ENSC 427: Communication Networks
Spring 2011:Final Project Presentation

Analysis of Video Surveillance over WiMax Networks

Marish Lalwani (mla17@sfu.ca)

Sajith Kulasekare (isk2@sfu.ca)

Website: www.sfu.ca/~mla17/ENSC 427.html

Roadmap

- Introduction
- Background information
- Network Topology
- Simulation Scenarios
- Simulation results
- Conclusion
- References

Introduction

➢ Project Idea

Considering WiMAX for video surveillance

➢ Motivation

- Fast growing demand for video surveillance technology in urban areas
- United States alone installs 2-3 million new surveillance cameras every year
- Video surveillance cameras will sky rocket to $6.48 Billion in 2012 up from $435.8million in 2005
- Wi-Fi and other network technologies restrict the wireless coverage to about 100m

Roadmap

- Introduction
- **Background information**
- Network Topology
- Simulation Scenarios
- Simulation results
- Conclusion
- References

Background information

What is WiMAX?

- Stand for Worldwide Interoperability for Microwave access also known as IEEE 802.16
- WiMAX can provide broadband wireless access up to 30 miles (50 km) for fixed stations, and 3 - 10 miles (5 - 15 km) for mobile stations

Background information

Why use WiMAX for Video Surveillance?

- WiMAX provides higher throughput of up to 72Mbps and longer wireless coverage
- WiMAX uses scheduling algorithms to provide QOS (Quality Of Service) for time sensitive traffic such as videos
- Unlike WiFi and other wireless technologies that offer little or no data security, WiMAX has a built in data encryption to tighten security of data being transferred
- High end WiMAX systems provide 99.9% availability, with only 5 minutes of downtime per year allowing practically non-stop monitoring and surveillance

Background information

Why use WiMax for Video Surveillance? (Cont.)

- WiMax enables mobile video monitoring which can used by authorities to monitor a crimes scenes
- Video cameras need not be fixed and can be moved and reconnected within minutes, offering higher scalability and flexibility

Background information

Why use WiMax for Video Surveillance?(Cont.)

- WiMax enables mobile video monitoring which can used by authorities to monitor a crimes scenes
- Video cameras need not be fixed and can be moved and reconnected within minutes, offering higher scalability and flexibility

Background information

- **WiMax Quality of Service (QoS)**

Measures the capability of a network to provide high value services such as voice and video. The main detractors from good QoS are

- Packet loss: number of packets dropped
- Delay: average time of transit
- Jitter: variation in packet arrival time
- Throughput: minimum end-to-end transmission rate

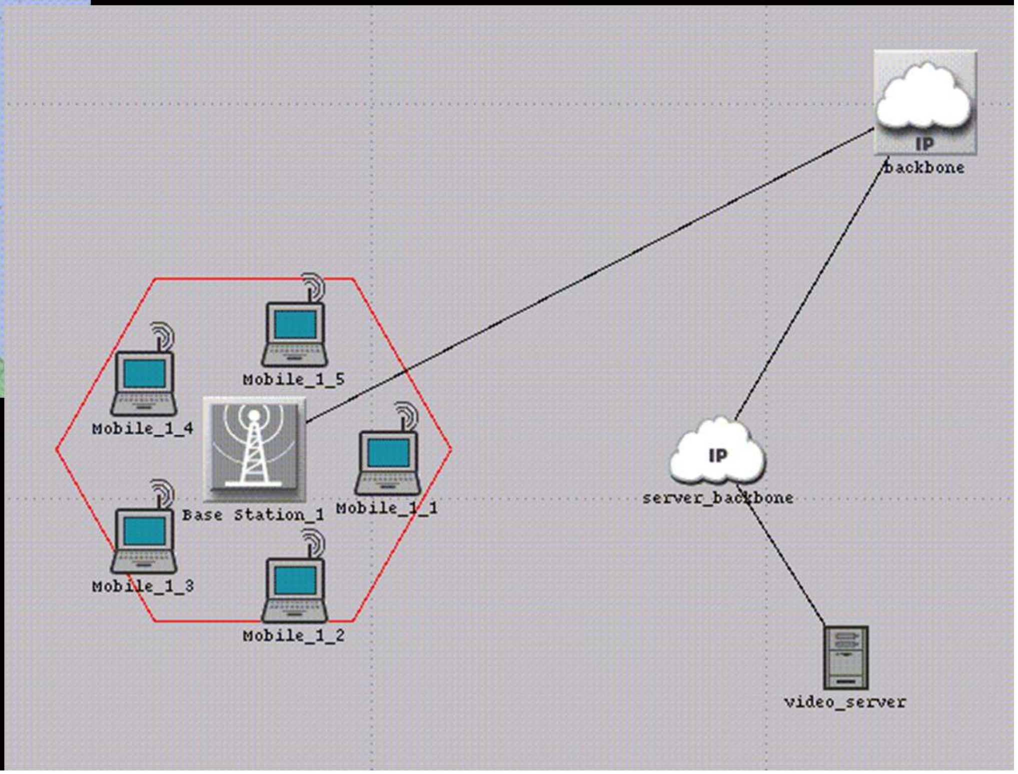
QoS Service Classes

Service	Description	QoS Parameters
UGS	Support for real-time service flows that generate fixed data packets	Maximum sustained rate Maximum latency tolerance Jitter tolerance
rtPS	Support for real-time service flows that transport variable size data packets on a periodic basis	Minimum reserved rate Maximum sustained rate Maximum latency tolerance Traffic priority
ertPS	Extension of rtPS to support traffic flows such as variable rate VoIP	Minimum reserved rate Maximum sustained rate Maximum latency tolerance Traffic priority Jitter tolerance
nrtPS	Support non real traffic services that require variable size data grants	Minimum reserved rate Maximum sustained rate Traffic priority
BE	Support for best-effort traffic	Maximum sustained rate Traffic priority

Roadmap

- Introduction
- Background information
- **Network Topology**
- Simulation Scenarios
- Simulation results
- Conclusion
- References

Network Topology



Roadmap

- Introduction
- Background information
- Network Topology
- **Simulation Scenarios**
- Simulation results
- Conclusion
- References

Simulation Scenarios

- Scenario I:

1 work station, 1 base station

- Scenario II:

5 work stations, 1 base station

- Scenario III:

1 work station, 1 base station (Uplink modulation scheme changed from 64 QAM to QPSK 3/4)

- Scenario IV

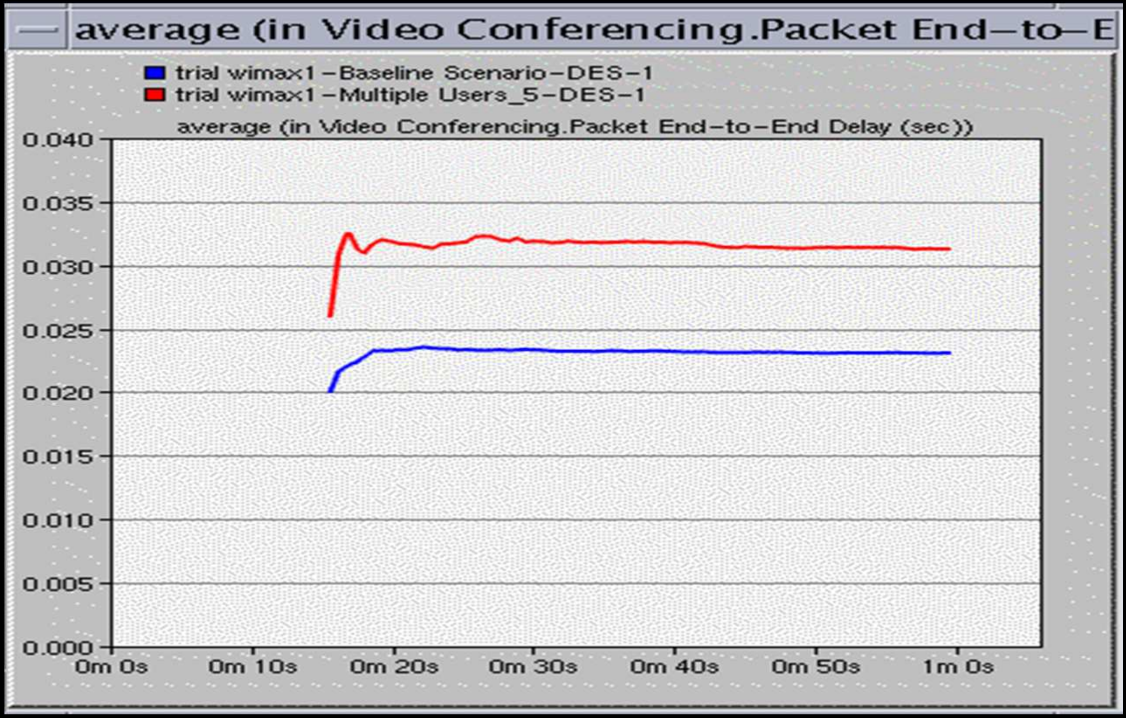
1 work station, 1 base station (Workstation distance increased from 1km to 30kms)

Roadmap

- Introduction
- Background information
- Network Topology
- Simulation Scenarios
- **Simulation results**
- Conclusion
- References

Simulation Results

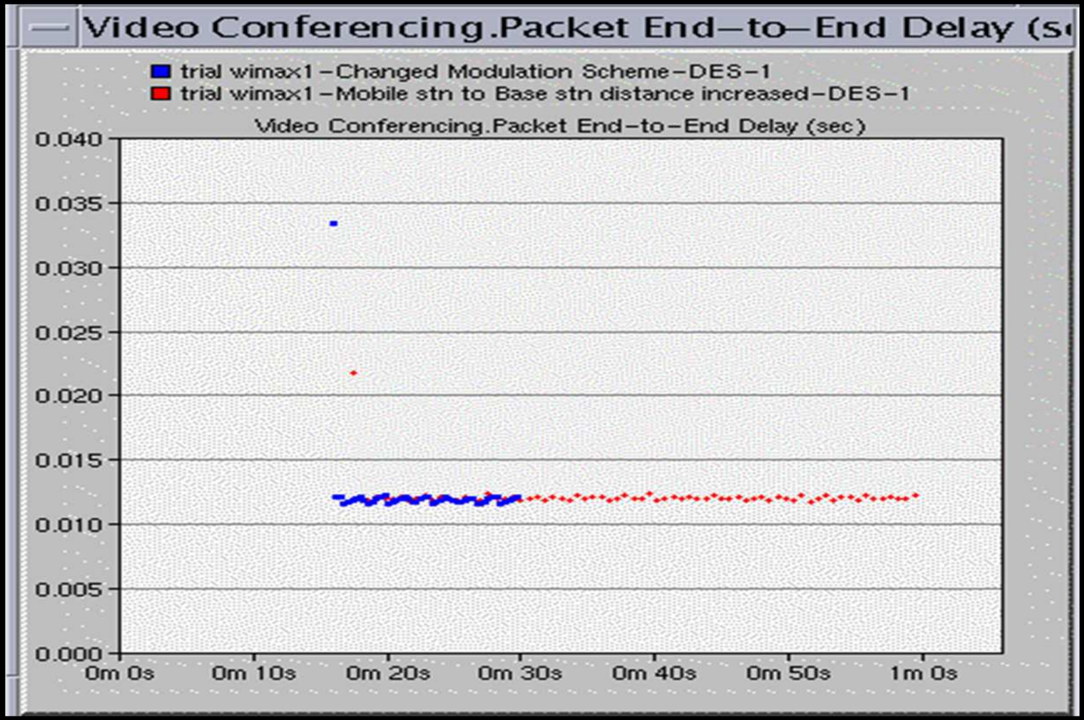
- End-to-end Delay for the 4 scenarios



The graph depicts higher delay is achieved as the users are increased from one to five.

Simulation Results

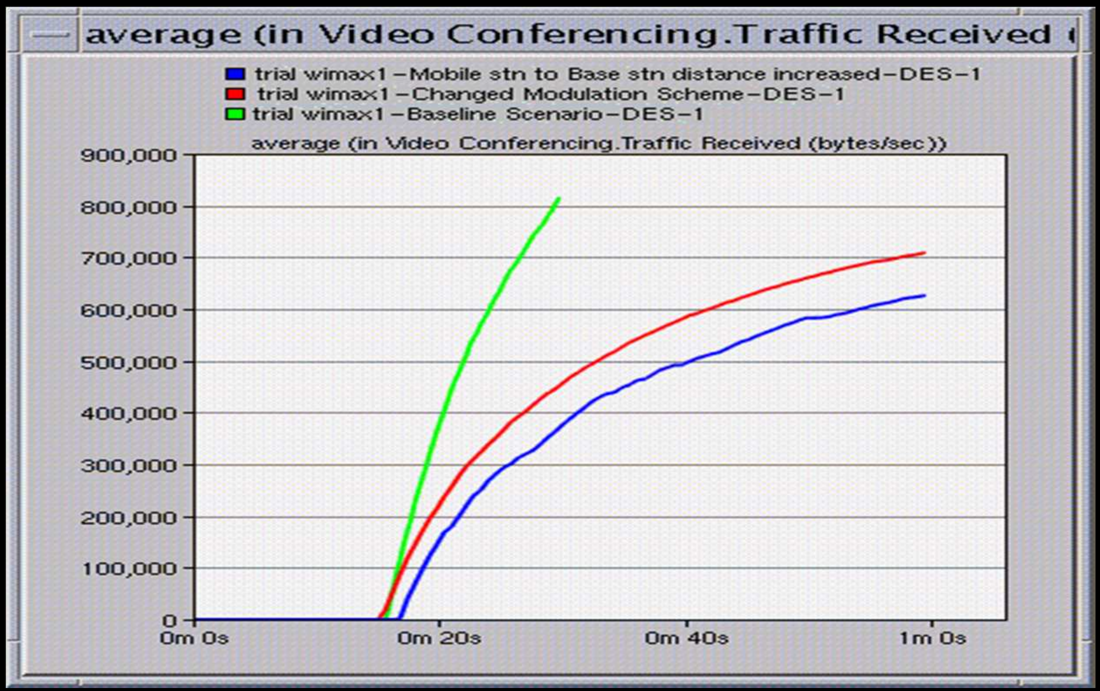
- End-to-end Delay



The graph depicts similar delay is achieved as the distance of the mobile stations is increased from 1km to 30kms and the modulation scheme is set to QPSK for the mobile stations. This implies that QPSK is Robust in nature.

Simulation Results

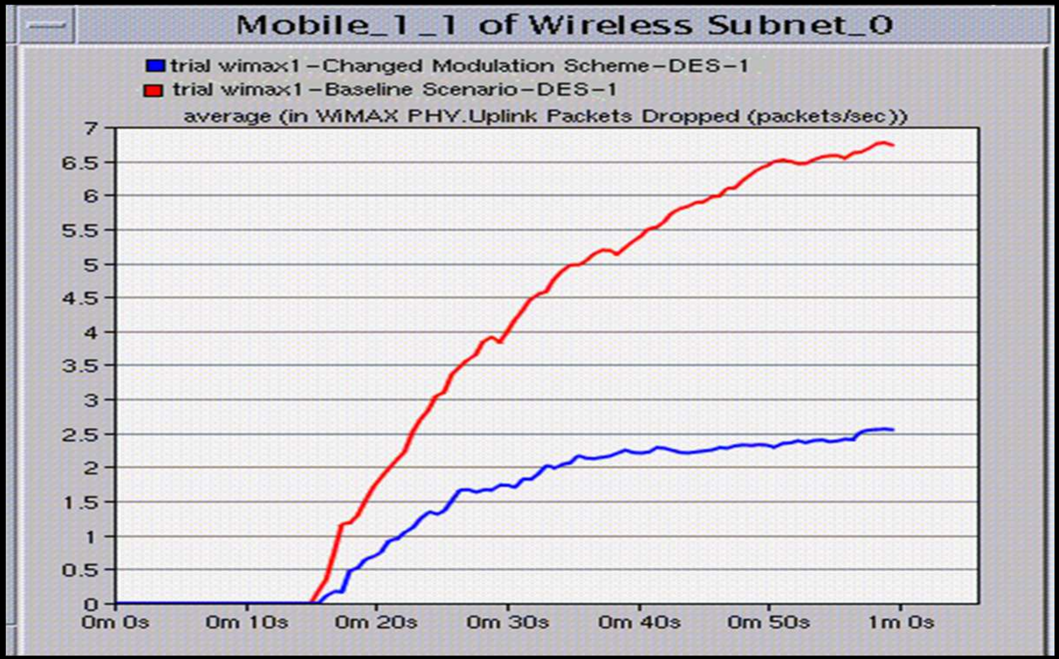
- Throughput



•Curves are averaged across a 1 min duration
•10kbps –5Mbps

Simulation Results

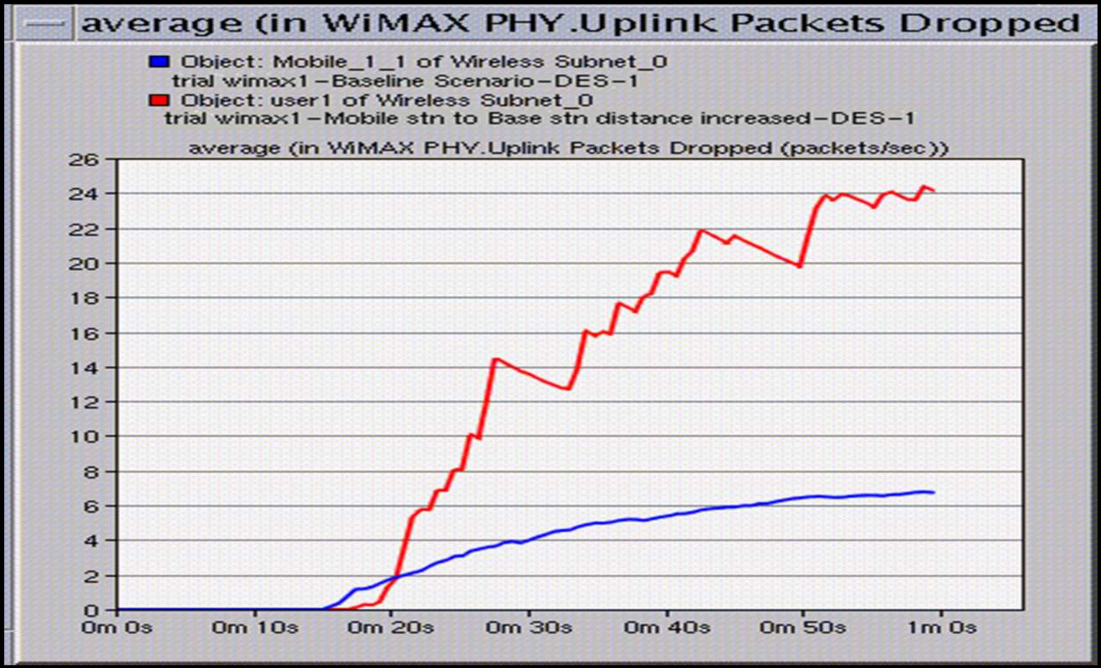
- Packets Dropped



The graph depicts the uplink packets dropped when the modulation scheme for the Mobile Station changes from 64-QAM(baseline) to QPSK

Simulation Results

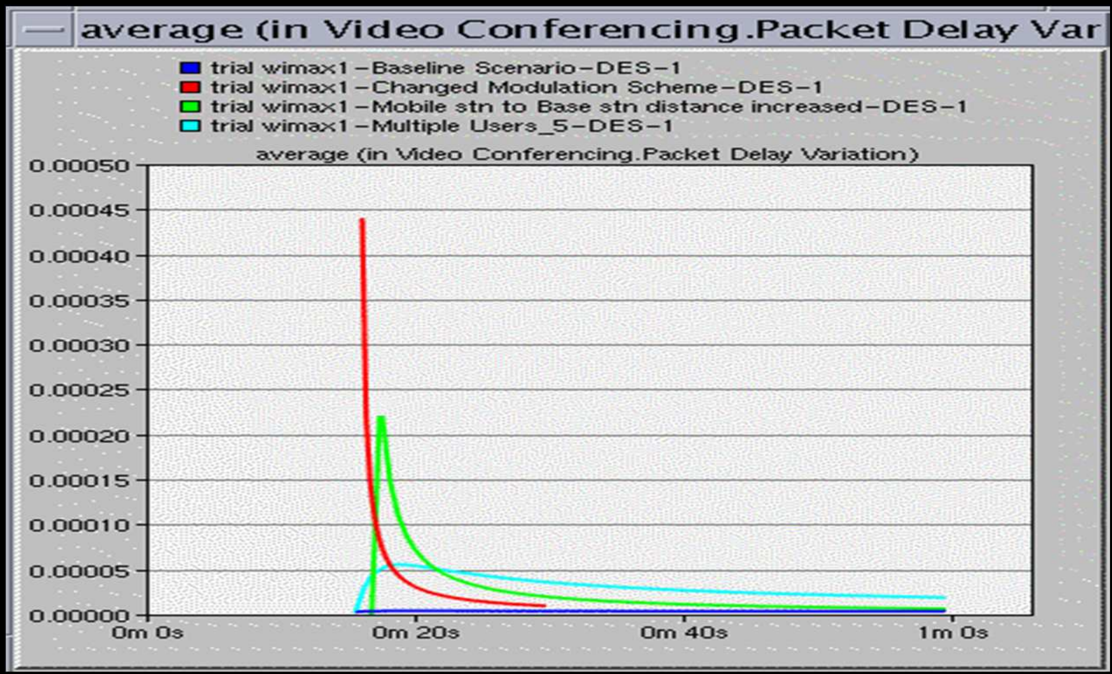
- Packets Dropped



The graph depicts the uplink packets dropped when the modulation scheme for the Mobile Station is QPSK and the distance is increased to 30km. As we increase the increase not even QPSK being robust is not able mitigate the uplink packets dropped.

Simulation Results

- Jitter – Defined by Packet Delay Variation



•Actual reception time –expected reception time
•Ideal < 20ms

Conclusion

- Various factors affect the QoS of WiMAX
- Packet Loss is a big issue in Video Surveillance
- Modulation scheme does not affect the Packet Loss if the distance of Mobile Station from Base Station is large
- Trade-off between the quality of the application and the delay

References

- [1] W. Hrudey and L. Trajkovic. (2011). Streaming Video Content Over IEEE 802.16/WiMAX Broadband Access [Online]. Available: http://www.ensc.sfu.ca/people/faculty/ljilja/cnl/presentations/hrudey/opnetwork08/hrudey_trajkovic_opnetwork2008_presentation_revised.pdf
- [2] 1571 Introduction to WiMAX Modeling for Network R&D and Planning [Online] Available: http://www.opnet.com/index.html
- [3] D. Pareek,"Wimax: Taking wireless to the MAX,"Boca Raton, FL: Auerbach Publications, 2006, pp.9-17
- [4]WiMAX Salient Features [Online]. Available:http://www.tutorialspoint.com/wimax/wimax_salient_features.htm
- [5] Sanida Omerovic.(2006). "WiMAX Overview"[Online]. Available: http://www.lkn.fe.uni-lj.si/Seminarji/s_omerovic.pdf
- [6] Fixed WiMAX Applications Focus: IP Video Surveillance Networks [Online], Fujitsu Microelectronics America, Inc.2007. Available: http://www.fujitsu.com/downloads/MICRO/fma/formpdf/WiMAX_ipvideowp.pdf
- [7] E. Boyer and Afrin Choudhary. (2010). Analysis of Quality of Service(QoS) for Video Conferencing in WiMAX Networks. Available: http://www.sfu.ca/~asc13/ensc427/
- [8] WiMAX QoS Service Classes [Online], Tranzeo Technologies Inc. 2010. Available:
- http://www.tranzeo.com/allowed/Tranzeo_WiMAX_QoS_Classes_Whitepaper.pdf
- [9] WiMAX (802.16e) Model User Guide [Online], OPNET Modeler 14.0. Available: http://api.ning.com/files/KhiYzGEICiMI3LC7T2WVwHw8Bknkbm6ST8I9QVSPfb4_/WiMAX802.16eModelUserGuide.pdf

Questions ?