

White spaces scanning : a step towards rural connection in Malawi

Issues, need and challenges

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Layout

- Introduction
- Plan - what we intend to do and why
- What's done already?
- What's next

Malawi...

- Population pre-dominantly rural (85%)
- Less internet users but rapidly growing
 - 0.15% in 2000
 - 0.4% in 2005
 - 4.7% in 2009 (UN-Data)
- Very little connectivity in rural areas

Need continued

- Reaching out and connecting institutions
 - » Governmental
 - » Academic
 - » Research
 - » Community



- Source - <http://www.intercare.org.uk/health-centre/malawi/pirimiti-health-centre>

The plan

- Deploy a wireless network using TV white spaces
- Connect government institutions in rural areas
- Connect Research Institutions and Community Hospitals

Collaboration

- e-CRG



- University of Malawi



- MACRA



- ICTP (T/ICT4D)



Why white spaces?

- Most other ways expensive
- No Coverage (GSM)



Continued...

- Show case
- exploited for other data handling applications independent of internet traffic
 - » linkage of radiology labs to referral hospitals
 - » electronic database and management systems
- MACRA involved – permission and support!
- Very few TV stations in Malawi – no vigorous scanning needed

Where we scan - Cost-effective

- Relatively cheap equipment - RF Explorer (can analyze 240 MHz – 960 MHz)



Equipment continued....

- GPS Receiver



- Laptop (running Linux and bash scripts)

The Scripts – capturing frequencies

```
[Chat with Kas <+26588176...  Inbox (213) - martthodi238...  Terminal - martin@localhos...  
Terminal - martin@localhost: ~/Documents/ecrg_code/changed/Zomba  
File Edit View Terminal Go Help  
#!/bin/bash  
  
count=1  
  
while :  
do  
  
# Measure Latitude  
  
latitude=$(gpspipe -w -n 5 | grep -m 1 TPV | cut -d, -f4,6-8,13 | cut -d, -f3)  
echo $latitude  
  
sleep 2  
  
# Measure Longitude  
  
longitude=$(gpspipe -w -n 5 | grep -m 1 TPV | cut -d, -f4,6-8,13 | cut -d, -f4)  
echo $longitude  
  
sleep 2  
  
# Measure Time  
  
dmeas=$(date)  
echo $dmeas  
  
sleep 2  
  
# Measure spectrum  
  
./rfexplorer /dev/ttyUSB0 024000000 0300000 050 120 $count  
mv $count data/200/$count.txt  
echo $latitude >> data/200/$count.txt  
echo $longitude >> data/200/$count.txt  
echo $dmeas >> data/200/$count.txt  
  
sleep 5  
  
./rfexplorer /dev/ttyUSB0 0300000 0400000 050 120 $count
```

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martin

```
[Chat with Kas <+26588176... Inbox (213) - martthodi238... Terminal - martin@localhos...
Terminal - martin@localhost: ~/Documents/ecrg_code/changed
File Edit View Terminal Go Help
#!/bin/bash
#####
#
# TO DO: convert data to .csv file
#
#####

day="2012-09-12" #one part of the date (doesn't change)...will be concatenated with the time
work_dir=./400/cafe
cd $work_dir
category="400MHz-500MHz" #initialize to this and change accordingly...tricky one this one :)
count=1
number_files=$(ls | wc -l)
date=$(tail -1 $count.txt | cut -c11-18)
incident_date="$day $date"
lat=$(cat cafe.txt | grep lat | cut -c7-19)
lon=$(cat cafe.txt | grep lon | cut -c7-19)

while [ $count -lt $number_files ]
do
    lines=0
    cat $count.txt | while read LINE
    do
        let lines++
        max=113
        if [ $lines -lt $max ]
        then
            freq=$(echo $LINE | cut -c1-9)
            signal=$(echo $LINE | cut -c11-20)
            echo "\"$freq $signal\", \"$incident_date\", \"$category\", \"$lat\", \"$lon\"" >> testdata.csv
        fi
    done
    #echo $count
    let count++
done
#pwd
#echo $date
#echo $latitude
```

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Some proposed sites

Rural Community Hospital



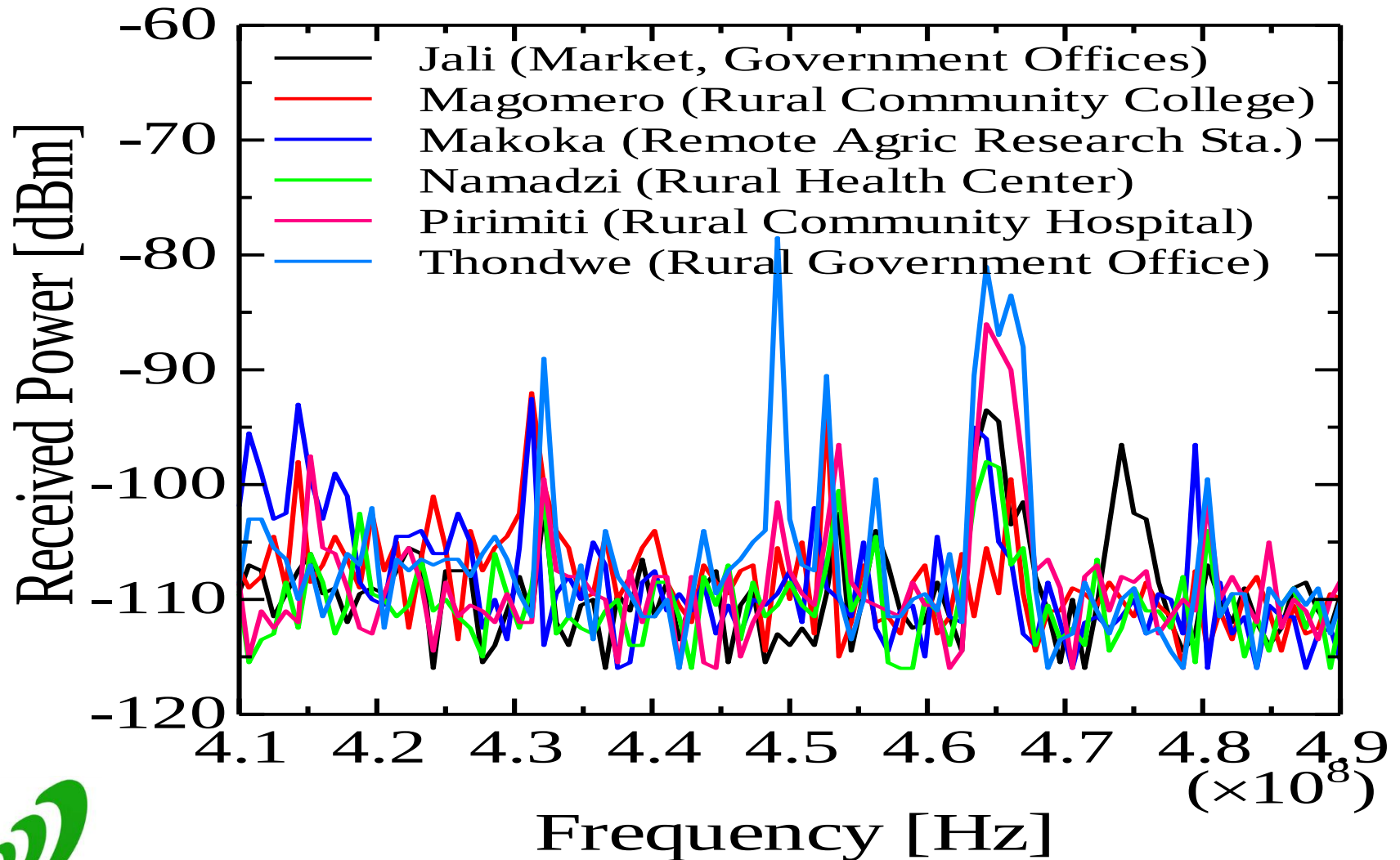
Rural College



At Magomero...better off?



Some outputs



Analysis

- Most frequencies idle in most places
- **Malawi has less TV stations most with less coverage**
- National TV station MBC, and other private broadcasters are switching to digital – with 31 December, 2013 as deadline

What happens next?

- Deploy wireless network – using Rural Connect White Space Broadband Radios (Carlson Wireless)
 - » No line of sight required
 - » Use un-congested band



Continued...

- five different sites - leverage optic fiber cables to extend the network further
- Great start of coverage

Challenges

- Devices must be rugged/robust
- Power
- Research assistance from students (leaving)
- Need for dedicated devices in some cases
- Community involvement not as expected



The end