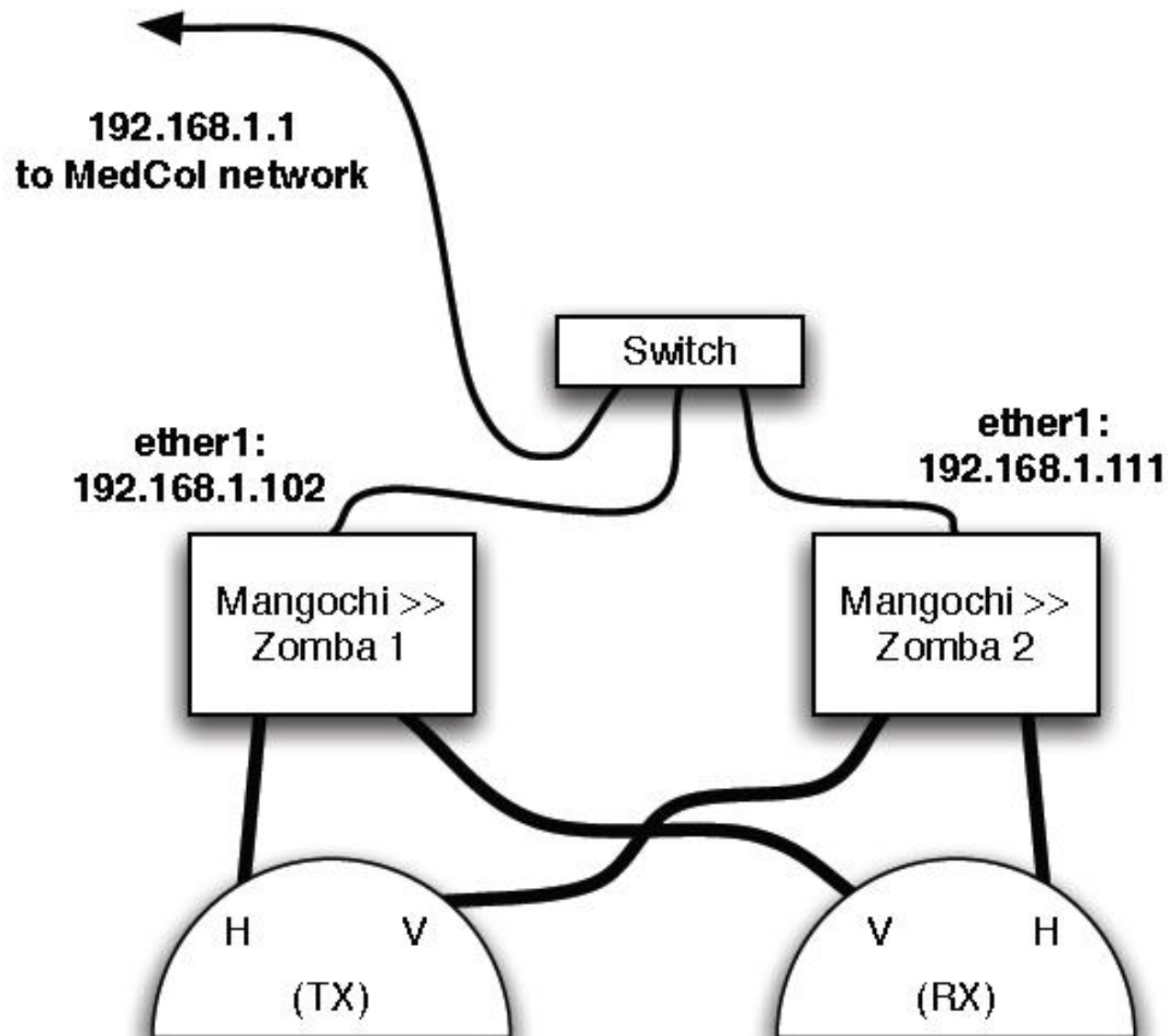




# Mikrotik Router Board



# NETWORK CONFIGURATION









# Break Time

- Chambo Treat







## Bandwidth Test

Test To: 192.168.1.104

Protocol: ☒ udp ☐ tcp

Local UDP Tx Size: 1500

Remote UDP Tx Size: 1500

Direction: both

Local Tx Speed:  ▼ bps

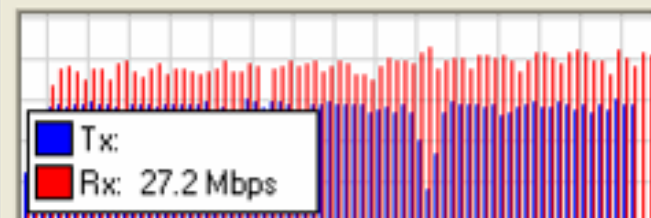
Remote Tx Speed:  ▼ bps

User: admin

Password:

Tx/Rx 10s Average: 19.1 Mbps/27.0 Mbps

Tx/Rx Average: 17.5 Mbps/24.0 Mbps

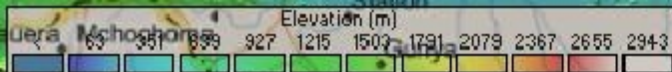


stopped

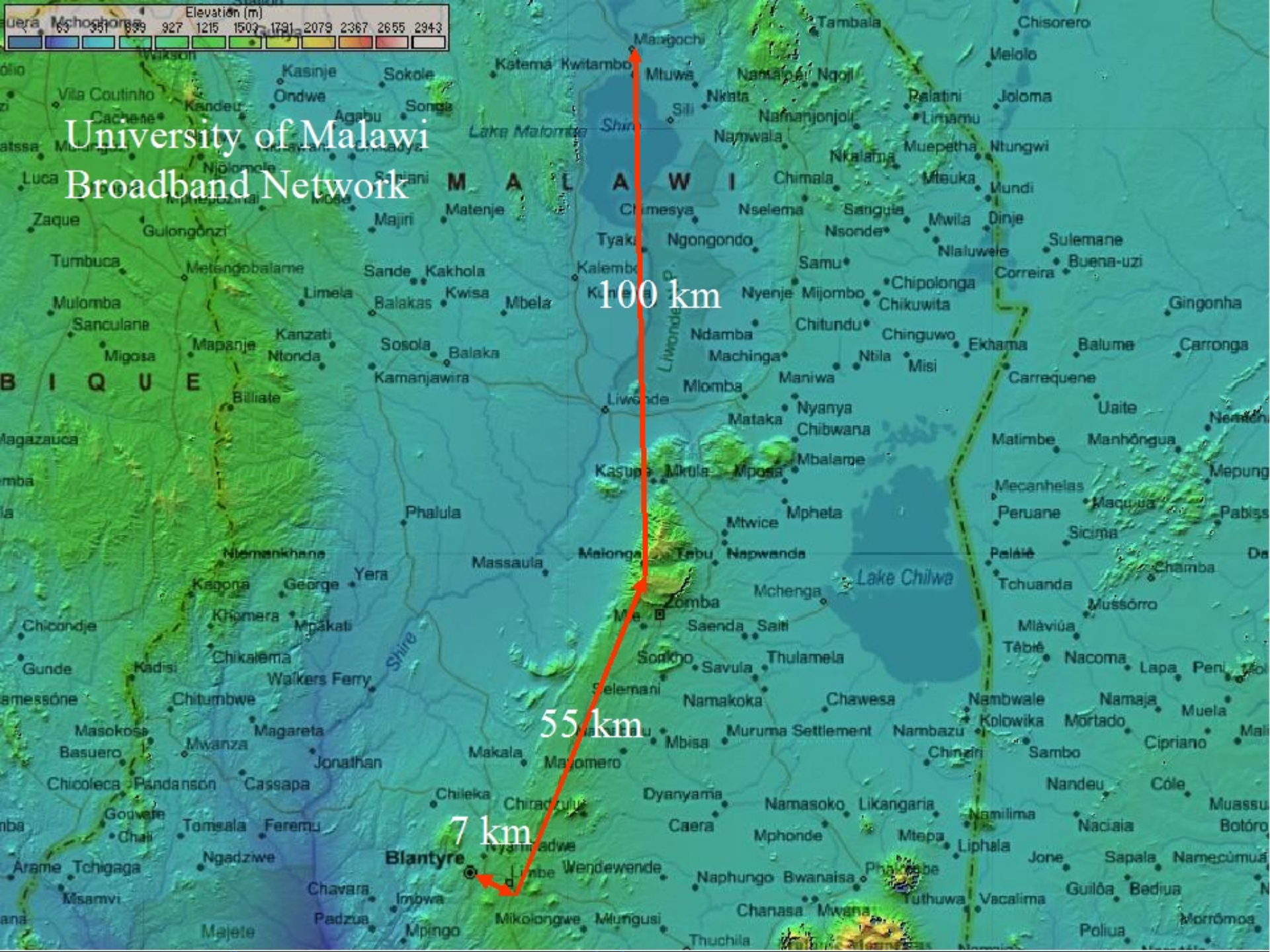
Start

Stop

Close



# University of Malawi Broadband Network





Mangochi

Azimuth=177.2°	Elev. angle=1.355°	Clearance at U.64km	Worst Fresnel=1.6%1	Distance=99.76km
Path Loss=152.2dB	E field=55.0dBμV/m	Rx level=-66.2dBm	Rx level=109.5543μV	Fx Relative=16.7dB

Zomba Peak

100 km

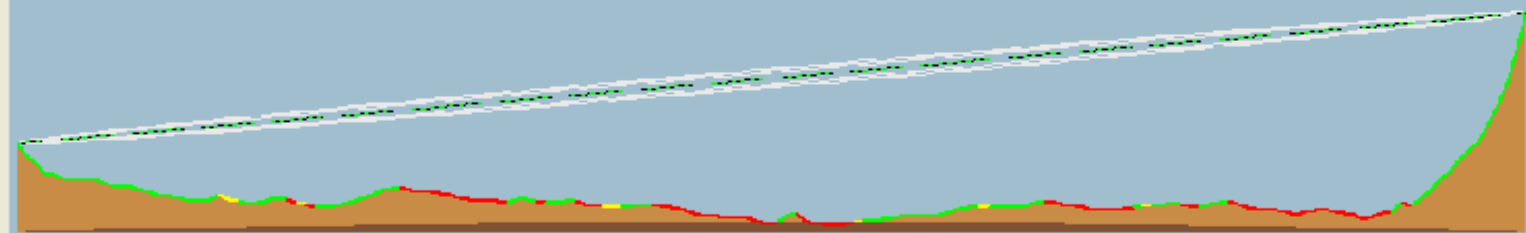


Mpingwe

Azimuth=271.0°	Elev. angle=0.510°	Clearance at U.05km	Worst Fresnel=2.0%1	Distance=54.01km
Path Loss=148.1dB	E field=62.0dBμV/m	Rx level=-60.1dBm	Rx level=220.6430μV	Fx Relative=22.8dB

Zomba Peak

55 km



Evans Hills

Azimuth=88°	Elev. angle=0.77°	Clearance at U.05km	Worst Fresnel=2.0%1	Distance=7.04km
Path Loss=29.5dB	E field=68.8dBμV/m	Rx level=-42.1dBm	Rx level=21.846μV	Fx Relative=20.8dB

Evans

7 km

