UbuntuNet-Connect 2014

UNIVERSITY OF JOHANNESBURG

Successful deployment and key applications of Television White Space Networks in Malawi

by

Jonathan Pinifolo

MACRA
Promoting Universal ICT Access

Lusaka, Zambia

UNIVERSITY OF JOHANNESBURG

PRESENTATION OUTLINE

- Introduction
- Network design
- Interference Calculation
- Network Performance Analysis
- Applications at Seismology Unit
- Conclusion

QUOTATION

"Everyone, everywhere should have the opportunity to participate

…..no one should be excluded from the benefits of the information society offers."

The WSIS Declaration of Principles,2003,item #4

MACRA
Promoting Universal ICT Access

UNIVERSITY OF JOHANNESBURG

INTRODUCTION

- Successful deployment and key applications with their social impact of the Malawi TVWS pilot project is presented

- Utilization of service sharing within frequency bands is one of the alternatives that can be deployed for spectrum efficiency.

- TVWS network has been deployed during the pilot phase of this project at the following selected sites; Saint Mary's Girls Secondary School, Pirimiti Rural Community Hospital, Malawi Defense Force Airwing and Geological Survey department.

MACRA
Promoting Universal ICT Access

UNIVERSITY OF JOHANNESBURG

COLLABORATIVE CONSUMPTION

INTRODUCTION Cont.

- These sites were chosen because of their national importance on education, security, natural disaster preparedness and health.
- The results indicate that the TVWS can be used for broadband connectivity in rural and underserved areas even when the broadcasting spectrum is already used.
- Network performance metrics like latency, SNR, throughput have been further analyzed using path loss empirical models.

MACRA
Promoting Universal ICT Access

UNIVERSITY OF JOHANNESBURG

NETWORK DESIGN

- The TVWS project is utilizing the free spectrum channels in the UHF TV band to provide broadband wireless connectivity

- The TVWS network was designed based on star topology utilising single UHF channel 31 (554 MHz) meant for digital Television broadcasting

MACRA
Promoting Universal ICT Access

UNIVERSITY OF JOHANNESBURG

NETWORK DESIGN…..con’t

INTERFERENCE CALCULATION

- *Primary to Secondary User Interference*

  It is therefore obvious that though, primary to secondary user interference is critical; it is non-existent in our network

- *Inter-device Interference*

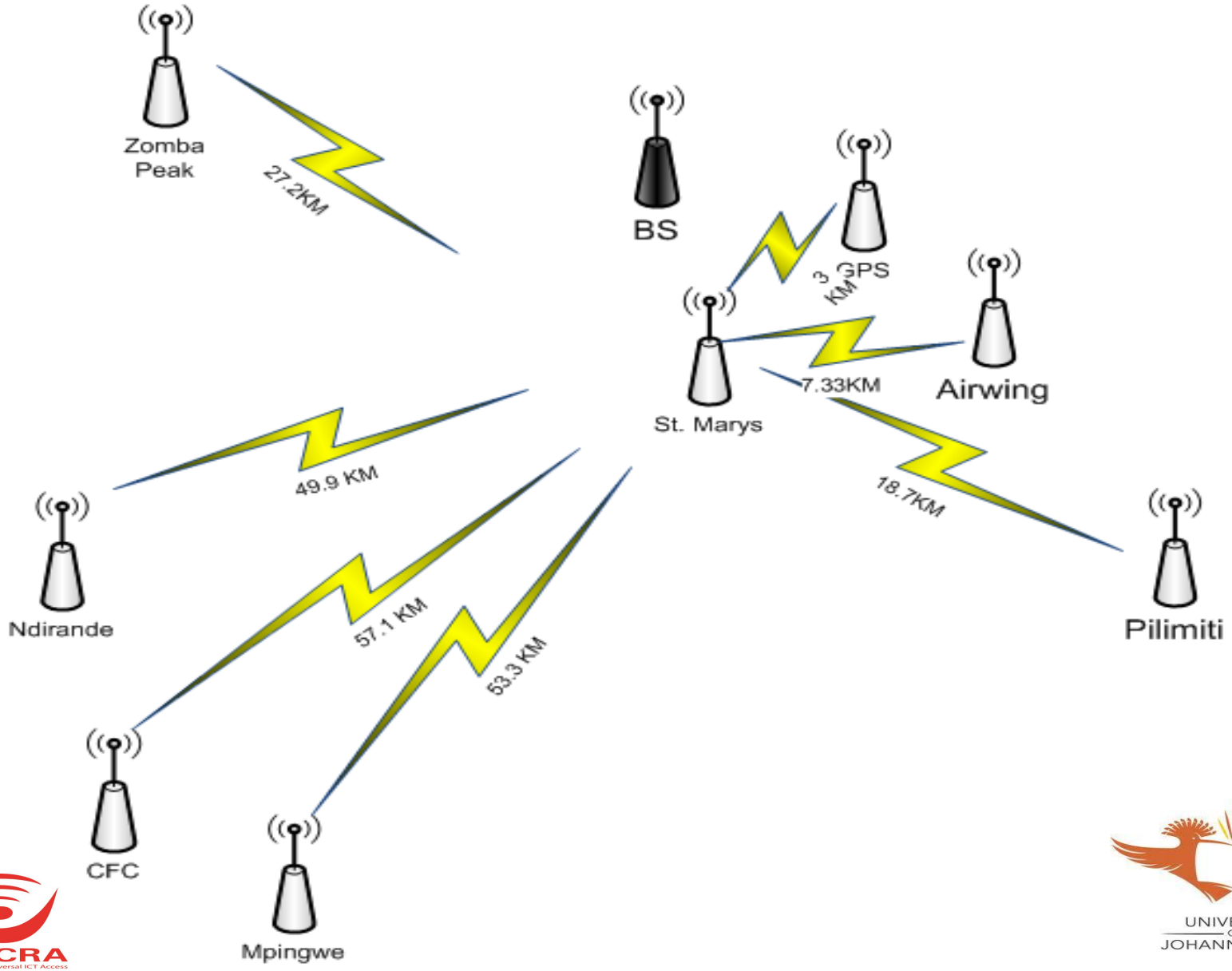
  This is the interference within the TVWS network and specifically among the WSDs.

  The obvious implication here is that all the four WSDs will scramble for the single channel

MACRA
Promoting Universal ICT Access

UNIVERSITY OF JOHANNESBURG

INTERFERENCE CALCULATION….Con't



MACRA
Promoting Universal ICT Access

UNIVERSITY OF JOHANNESBURG

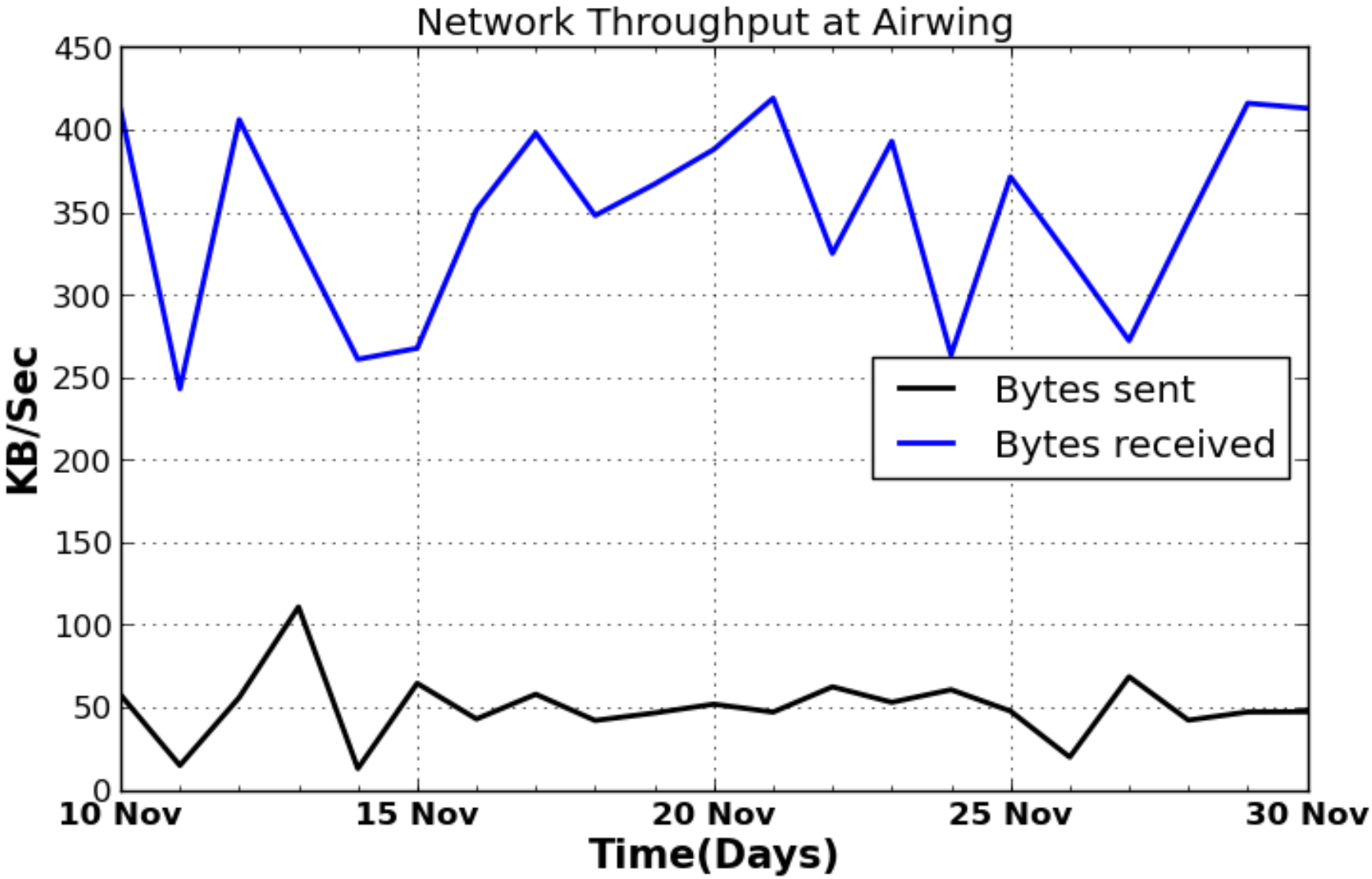
NETWORK PERFORMANCE

- Performance status of the Malawi TVWS pilot is further presented
- Basic performance metrics like throughput, latency, SNR have been analyzed using known path loss empirical models like Hata, Asset and Friis.
- Typically, for the tested link at 7.5km from the BS, an average SNR = 24.7dB, data-rate of 420kbps and latency of 118ms were observed using the collected data.
- Throughput and latency are computed averages from the measured data over one month at station premises .

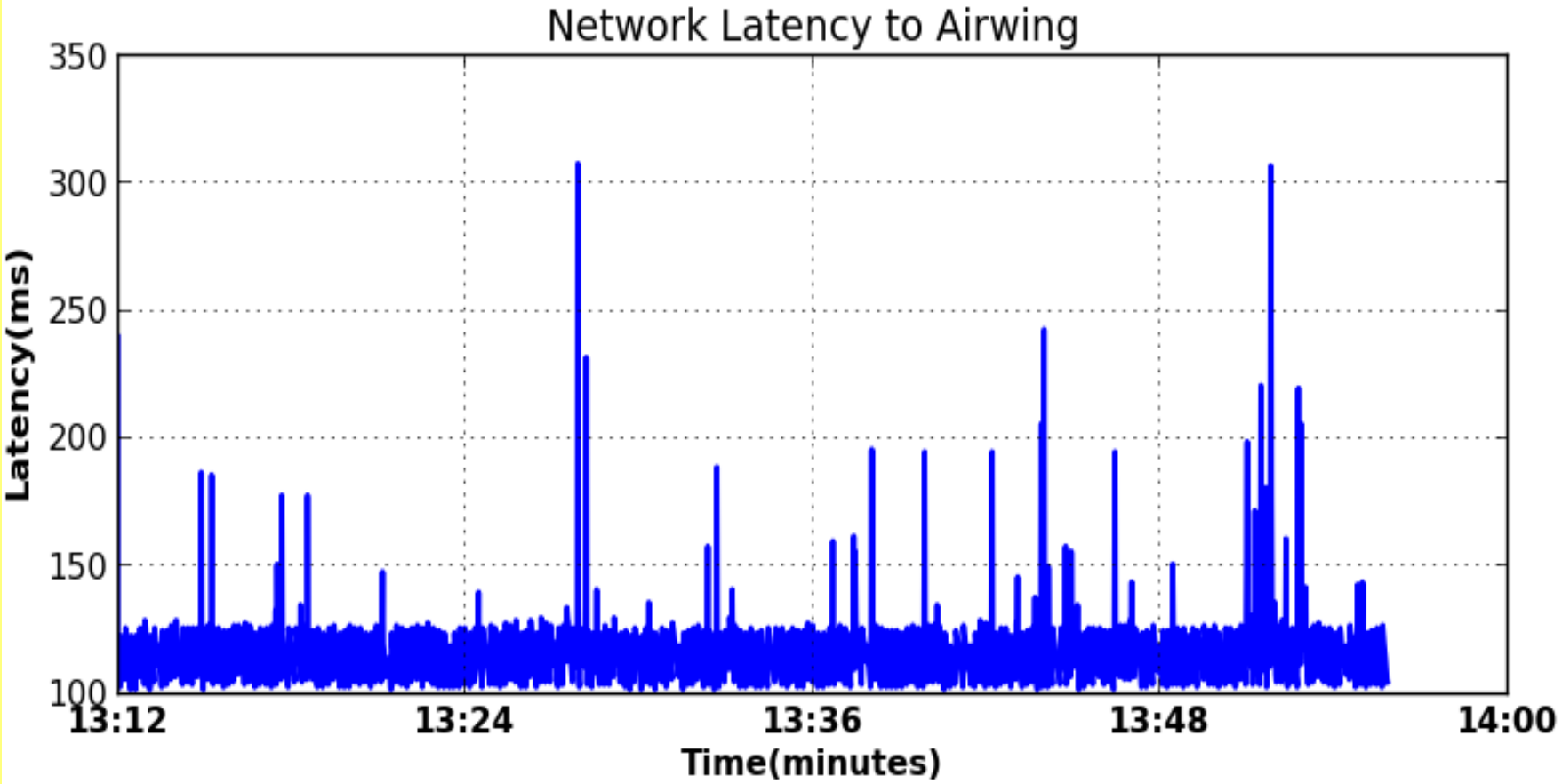
MACRA
Promoting Universal ICT Access

UNIVERSITY OF JOHANNESBURG

Performance Graphs



Performance Graphs



MACRA
Promoting Universal ICT Access

UNIVERSITY OF JOHANNESBURG

TYPICAL APPLICATION

- The science revolving around seismology involves constraining of earthquake source parameters and disseminating such information to the general public.

- Such information is also used by the construction industry where civil engineers are guided on best structural designs that can withstand a certain ground motion due to earthquakes.

MACRA
Promoting Universal ICT Access

UNIVERSITY OF JOHANNESBURG

TYPICAL APPLICATION….Cont

- To achieve this, an efficient data acquisition and analysis platform has to be put in place so as to be ready to disseminate information to public within 2-30 minutes of an earthquake occurrence and on demand through production of bulletins.

- Connectivity between the Data Centre and the remote seismic station has to be established in order to access data on real-time or near real-time.

MACRA
Promoting Universal ICT Access

UNIVERSITY OF JOHANNESBURG

TYPICAL APPLICATION….Cont

- The pilot connectivity program at the Seismology Section of the Geological Survey Department commenced with hooking up online a Continuous Global Positioning System (cGPS) where it transfers data to a local computer (server) ready to be uploaded to a remote server at UNAVCO in the USA on regular basis.

- The internet provided through TVWS is working well and has improved the data transfer and availability between the cGPS unit and local server.

MACRA
Promoting Universal ICT Access

UNIVERSITY OF JOHANNESBURG

PROJECT BENEFICIARIES

CONCLUSION

- The closer the distance between two white space devices (WSDs), the greater is the interfering power and for distances less than 7 km, it has been shown that a reference WSD could be overwhelmed, since the receiver sensitivity is nearly equal to or less than the interfering power

MACRA
Promoting Universal ICT Access

UNIVERSITY OF JOHANNESBURG

THE END

Thank you very much for your attention

E-mail: jpinifolo@macra.org.mw
URL: www.macra.org.mw

MACRA
Promoting Universal ICT Access

UNIVERSITY OF JOHANNESBURG