ENSC 427: COMMUNICATION NETWORKS
FINAL PROJECT PRESENTATION
Spring 2010

Analysis of Quality of Service (QoS) for Video Conferencing Over WiMAX Networks

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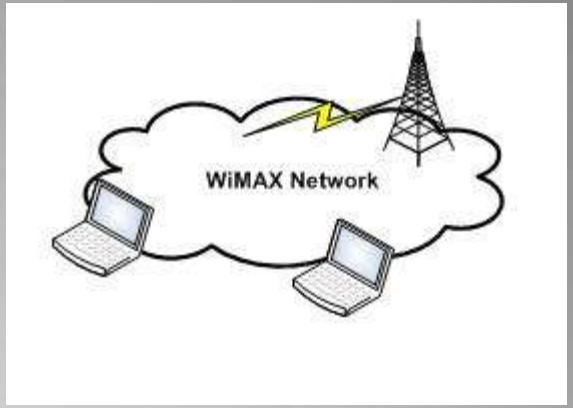
Roadmap

- Introduction
- Background Information
- Implementation Details
- Discussion of Results
- Conclusion
- References

Introduction



- Project Idea
  - How effectively can we do video conferencing on a WiMAX network?
  - How can we improve its Quality of Service (QoS)?

Introduction

- Motivation

  - WiMAX is readily available. As of April 2010, WiMAX forum claims there are over 558 WiMAX networks deployed in over 147 countries.

  - Video conferencing is becoming very popular, which enables face-to-face, real-time communications.

  - Video conferencing over WiMAX requires low packet loss, latency, and jitter which means high QoS.

Background Information

- Exploring Three Technologies
  - WiMAX: Worldwide Interoperability for Microwave Access
  - Video Conferencing
  - QoS: Quality of Service
- Key Issues
  - Call Quality
  - Packet Loss
  - Transmit Power
  - Distance

Background Information (WiMAX)

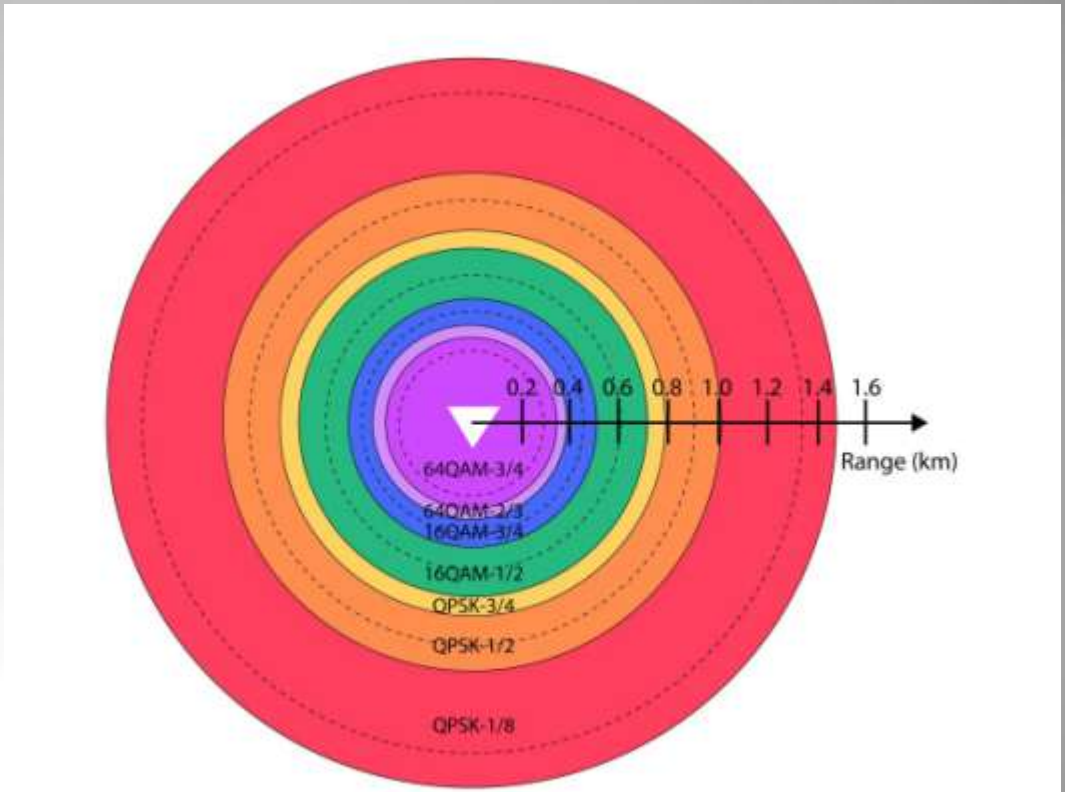
- Past: IEEE Std 802.16 (2004) - Fixed WiMAX
- Present: IEEE Std 802.16e (2005) - Mobile WiMAX
- Future: IEE Std 802.16m - 1Gbit/s fixed speeds
- Use: Mobile Internet
- Frequency range: 2-11 GHz (Non LOS), 10-66 GHz (LOS)
- Signal Range: 8km (Non LOS), 50km (LOS)
- Bandwidth: 75 Mbps (theoretical), 30 Mbps (practical)
- Transmitter power: BS - 20W/+43dBm, MS - 200mW/+23dBm
- Transmitter modulation: QPSK, 16-QAM, 64-QAM, etc

LOS: Line of Sight
QPSK: Quadrature Phase-Shift Keying
QAM: Quadrature Amplitude Modulation

BS: Base Station
MS: Mobile (user) Station

Background Information

- Transmitter power over WiMAX Network
  - Modulation
    - QPSK
    - 16-QAM
    - 64-QAM



J. Burke and K. Lopez. (2008, Nov. 24). WIMAX TRANMISSION POWER [Online]. Available: http://www.wimaxcom.net/2008/11/wimax-transmit-power.html

Implementation Details

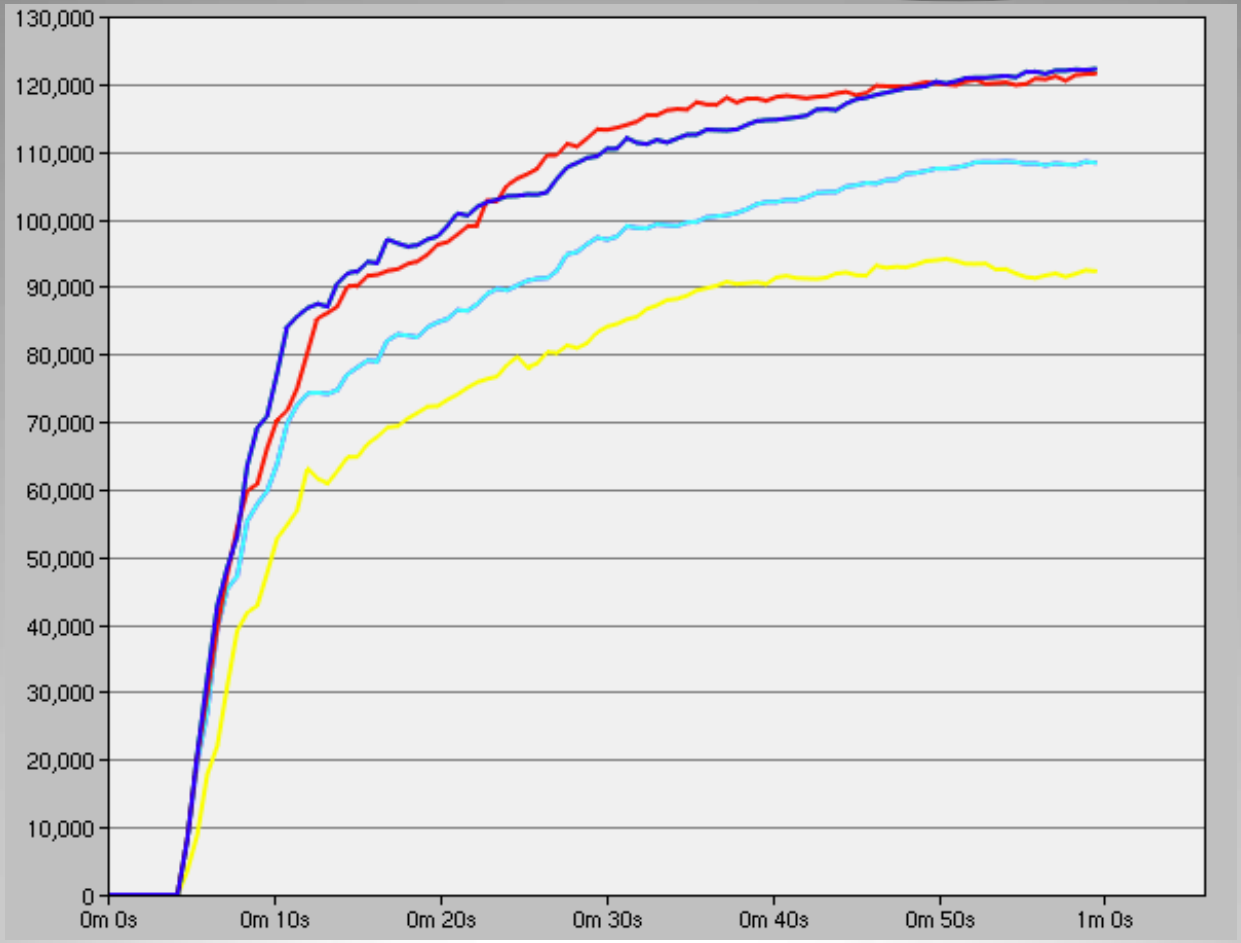
- Simulate video conferencing calls between two WiMAX users in different scenarios
  - Varying transmitting power of base station
  - Varying transmitting power of users
  - Varying transmitting mode of users
  - Varying users' distance from the base station
  - Enabling and disabling ARQ (Automatic Repeat Request)
  - Changing buffer sizes of users

Implementation Details

- Video conferencing traffic model in OPNET
  - Video Conferencing
    - Low-quality video stream: 128kbps
  - Voice Application
    - PCM Quality and Silence Suppressed

OPNET Topology

Results – Transmitter Power



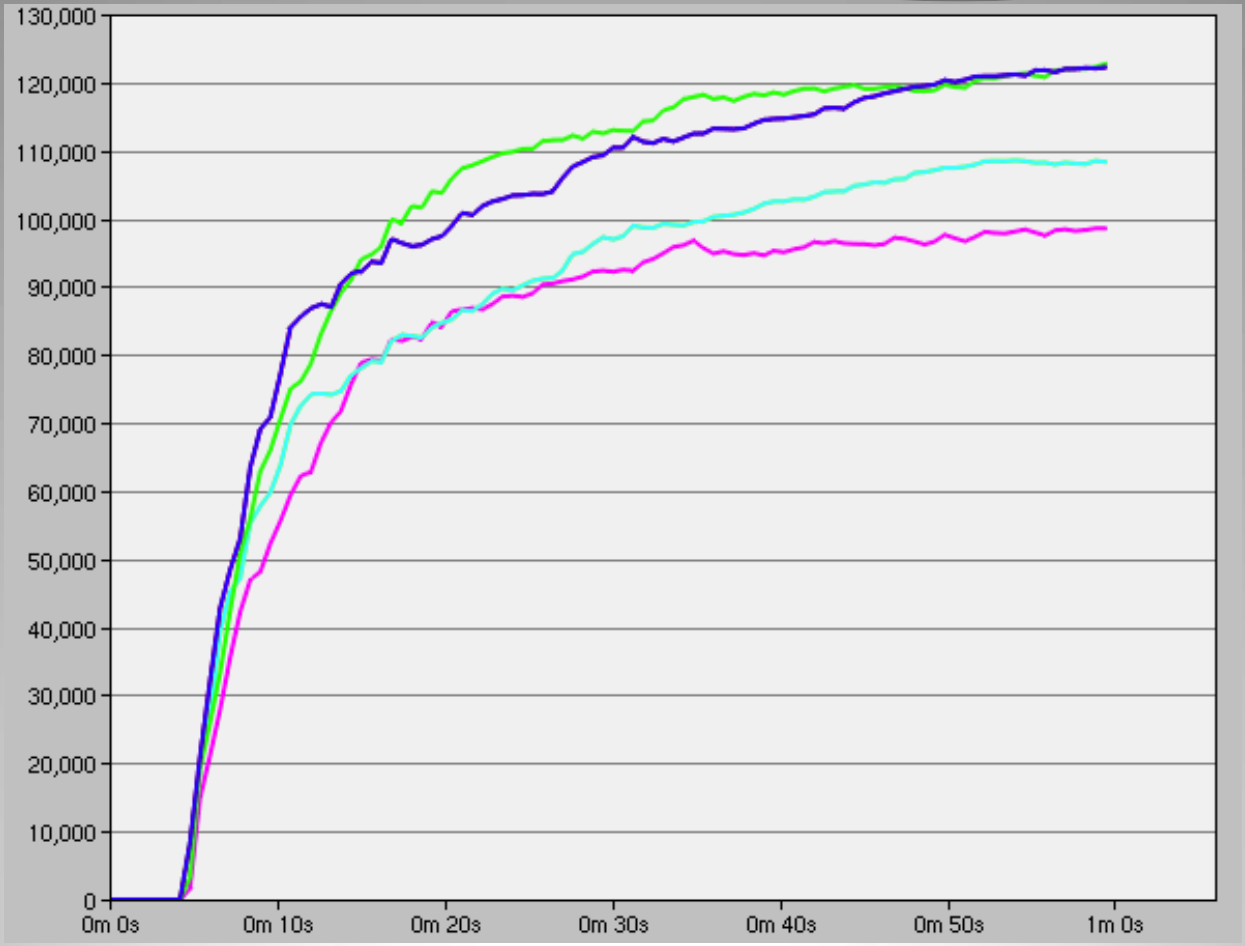
Blue: 10W BS, 2W user; data sent

Red: 1W BS, 0.2W user; data sent

Cyan: 10W BS, 2W user; data receive

Yellow: 1W BS, 0.2W user; data receive

Results – Distance



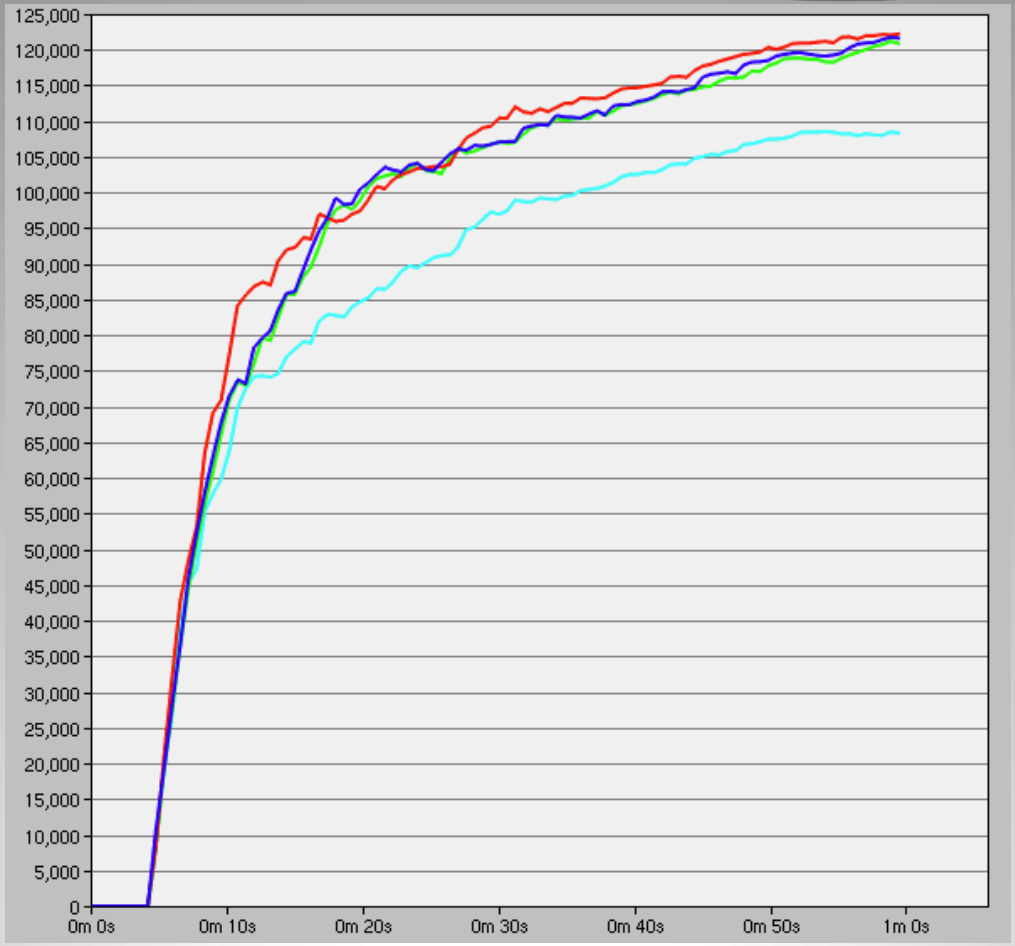
Blue: 1km to users; data sent

Green: 1.5km to users; data sent

Cyan: 1km to users; data receive

Magenta: 1.5km to users; data receive

Results – ARQ



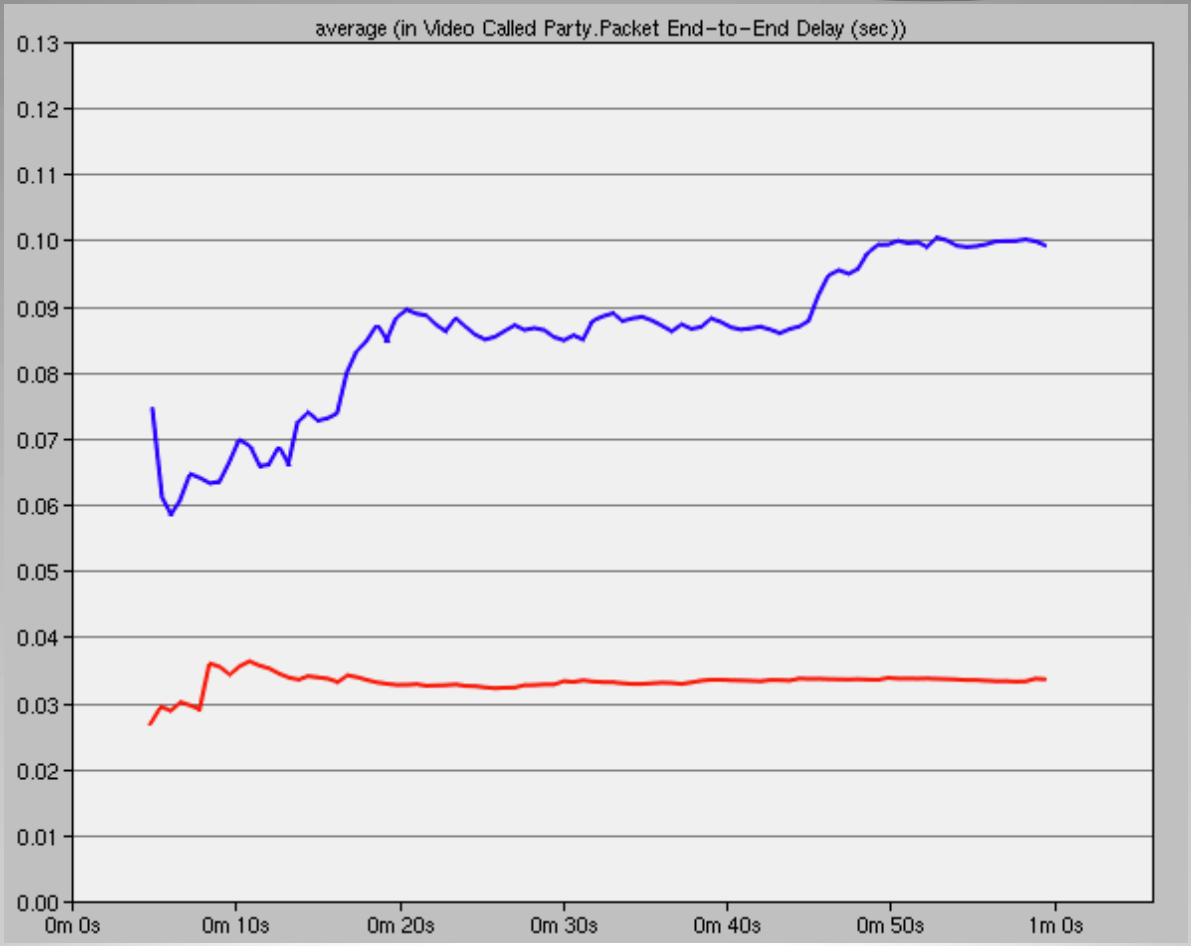
Blue: ARQ enabled; data sent

Red: ARQ disabled; data sent

Green: ARQ enabled; data receive

Cyan: ARQ disabled; data receive

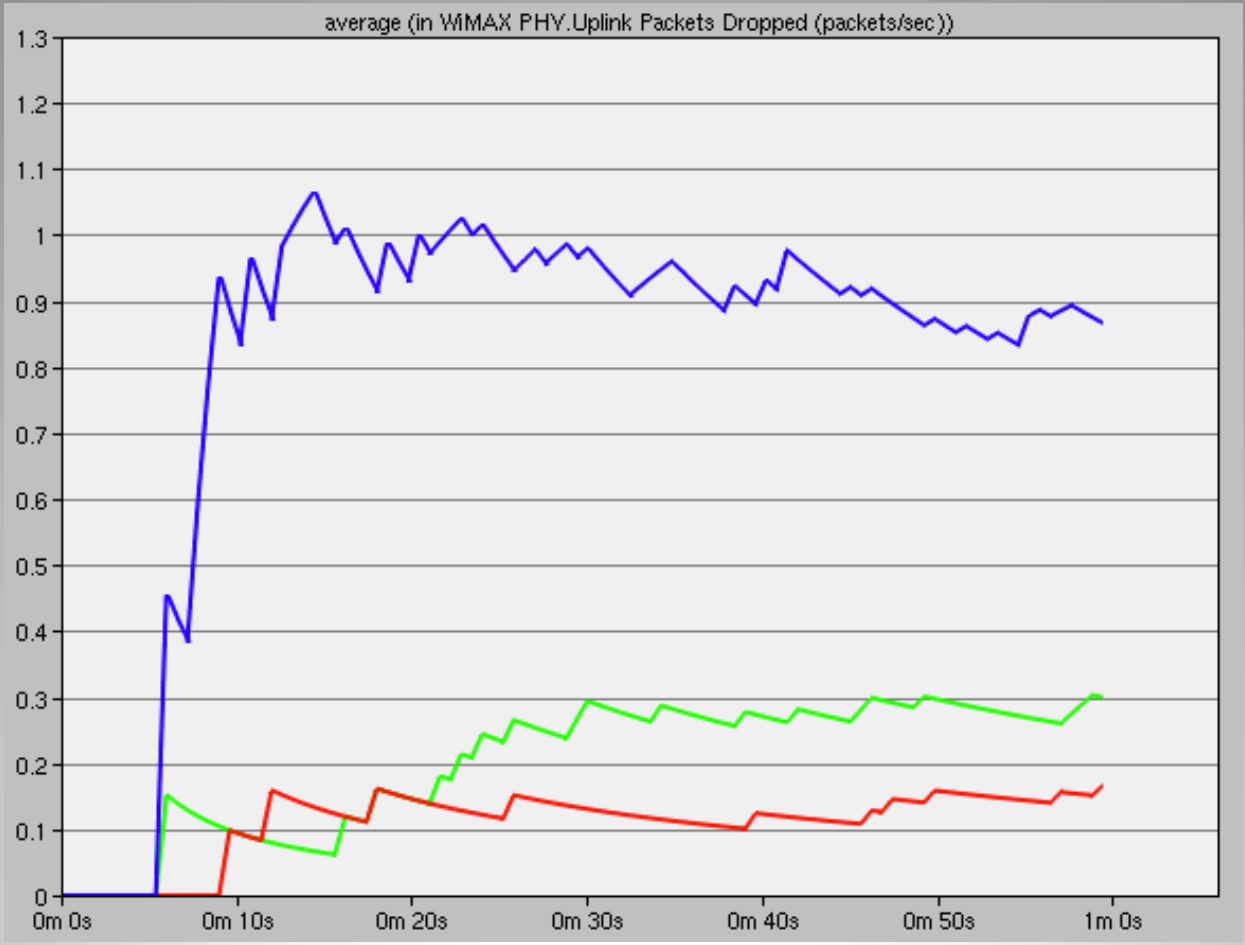
Results – ARQ, delay



Blue: ARQ enabled

Red: ARQ disabled

Results – Transmission modulation

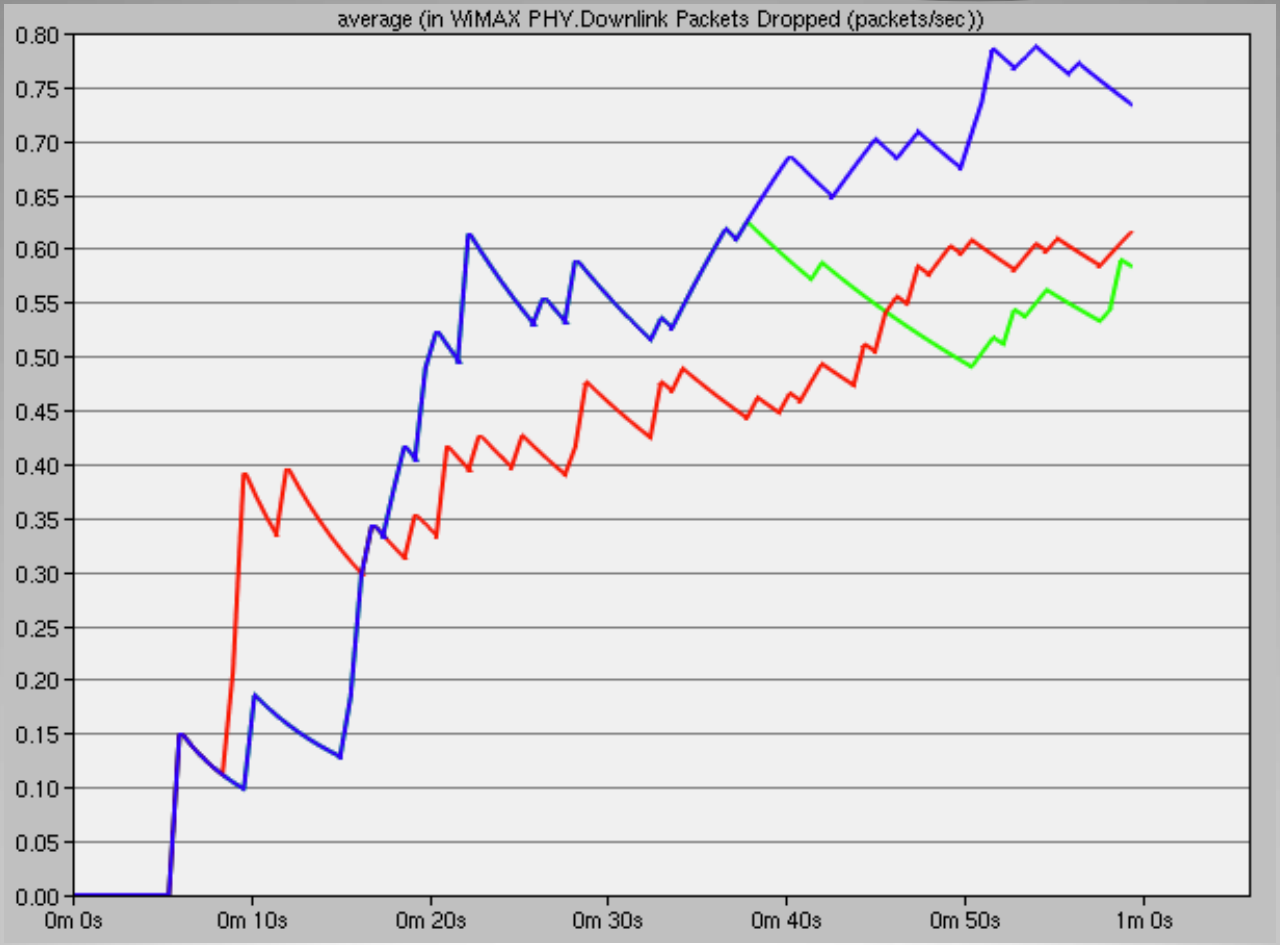


Blue: QPSK

Red: 16-QAM

Green: 64-QAM

Results – Buffer, downlink

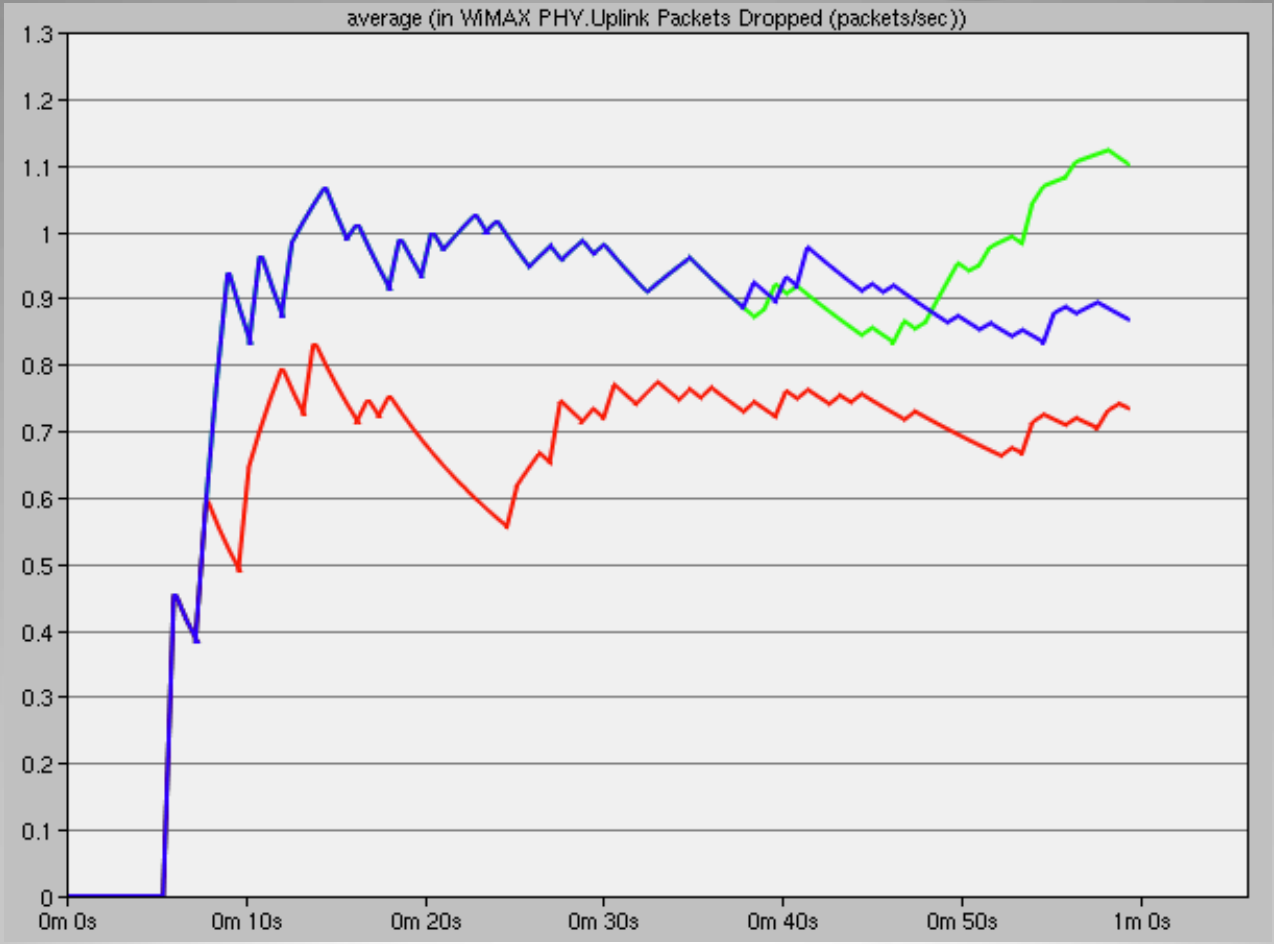


Blue: 128KB

Red: 64KB

Green: 256KB

Results – Buffer, uplink



Blue: 64KB

Red: 32KB

Green: 128KB

Conclusion

- Packet Loss is a big issue in video conferencing
- There are trade-offs between quality and delay
- Various concepts affect the QoS of WiMAX

References

[1] "WiMAX”. (2010, April 7). Available: http://en.wikipedia.org/wiki/WiMAX

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