ENSC- 835 COMMUNICATION NETWORKS SPRING 2011

COMPARISON OF WIMAX AND ADSL BY STREAMING AUDIO AND VIDEO CONTENT

Team-2
Tanjila Farah-301136804
(tfarah@sfu.ca)
Rajvir Gill-301135155
(rajvirg@sfu.ca)
www.sfu.ca/~tfarah
www.sfu.ca/~rajvirg

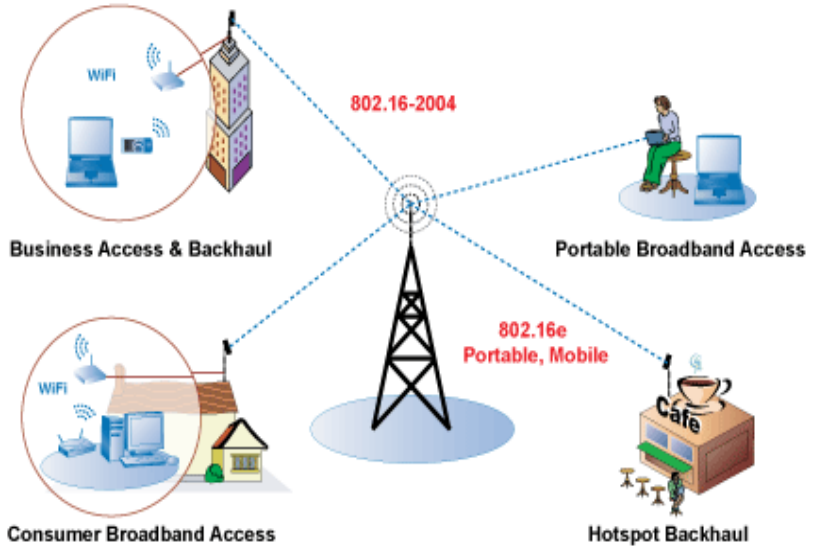
ROADMAP

- **Introduction**
- Design
- Validation
- Analysis
- Conclusions
- Challenges
- Future Work
- References

INTRODUCTION

Focus of the study:

Can WiMAX deliver comparable network performance to ADSL broadband access for streaming audio, video applications and simple applications like HTTP, FTP and Email?



WiMAX: Worldwide Interoperability for Microwave Access.
ADSL: Asymmetric Digital Subscriber Line
HTTP : Hyper Text Transfer Protocol
FTP : File Transfer Protocol

INTRODUCTION

What is WiMAX Broadband Access?

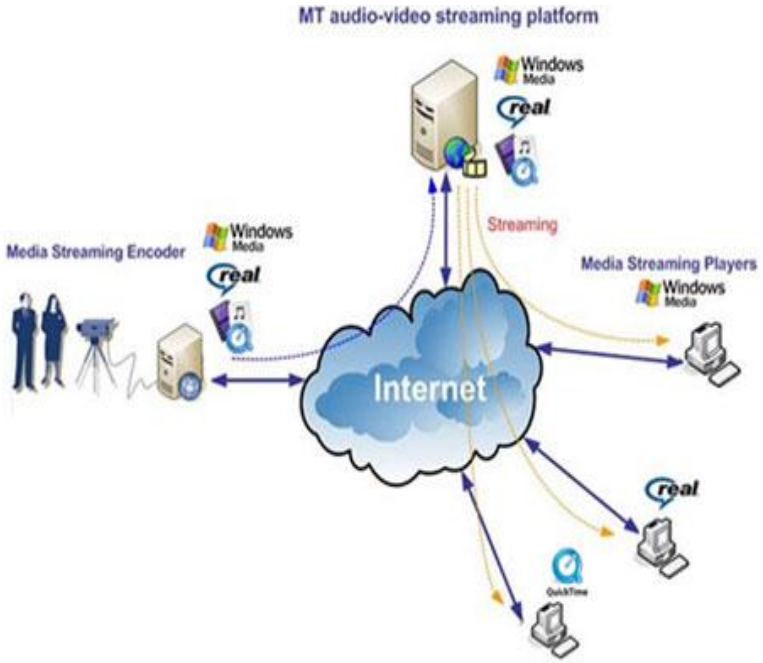
- Worldwide Interoperability for interoperability Microwave Access
  - IEEE 802.16 802.16-2004
  - IEEE 802.16e 802.16e-2005
- All IP network architecture
- Flexible QoS supports voice & video
- Connection oriented bandwidth request / grant scheme
- Optimized for outdoors
- Scalable to 1000's of users
- Point to multipoint mode
- Two types: Fixed, mobile
- Replaces ADSL, T1 line

QoS: Quality of Service

T1: Transmission One

INTRODUCTION

- **What Is Audio and Video Streaming?**
  - Digital audio/video source delivered to clients over an IP network infrastructure
  - Digital data information is organized as frames
  - Frames are compressed using MPEG-4 codec scheme
  - Compressed frames are encapsulated in protocol headers
  - Audio/video frame packets are transmitted at a constant rate



INTRODUCTION

- **Other Applications:**

- HTTP is the foundation of data communication for World Wide Web and designed to retrieve web pages.
- FTP is designed for transferring files and offers faster overall throughput and better error checking.
- Electronic mail is method of exchanging messages from senders to receivers.

INTRODUCTION

Contribution:

- **Reference Model:**

Will Hrudey "**Streaming Video Content over WiMAX Broadband Access**"

- Application: Video only
- OPNET version 14

- **New Model:**

- Applications: Video, Audio, HTTP, FTP and Email
- OPNET version 16

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DESIGN

The model is designed for observing the following performance matrices:

- **Loss** –Number of Packets Dropped
  1 -(number of received packets) / (number of expected packets)

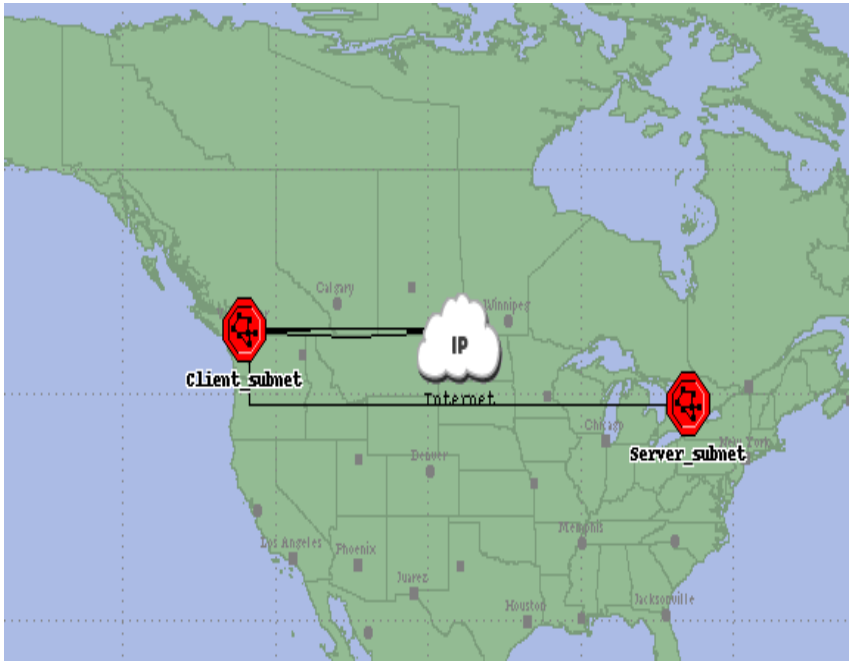
- **Delay** –Average Time of Transit
  Processing delay + propagation delay + queuing delay

- **Jitter** –Variation in Packet Arrival Time
  Actual reception time –expected reception time

- **Throughput** –Minimum End-to-End Transmission Rate
  Measured in bytes / sec (or bps)

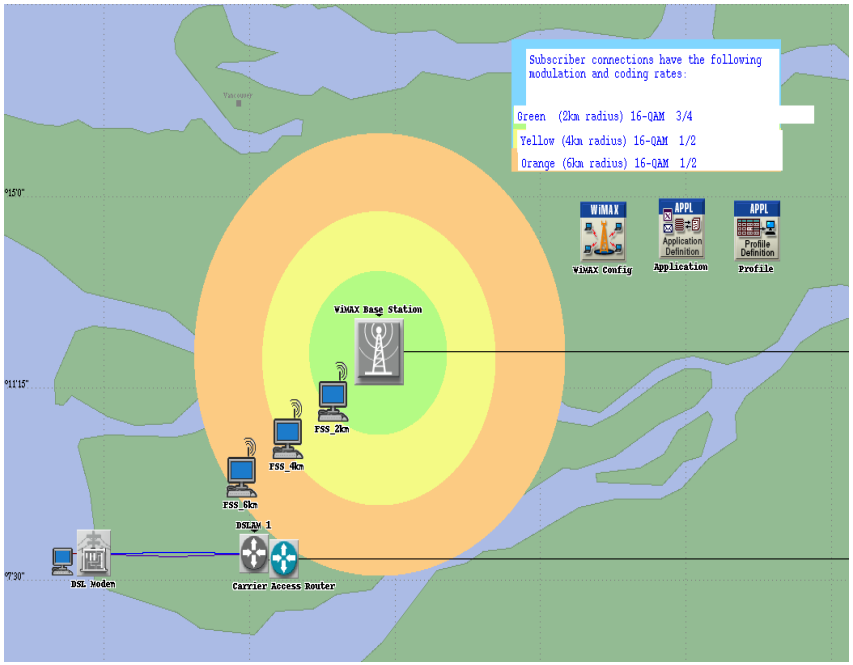
DESIGN

- **Network Topology**
  - Server subnet located in Toronto
  - Client subnet located in Vancouver



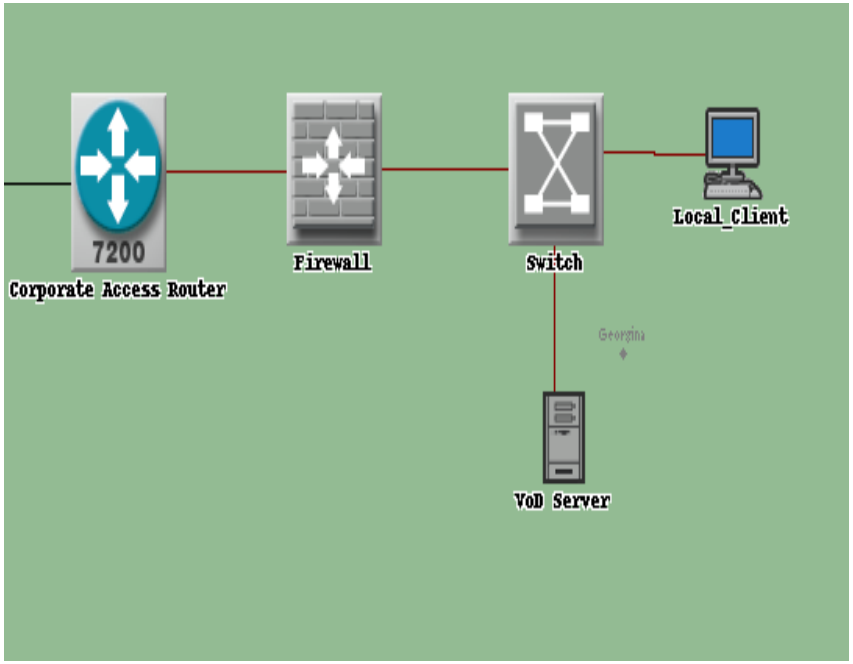
DESIGN

- **Client Subnet Topology**



DESIGN

- **Server Subnet Topology**



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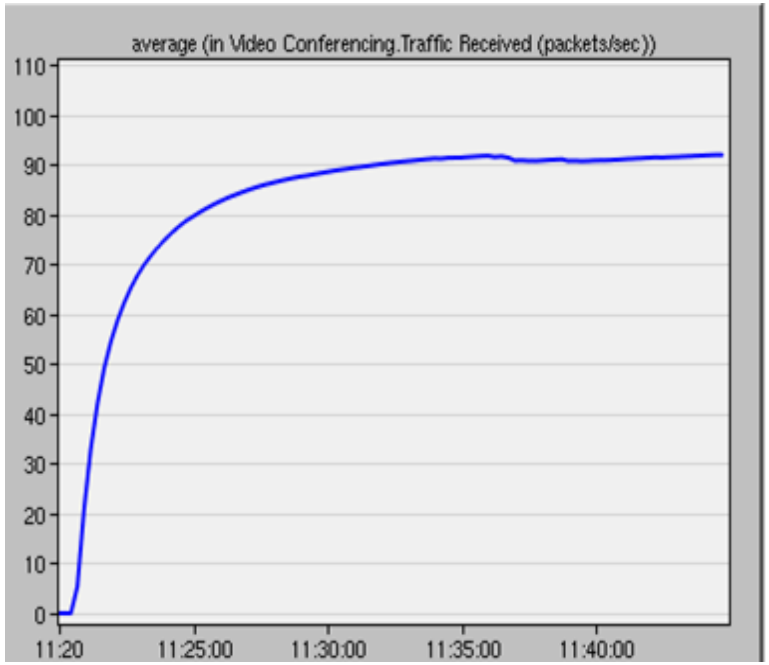
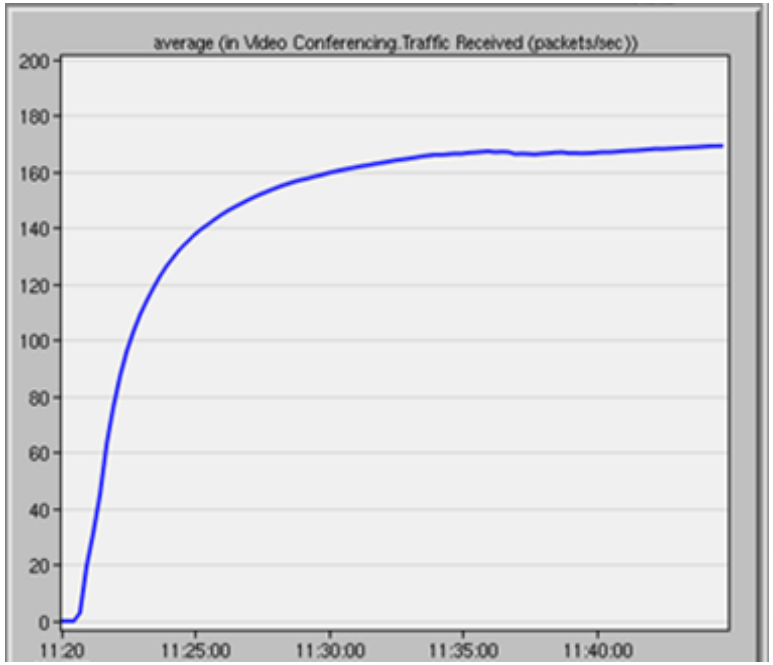
VALIDATION



Network traffic received (packet/sec) (reference model)



Network traffic received (packet/sec)

- Compare all performance matrices of reference model with new model.
- Reference model graph shows an average of 90 packet per second, whereas new simulated model shows a significantly high rate of 165 packet per second received.

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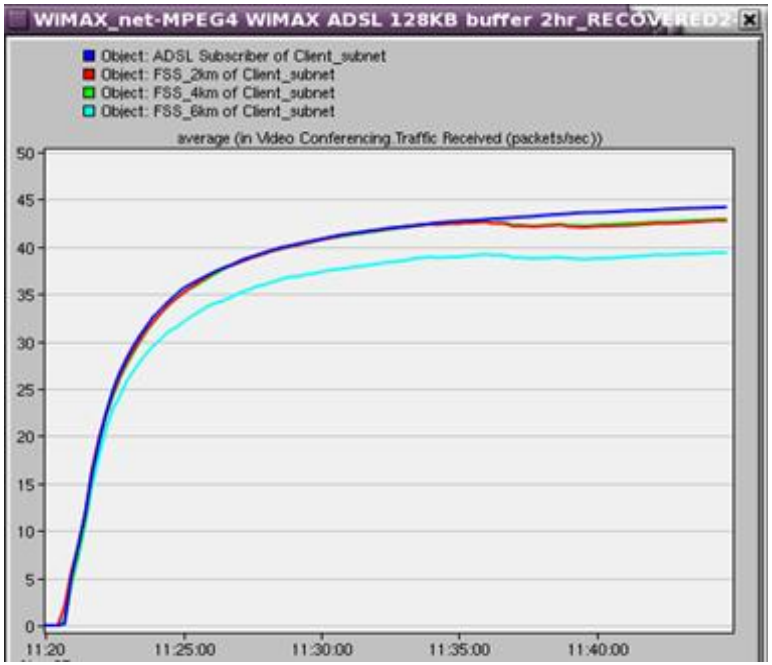
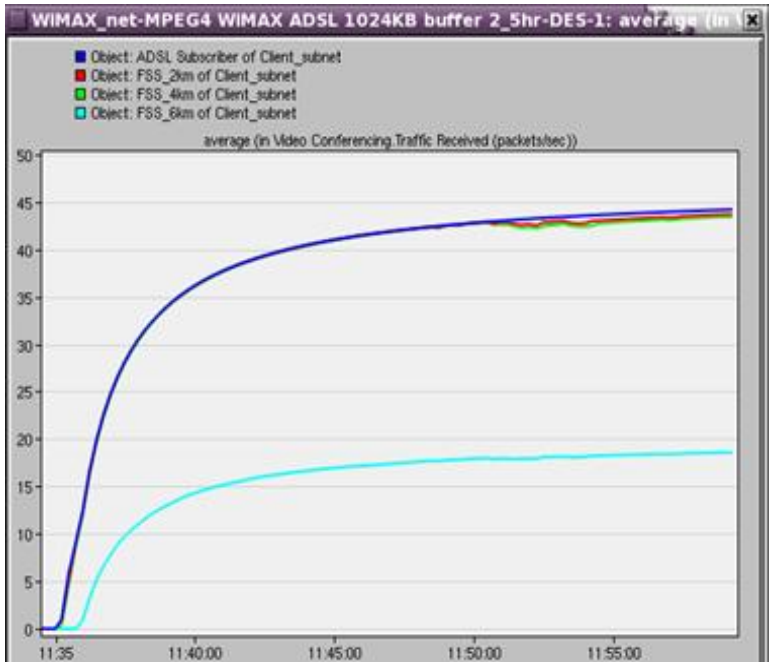
ANALYSIS

- **Packet Loss Measurement (Average)**



Traffic received for buffer size 128KB

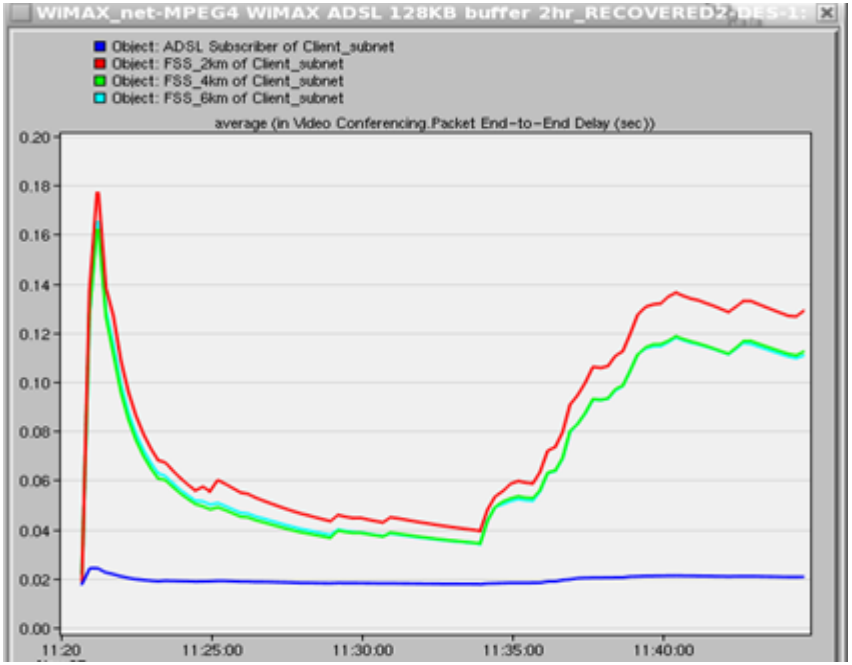


Traffic received for buffer size 1024KB

- WiMAX results depicts loss as deviation from the blue line representing ADSL results for 50pkts/sec
- Buffer size 1024 KB is large enough to reduce number of packets dropped and results for WiMAX become comparable to ADSL results

ANALYSIS

- **Delay Measurement**

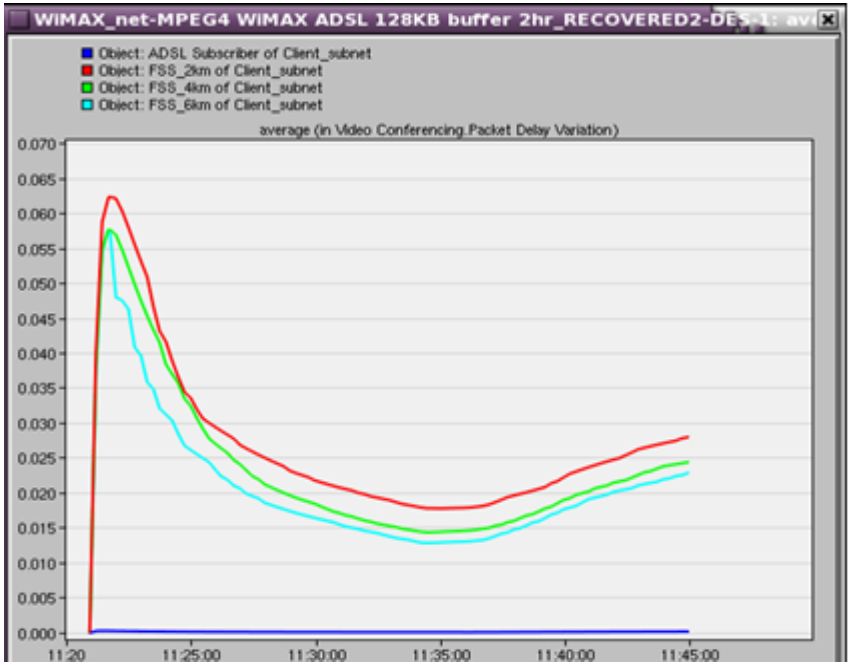


End-to-end packet delay

- ADSL client curve approaches the ideal delay of 10 ms or less
- WiMAX client station curves are closely tracked each other and approaches the average delay of 60 ms.

ANALYSIS

- **Jitter Measurement**

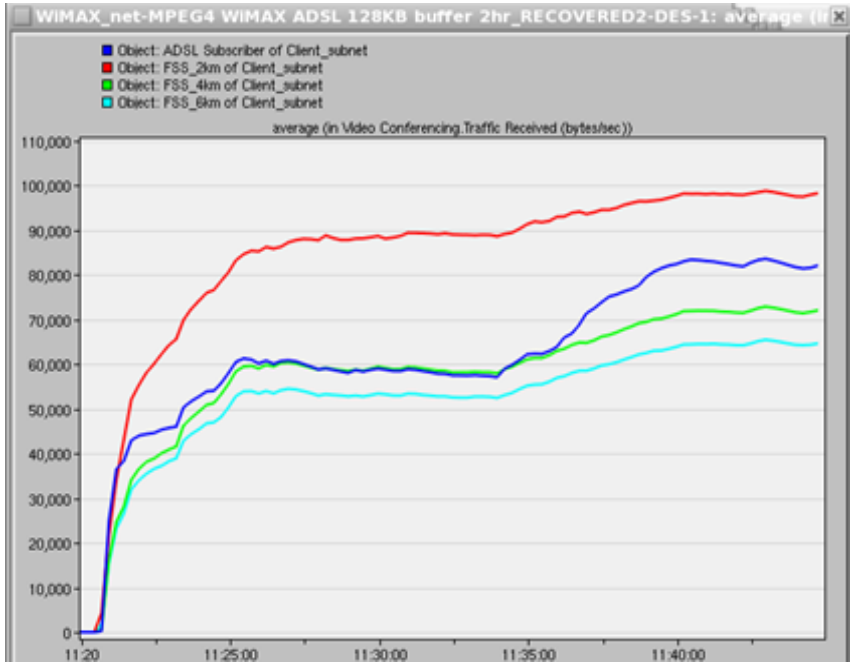


Video packet jitter

- ADSL client curve performed better than the ideal jitter of 20 ms
- WiMAX client station curves are closely tracked each other and approaches the average jitter of 24 ms

ANALYSIS

- **Throughput**

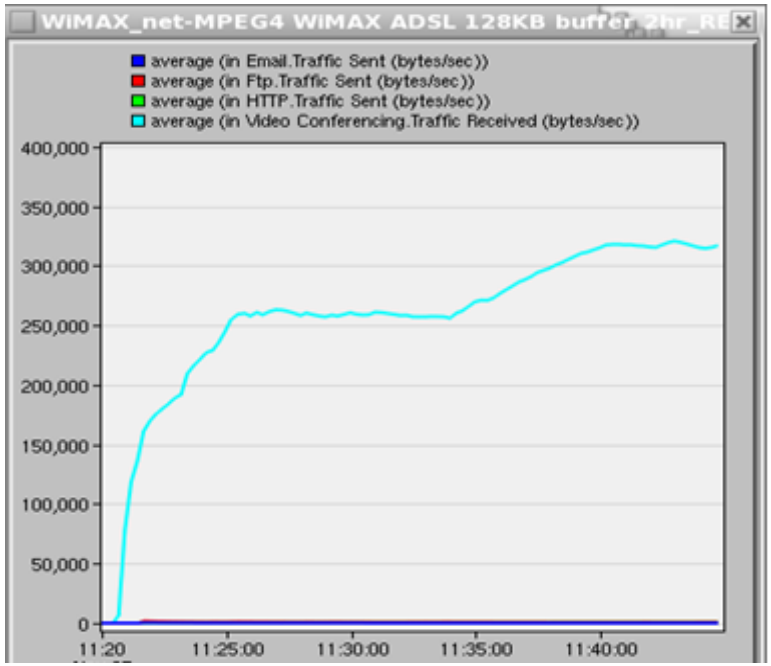


Minimum throughput

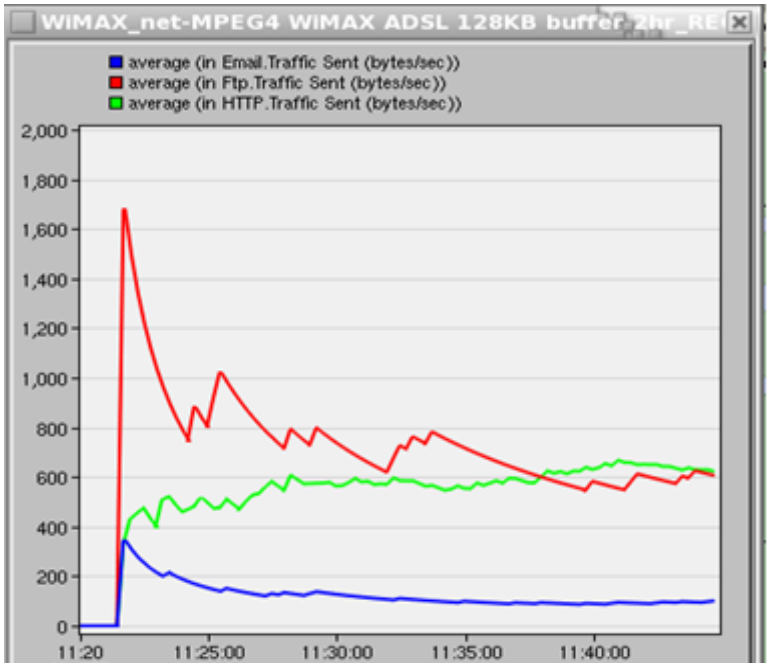
- 2 km WiMAX client curve exhibits better throughput than ADSL client curve
- As distance increases, 4 km and 6 km WiMAX client curves shows deviation

ANALYSIS

- **Throughput comparison of all applications**



Throughput comparison of audio/video and other applications like HTTP, FTP, and Email



Throughput comparison of HTTP, FTP, and Email

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CONCLUSION

- Simulation Time : 30 minutes

- WiMAX satisfies the performance metrics
  - WiMAX packet loss significantly reduced by increasing BS buffering

- Overall results in comparison to ADSL are promising
  - Dependant on specific carrier deployment parameters WiMAX has the capacity to deliver higher throughput rates and QoS

- Simulations do not guarantee real world equivalence
  - Must be considered when interpreting results

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CHALLENGES

- Environment (licensing, access)
- Disk Quota exceeded
- Learning WiMAX fundamentals within project duration

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FUTURE WORK

- Conduct comprehensive analysis of WiMAX networks and characterize more WiMAX parameters
- Research and refine all performance matrices
- Incorporate other applications like remote login and network printer
- WiMAX mobility and shadowing

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REFERENCES

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THANK YOU