Analysis of Video Conferencing on LTE Network with OPNET 16.0

School of Engineering Science
Simon Fraser University

ENSC 427, Spring 14, Team 08

http://www.sfu.ca/~kjavanma/

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Petar Arnaut	301095130
Kamyar Javanmardi	301120403
Janine Li	301132839

Roadmap

- Introduction
- Scope of the Project
- Simulation Design
- Analysis
- Conclusions, Challenges, and Future Work
- References

Introduction

- Why LTE (Long-Term Evolution)?

  - Definition [1]
  - Advantage [2]
  - Economic growth [3]

- Why OPNET®?

  - More simulation features than other simulators
  - Ability to access with a wide range of available standards and vendors
  - Used by large companies

Introduction

- Video Conference

- Video frame inter-arrival rates range from 10 fps to 30 fps
- Sent bit rate is constant
- Classify the quality of video content by some factors such as frame inter-arrival rate and pixel color depth

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Scope of the Project

Case I. Single-Base Station

Bandwidth	E2E delay (s)
	Throughput (bps)
	Traffic sent/received (bps)
Distance Between Base Station and Destination	E2E delay (s)
	-
	-
Quality of Video Content	E2E delay (s)
	Throughput (bps)
	Traffic sent/received (bps)

E2E delay: End-to-End delay refers to the time taken for a packet to be transmitted across a network from source to destination

Throughput: the rate of successful message delivery over a communication channel

Traffic s/r: the amount and type of traffic on a particular network is sent or received

Scope of the Project

Case II. Multiple-Base Stations	
vs. Single Base Station	E2E delay (s)
	Throughput (bps)
	Traffic sent/received (bps)
Single User vs. Multiple Users	E2E delay (s)
	Throughput (bps)
	-

E2E delay: End-to-End delay refers to the time taken for a packet to be transmitted across a network from source to destination

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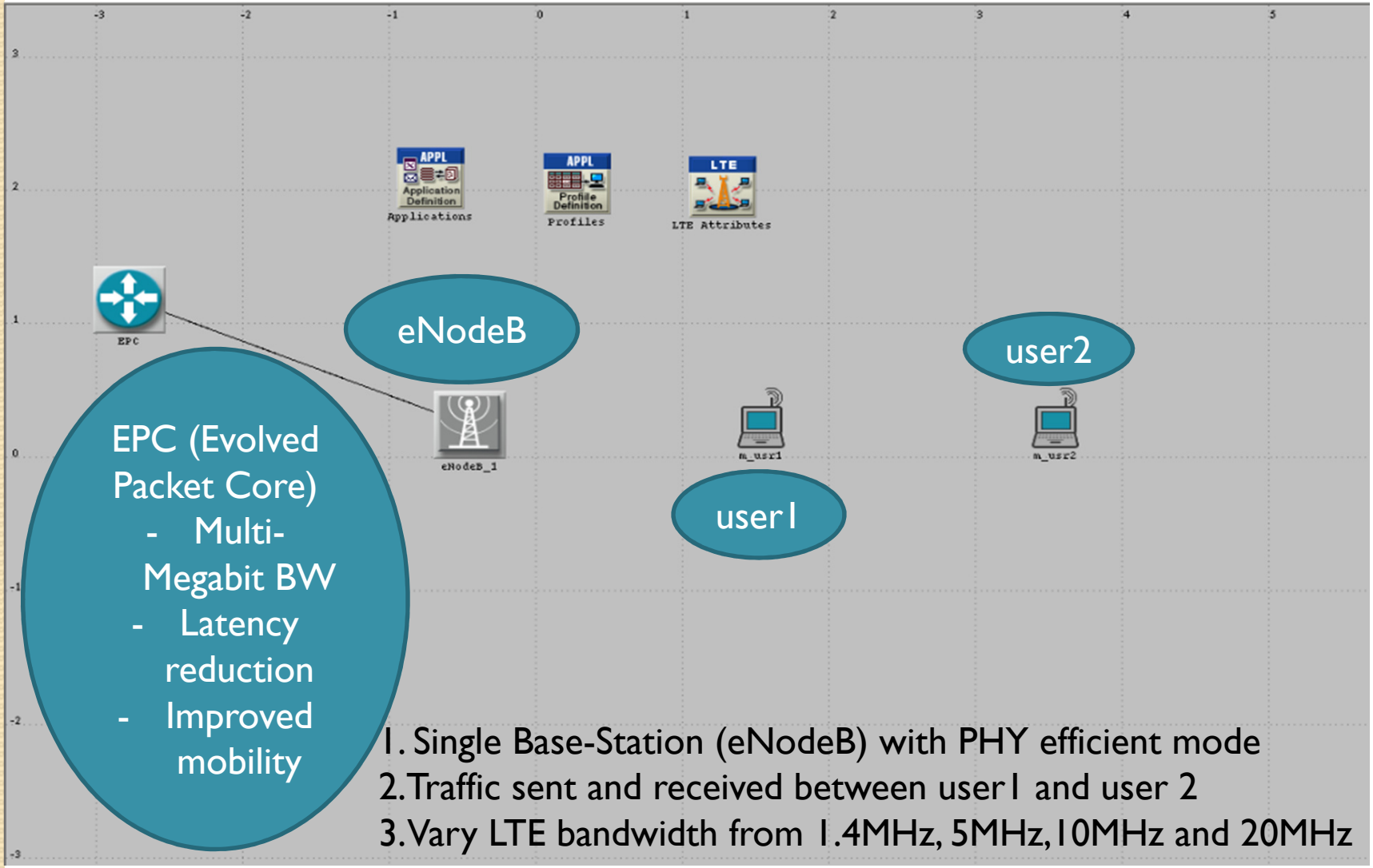
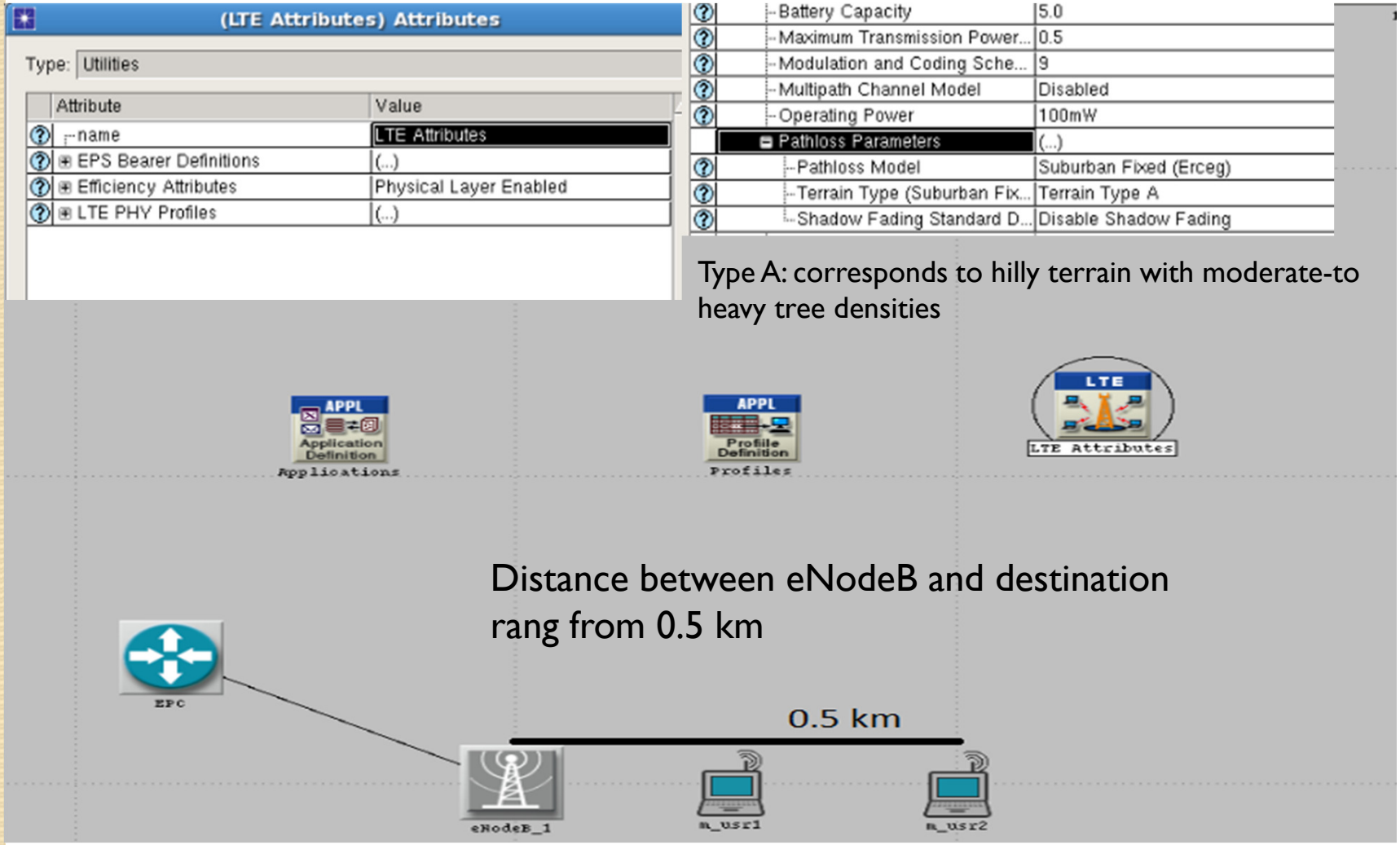
Simulation Design

Case I - Scenario I (Bandwidth)



Simulation Design

Case I – Scenario 2 (Distance)

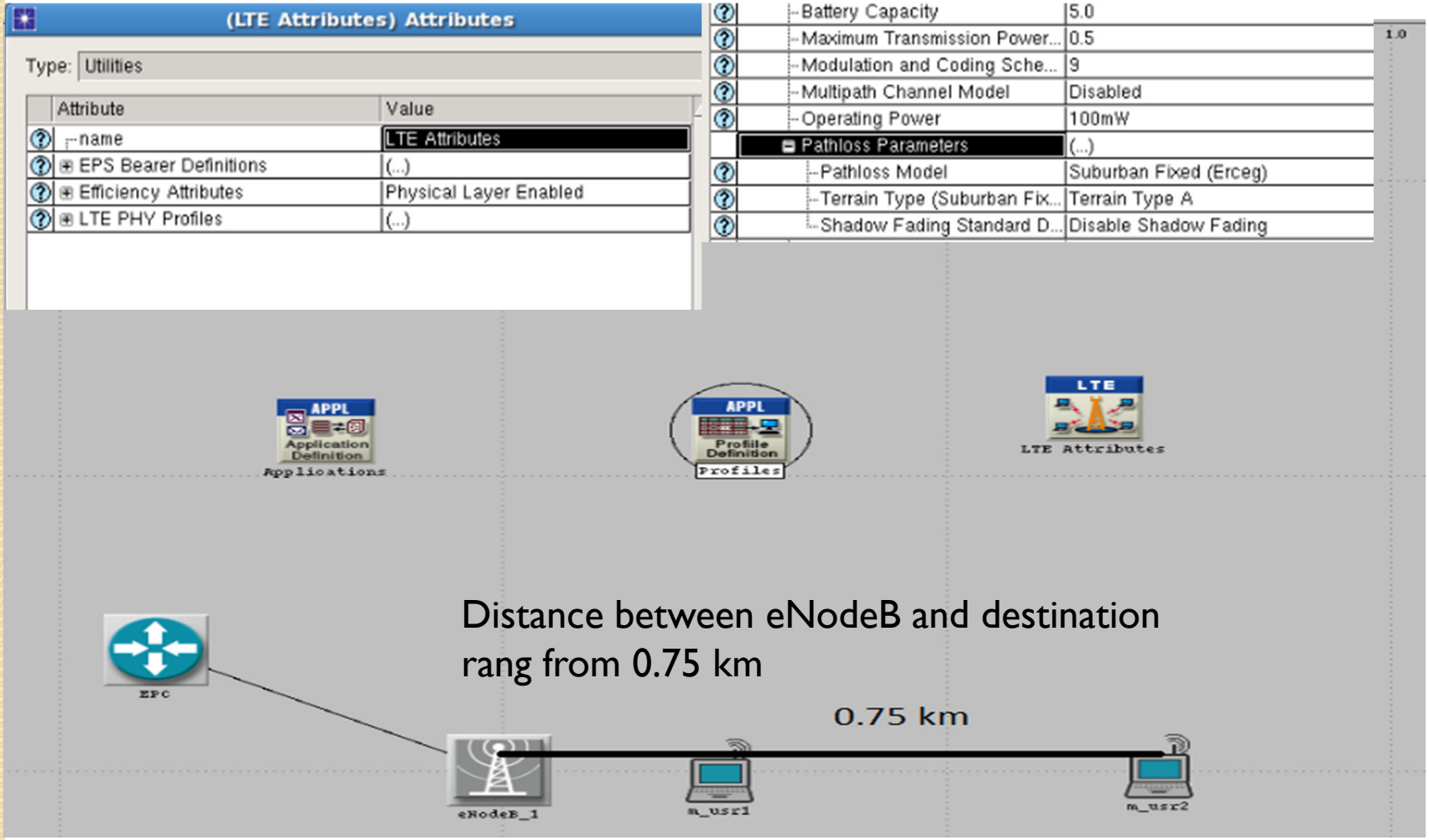


Type A: corresponds to hilly terrain with moderate-to heavy tree densities

Distance between eNodeB and destination rang from 0.5 km

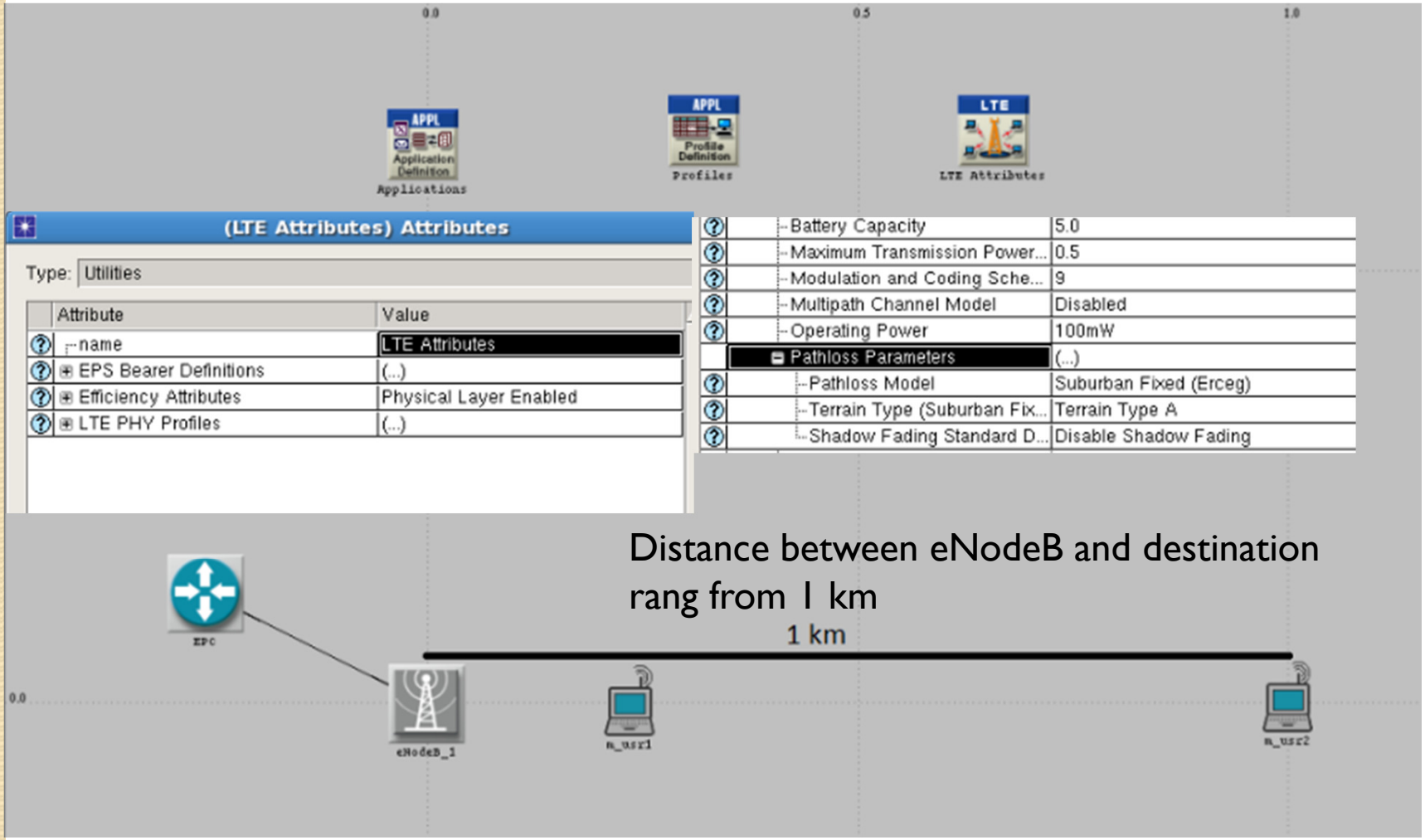
Simulation Design

Case I – Scenario 2 (Distance)



Simulation Design

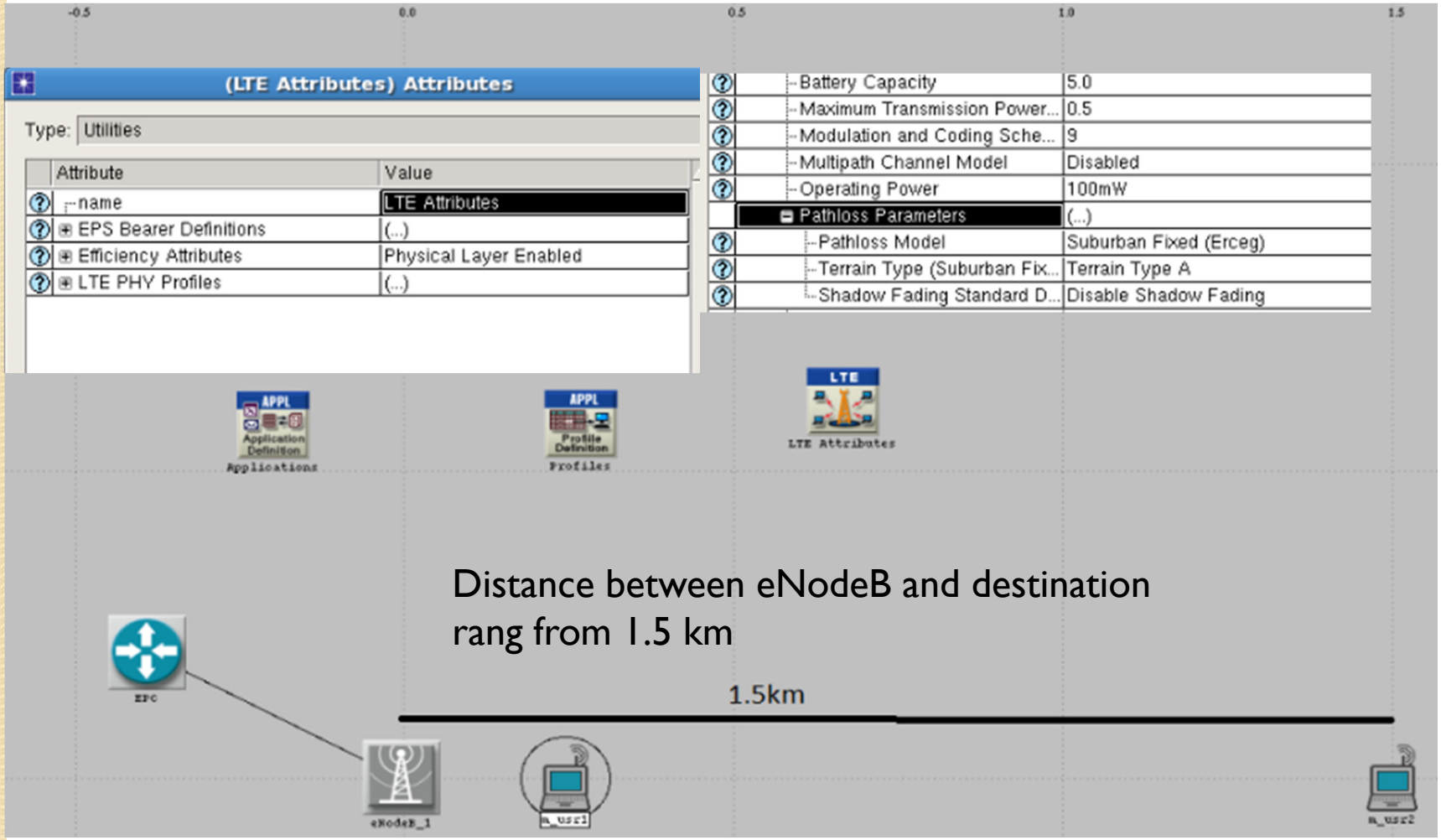
Case I – Scenario 2 (Distance)



Distance between eNodeB and destination rang from 1 km

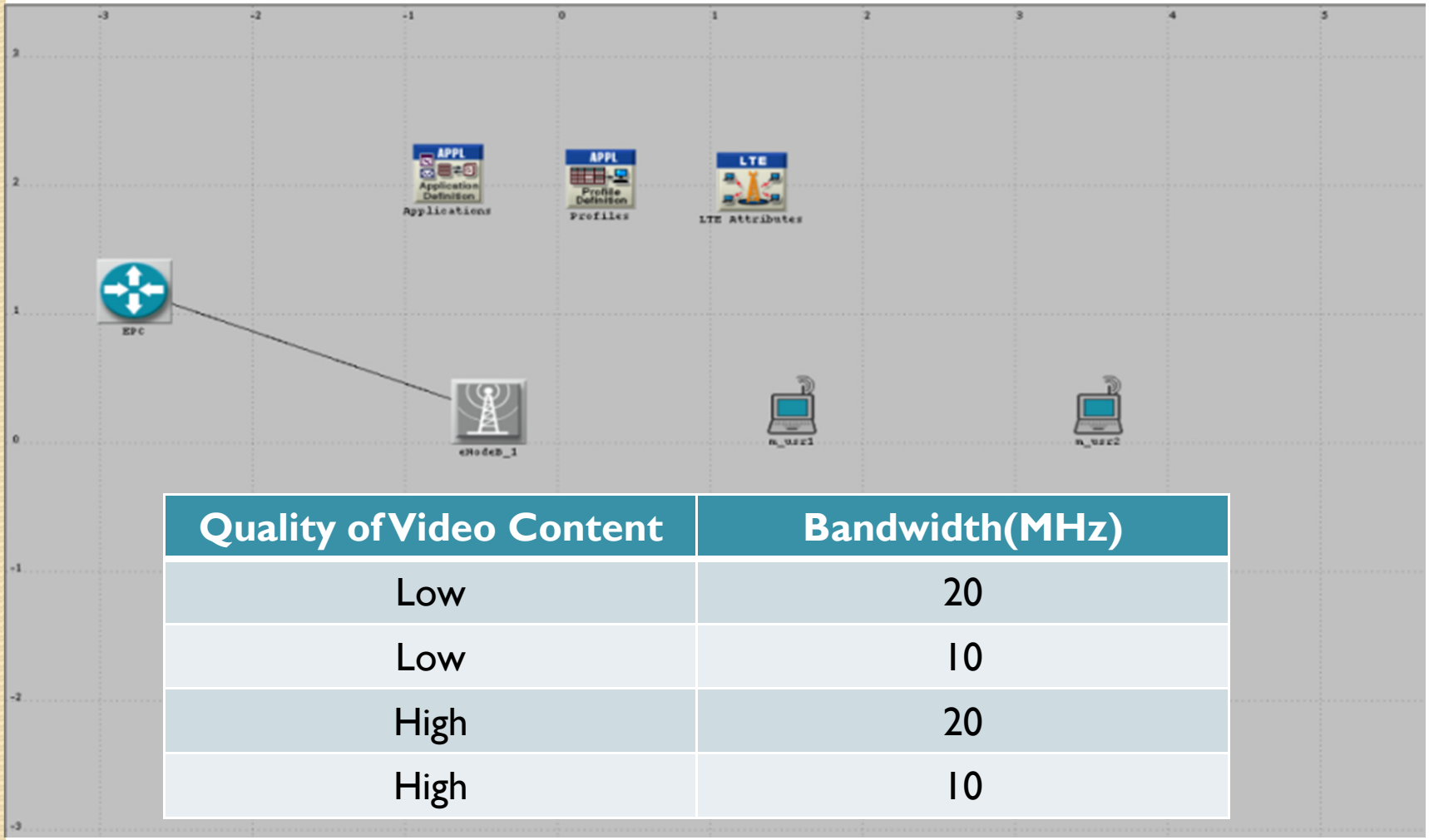
Simulation Design

Case I – Scenario 2 (Distance)



Simulation Design

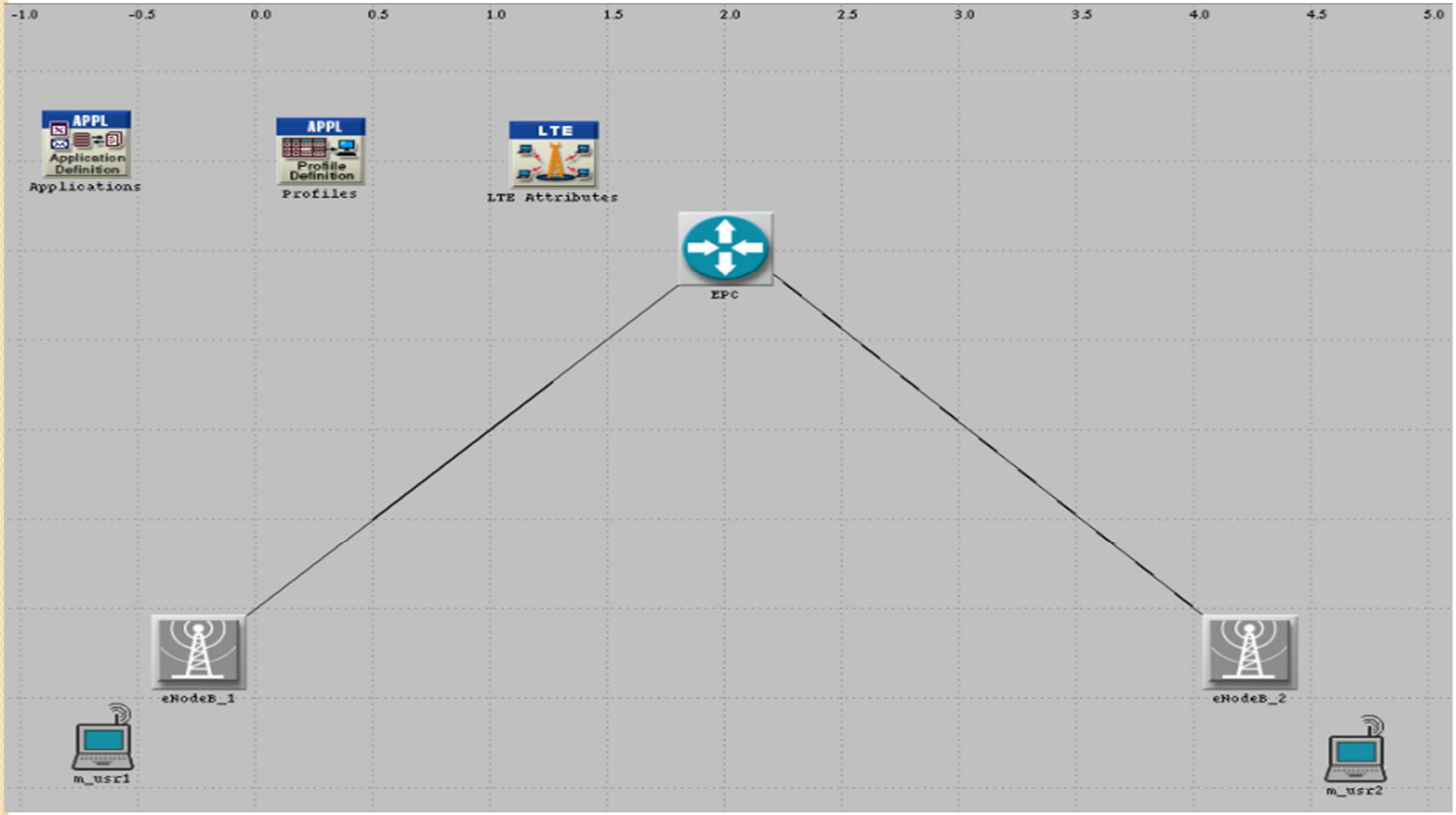
Case I – Scenario 3 (Video Quality)



Quality of Video Content	Bandwidth(MHz)
Low	20
Low	10
High	20
High	10

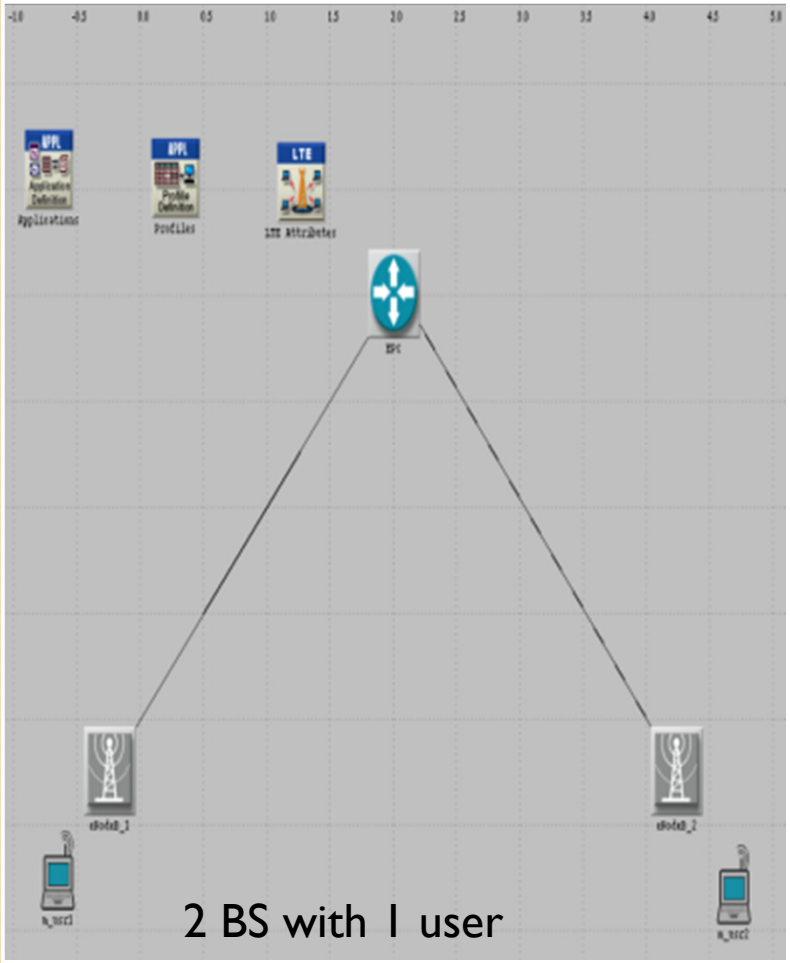
Simulation Design

Case II – Scenario 1
(Single Base Station vs. Multiple Base Stations)

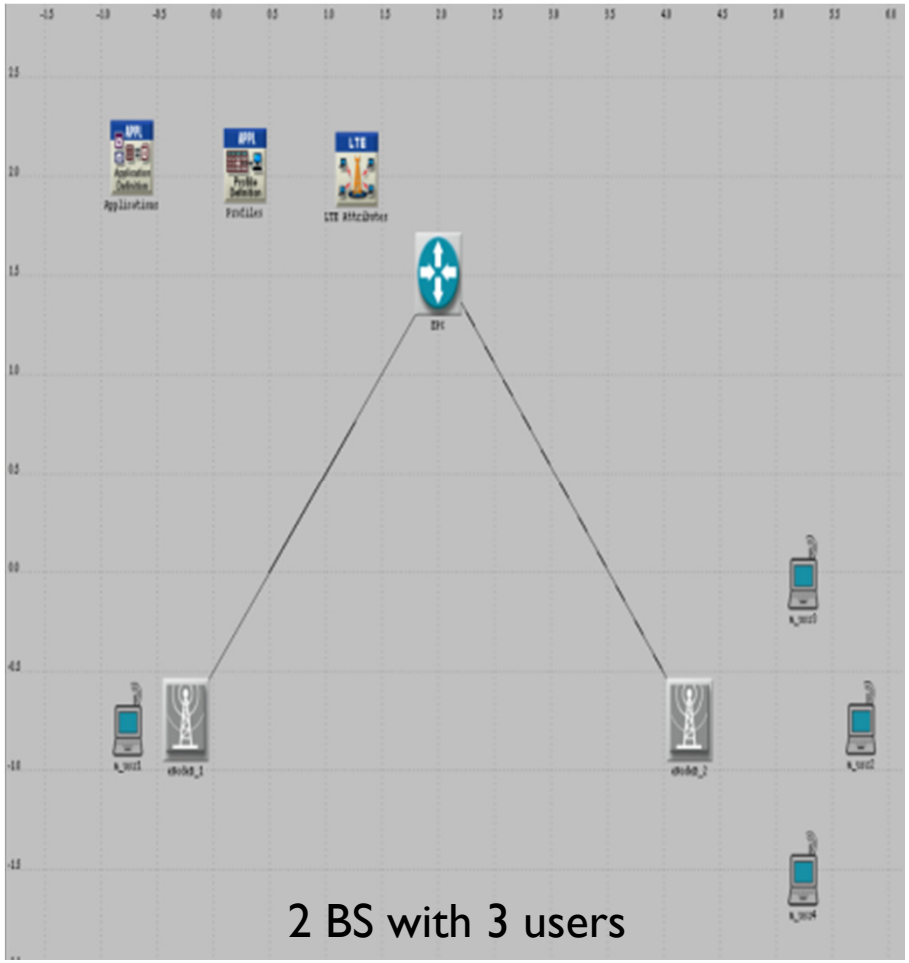


Simulation Design

Case II – Scenario 2 (Multiple Base Stations single user vs. multiple users)



2 BS with 1 user



2 BS with 3 users

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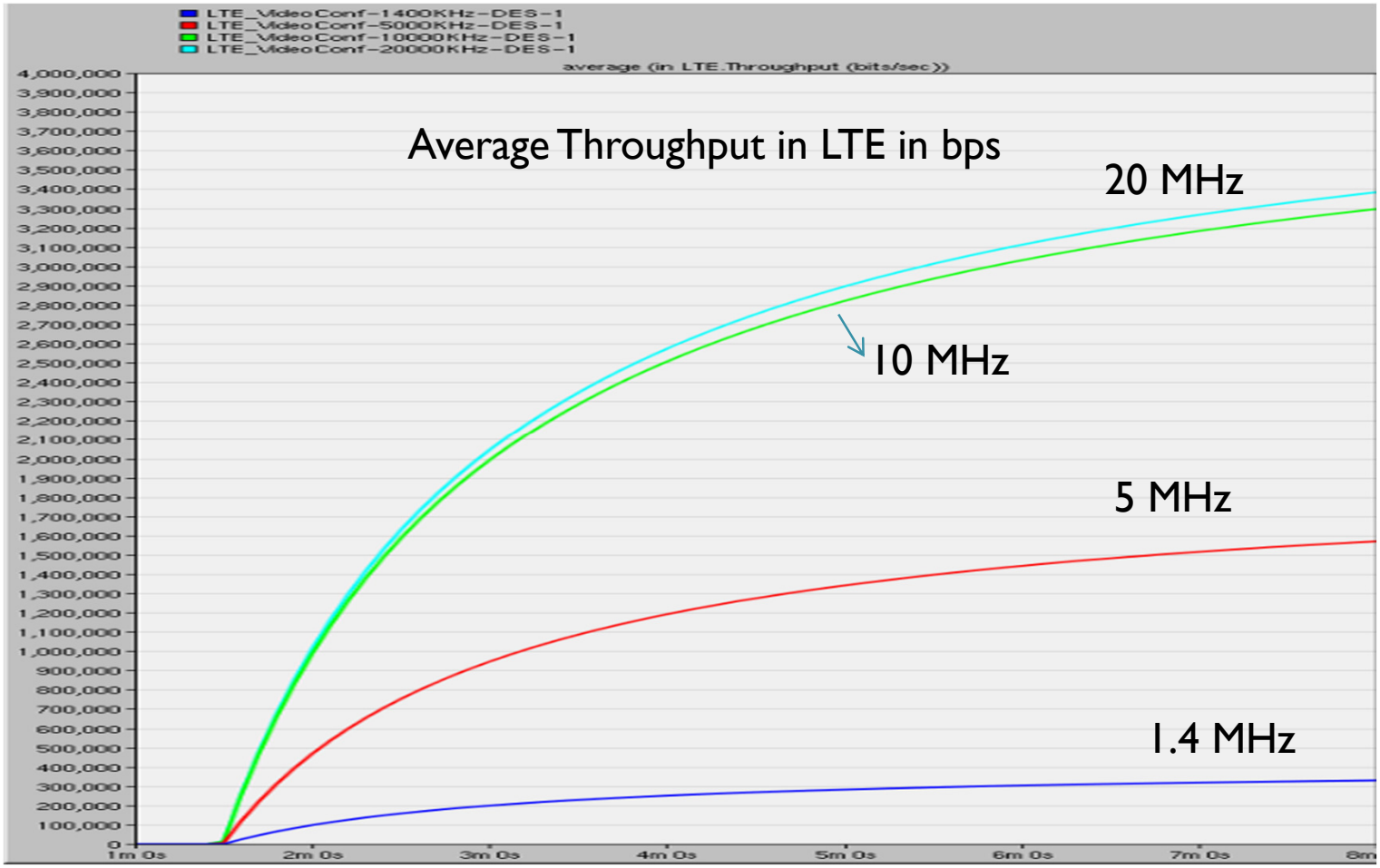
Results Analysis

Case I – Scenario I– E2E delay

Bandwidth (MHz)	E2E delay at peak (s)
1.4	≈ 22
5	≈3.8
10	≈3.4
20	≈0.036

Results Analysis

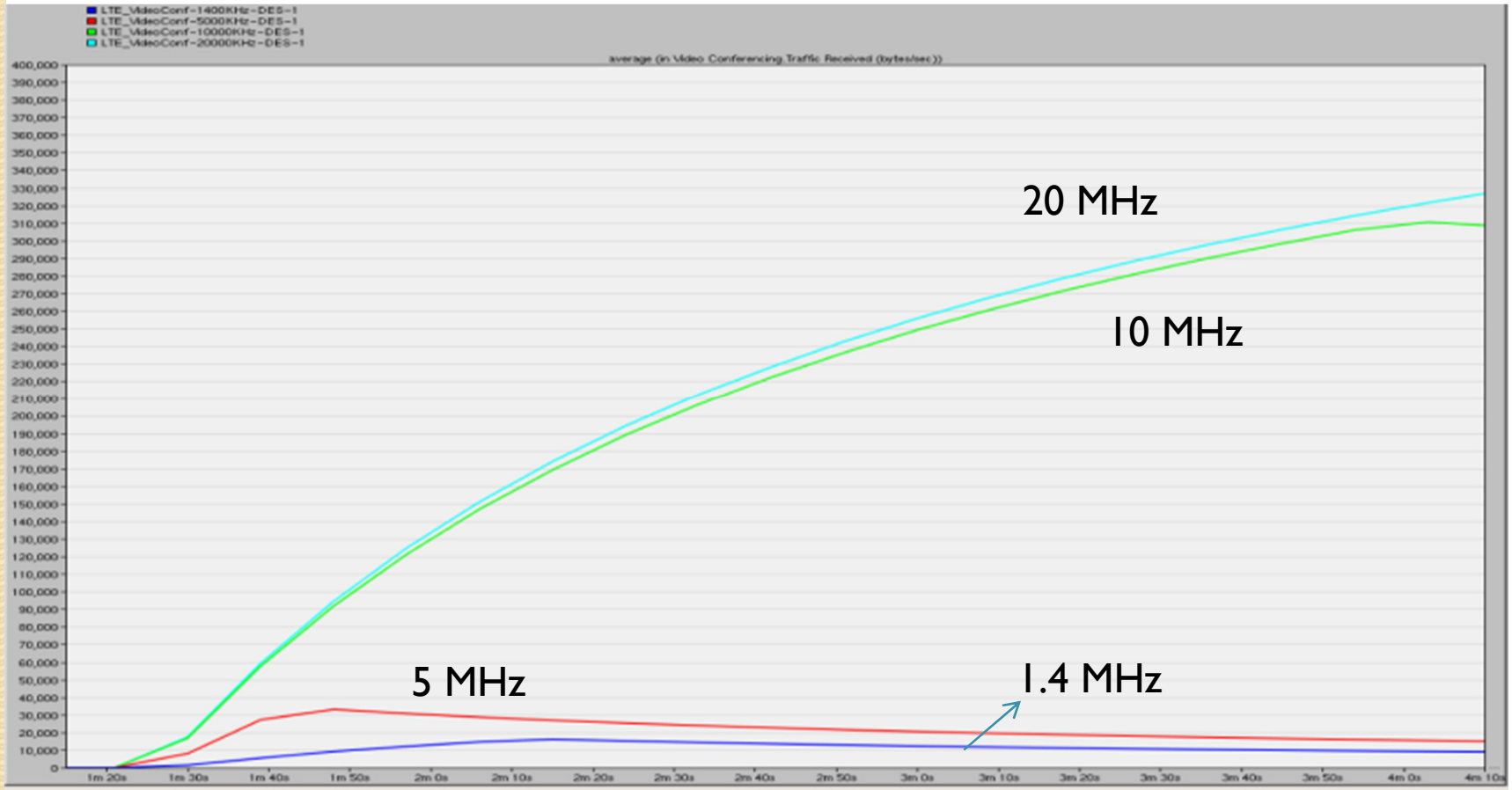
Case 1 – Scenario 1 – Throughput



Comparing with 20MHz and 1.4MHz, 20 MHz has the greatest throughput, while 1.4 MHz, the throughput drops dramatically. However, there is not large difference Between 10 and 20 MHz of the throughput.

Results Analysis

Case I – Scenario I – Traffic Received

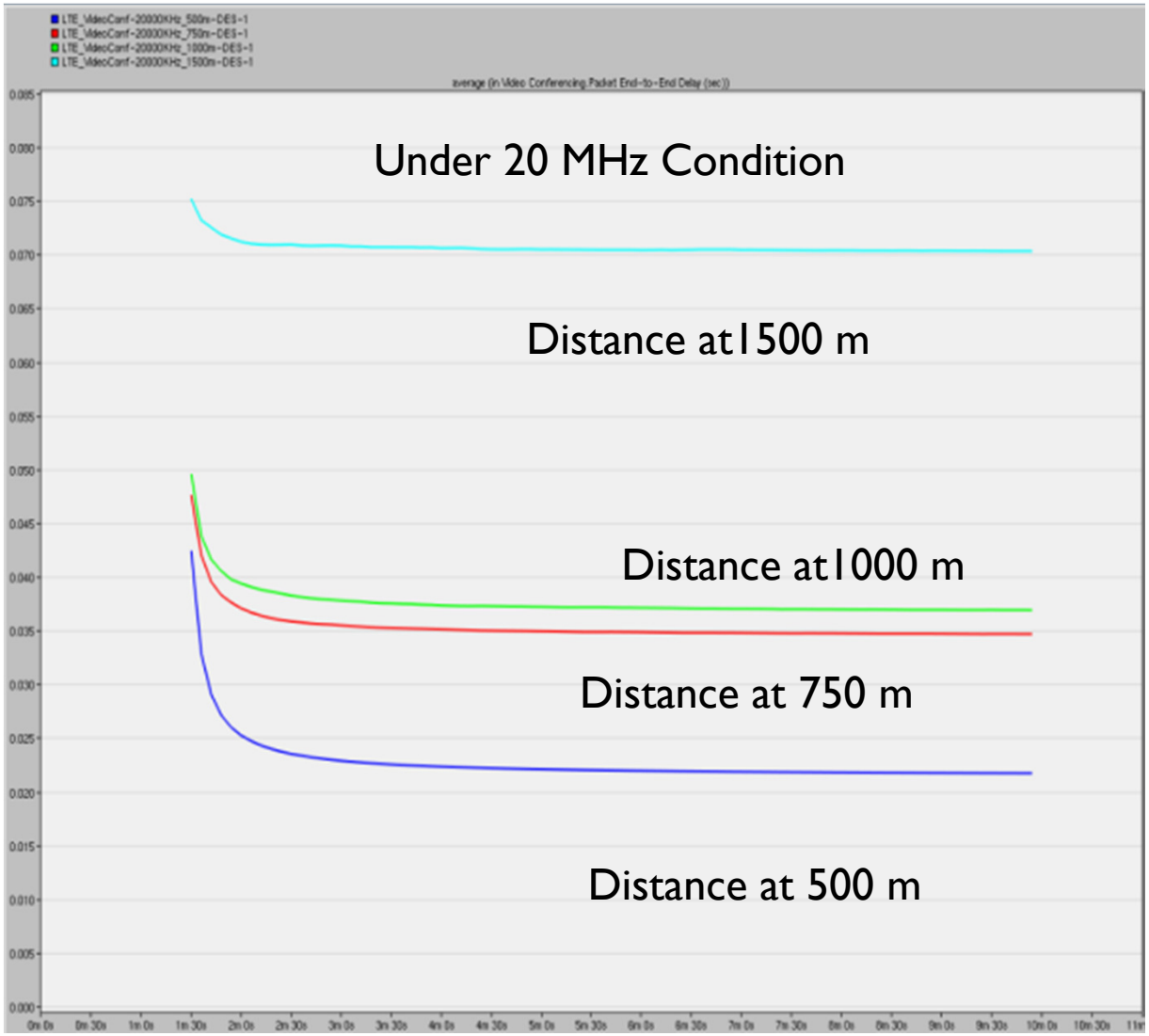


Comparing 20MHz and 10 MHz in traffic received, the traffic received (bps) of 10 MHz just slightly differs with 20 MHz traffic received (bps).

Results Analysis

Case I – Scenario 2 – E2E delay

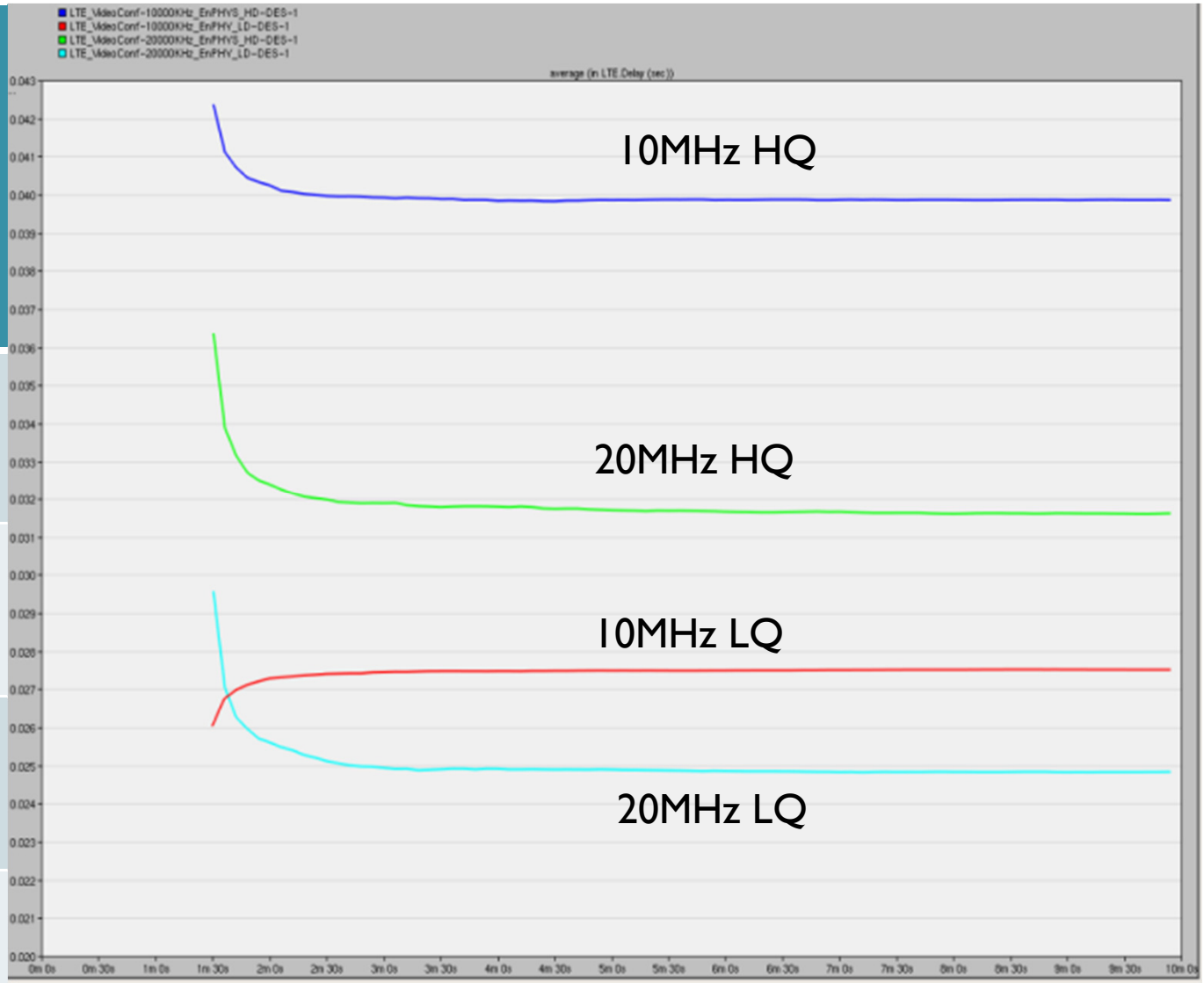
Distance (m)	Average E2E delay (s)	At the Beginning (s)
1500	0.071	0.075
1000	0.038	0.050
750	0.035	0.048
500	0.022	0.043



Results Analysis

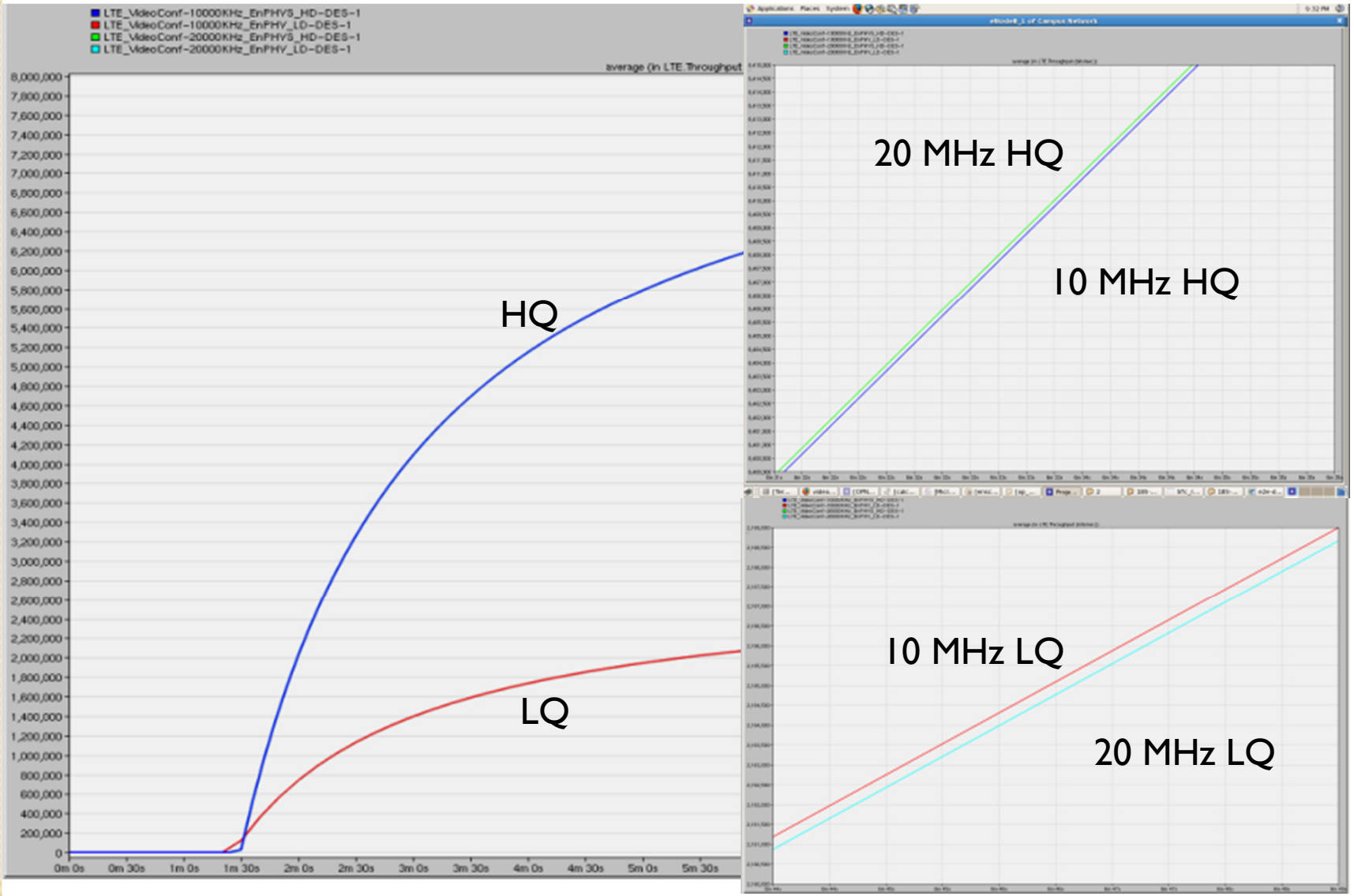
Case I – Scenario 3 – E2E delay

Bandwidth (MHz)	Quality of Video	E2E delay (s)
10	HQ	≈0.0409
20	HQ	≈0.0318
10	LQ	≈0.0275
20	LQ	≈0.0248



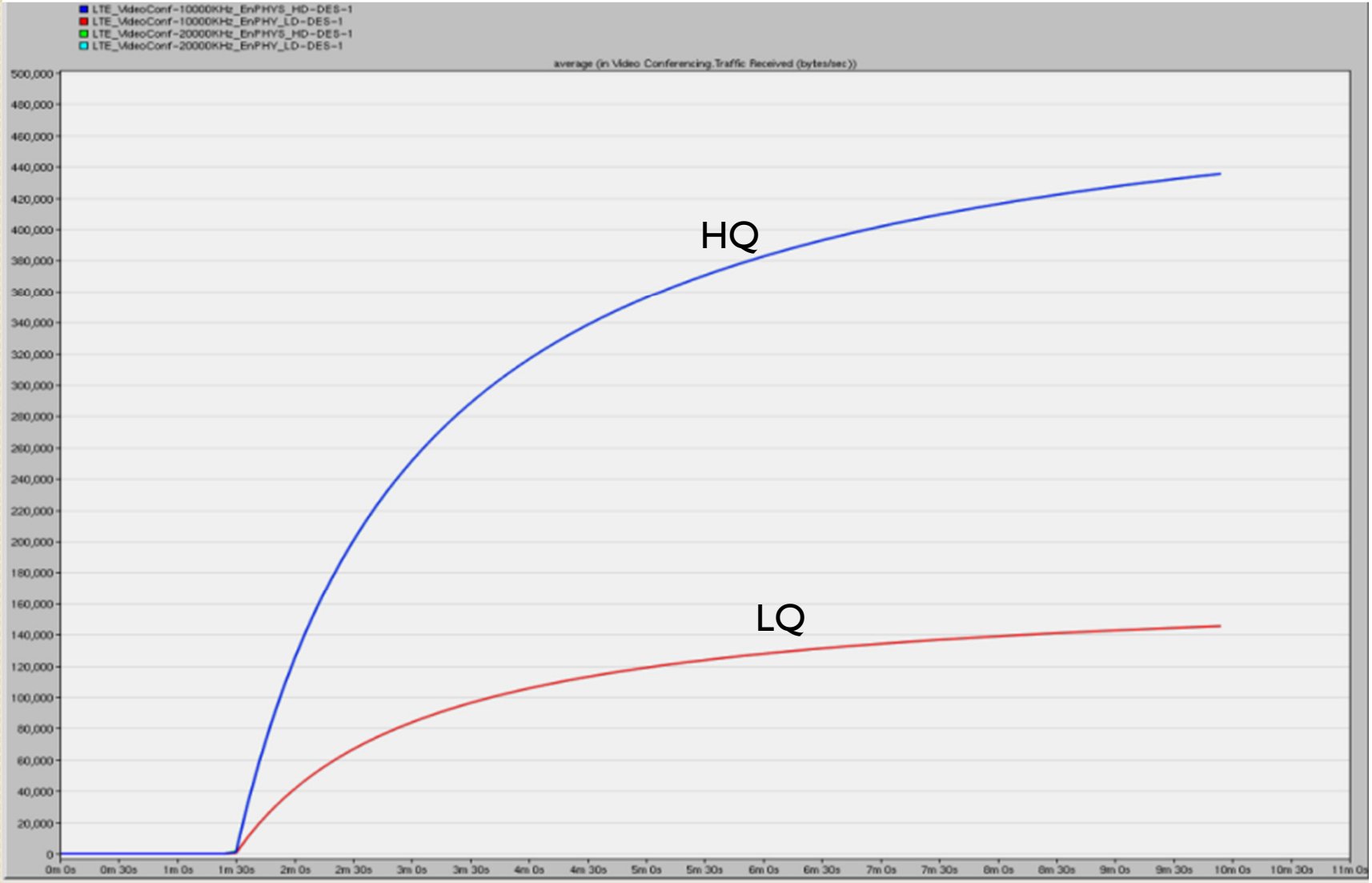
Results Analysis

Case I –Scenario 3– Throughput (bps)



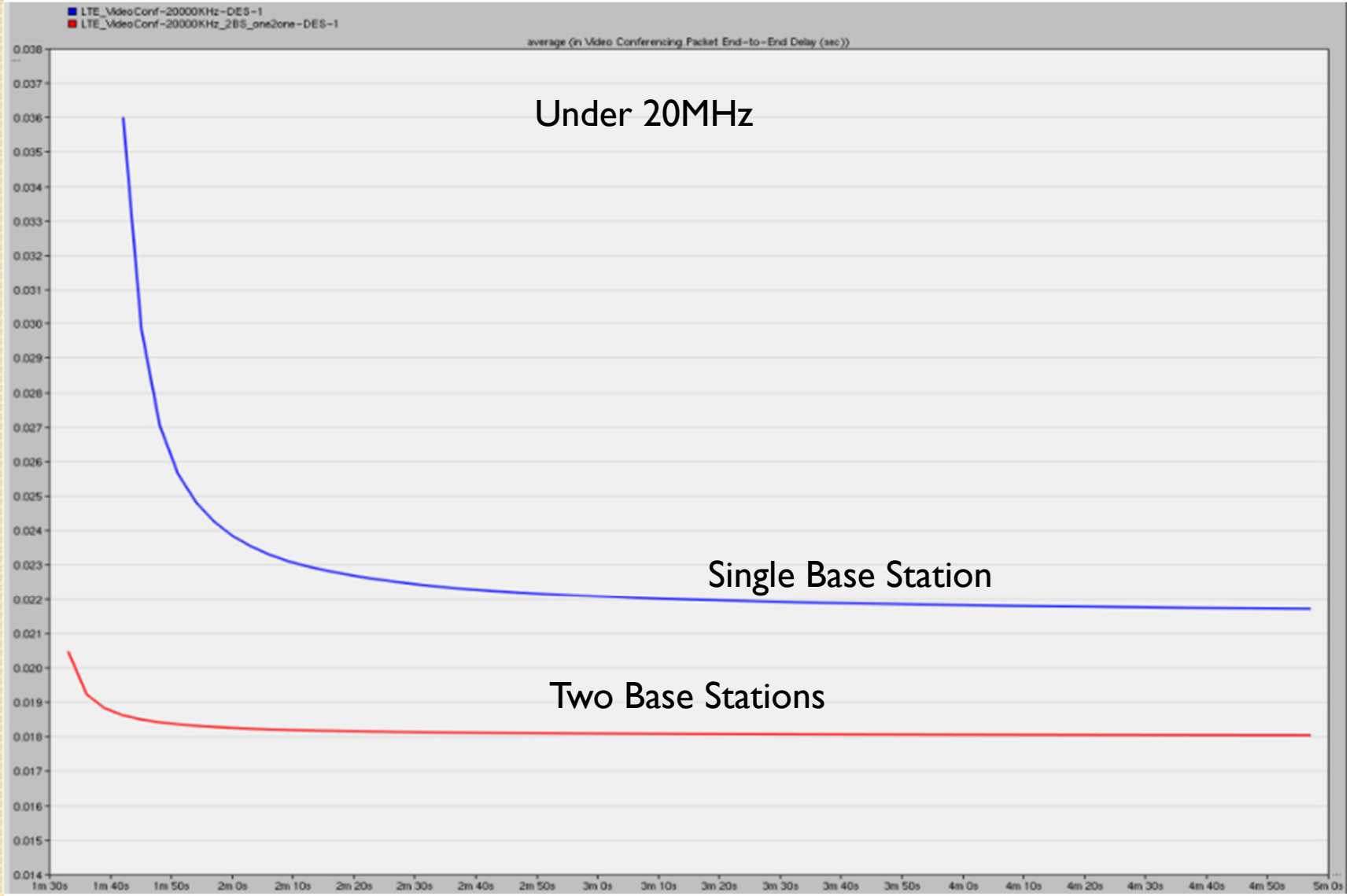
Results Analysis

Case I –Scenario 3– traffic received



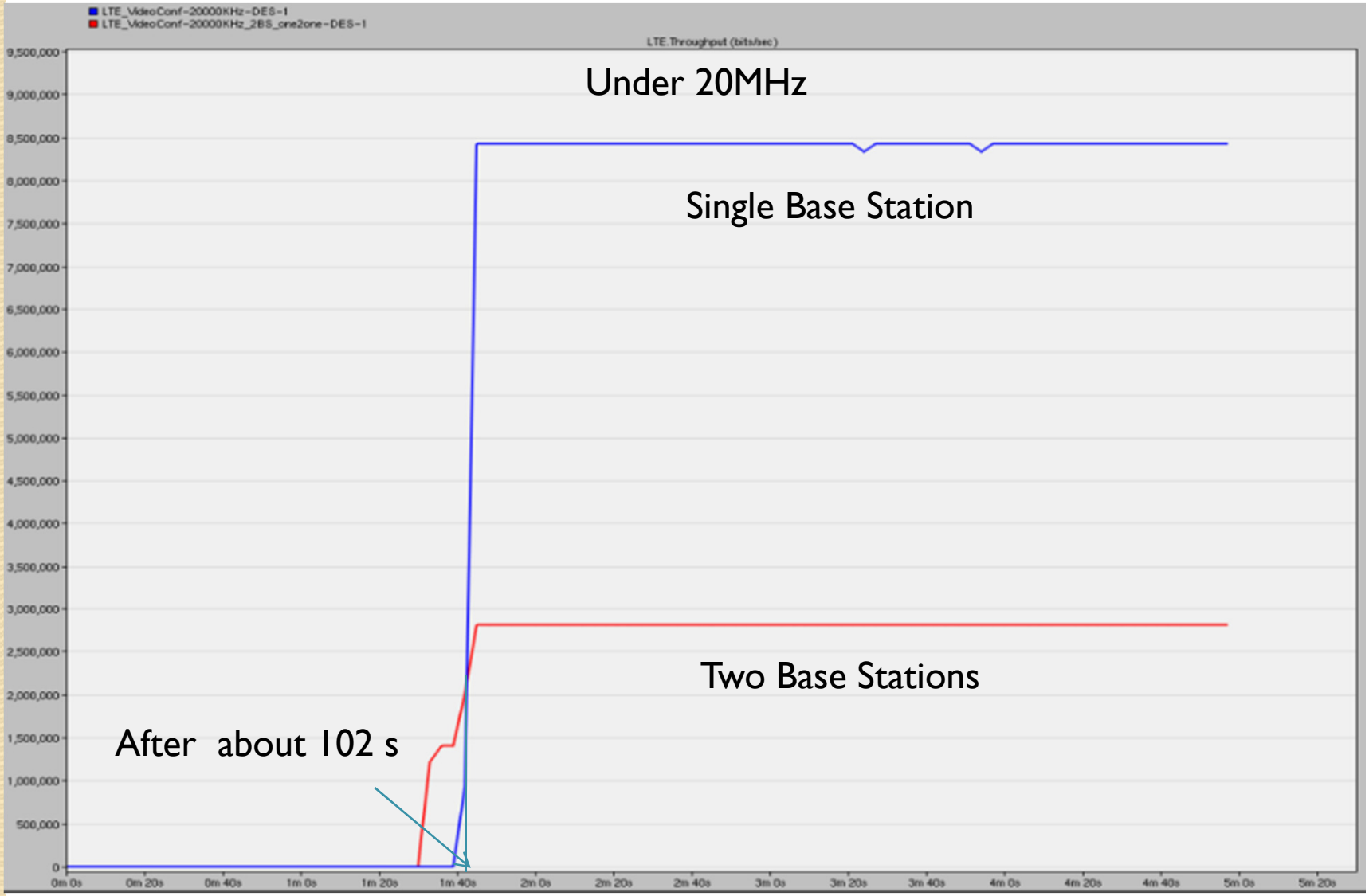
Results Analysis

Case II–Scenario I – E2E Delay



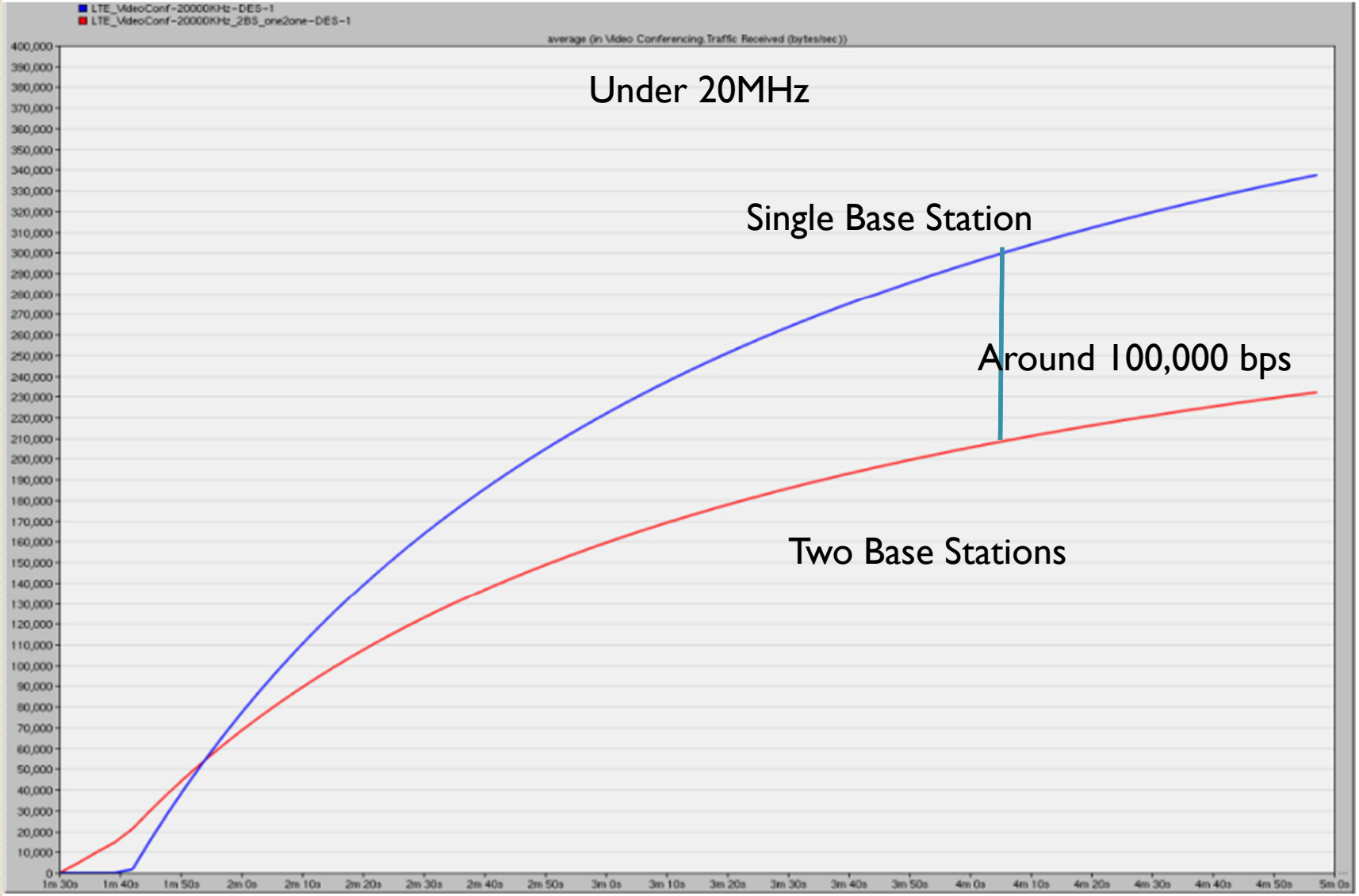
Results Analysis

Case II–Scenario 1 – Throughput (bps)



Results Analysis

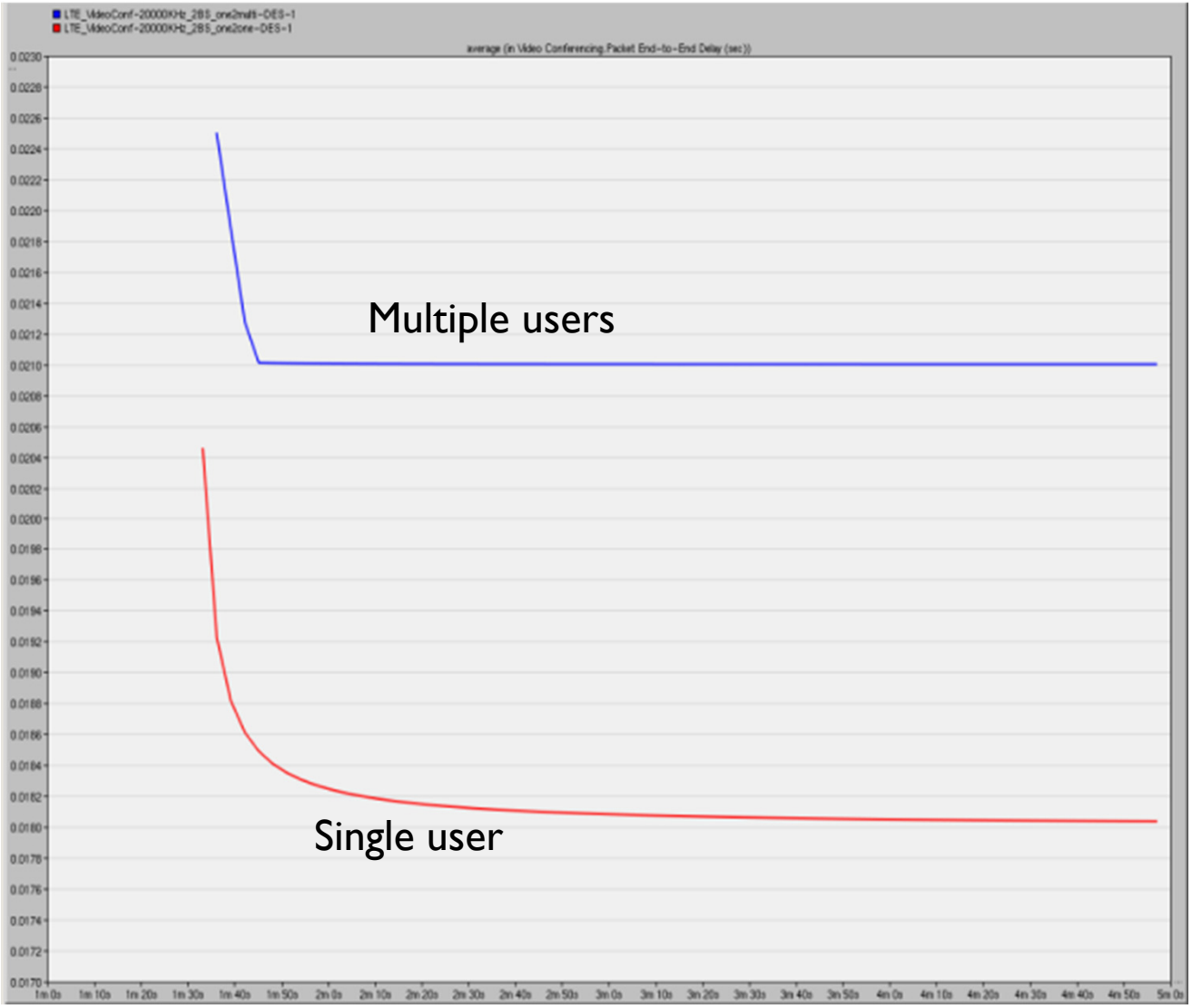
Case II–Scenario 1– Traffic Received (bps)



Results Analysis

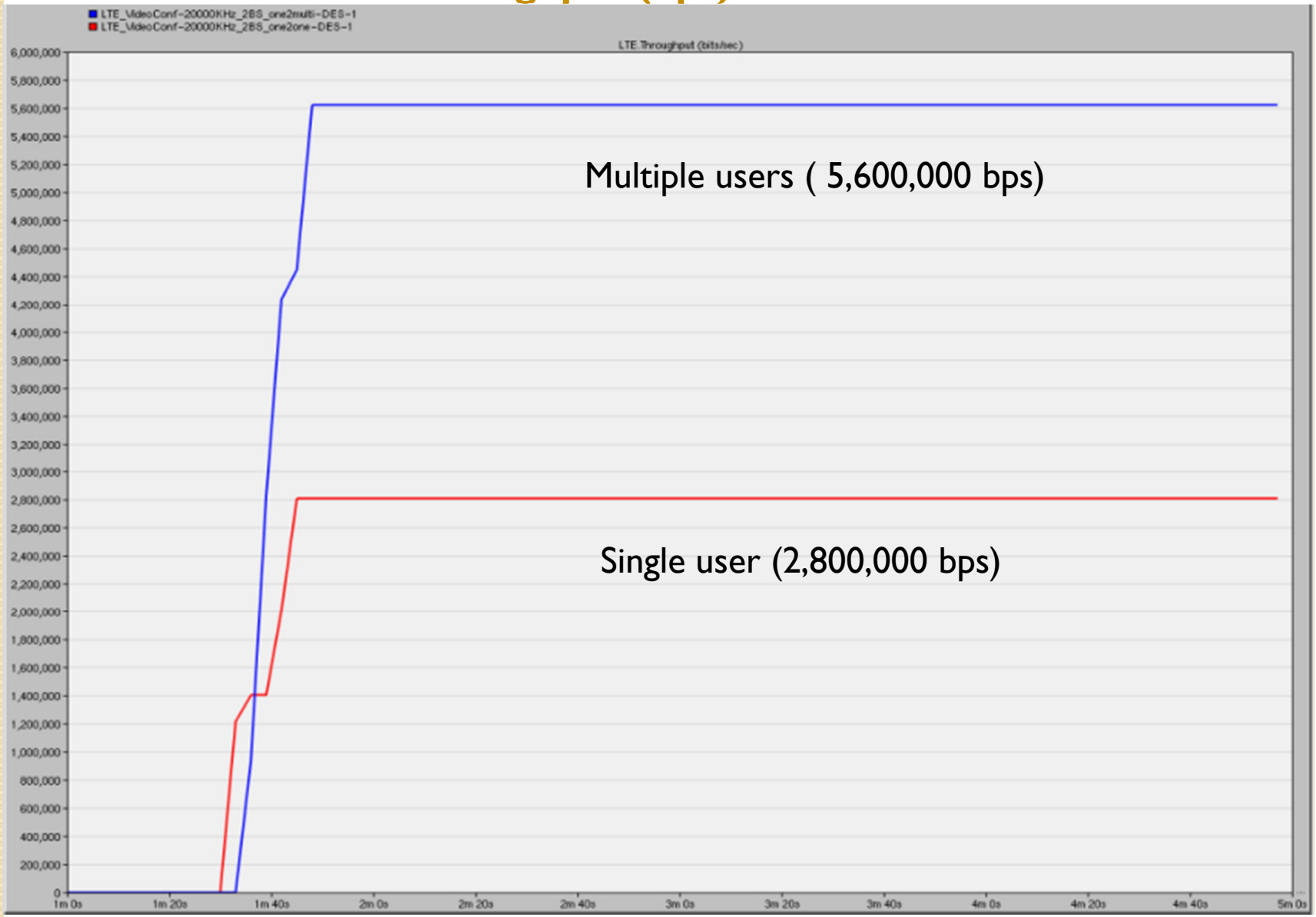
Case II–Scenario 2– E2E delay

	Single user	Multiple users
E2E delay (s) when stable	≈0.0180	≈0.0210



Results Analysis

Case II–Scenario 2– Throughput (bps)



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Conclusions

The effects of:

- Signal bandwidth – more BW, lower delay and higher throughput
- Distance from eNodeB – closer, lower delay and higher throughput
- Video quality (load) – lower load, lower delay and higher throughput
- Number of users – more users, more BW needed

Challenges

- Understanding of LTE configuration within the new software tool
- No previous academic work to be used as a reference

Future Work

- Analysis of LTE networks with different applications
- Using all the LTE and network attributes
- Studying and comparing LTE against another wireless data technology (WiMAX)

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References

[1] F.Zivkovic, J.Priest, H.Haghshenas " Quantitative Analysis of Streaming Multimedia over WiMAX and LTE Networks Using OPNET v. 16.0 ".[Online] Available: http://www2.ensc.sfu.ca/~ljilja/ENSC427/Spring13/Projects/team9/ENSC_427_Group_9_Final_Report.pdf [Accessed: 01 March 2014].

[2] "LTE: Long Term Evolution". [Online] Available: http://www.sfu.ca/~srajara1/Index.html [Accessed: 14 Febuary 2014].

[3] M. Torad, A.E. Qassas and H.A. Henawi, "Comparison between LTE and WiMAX based on System Level Simulation Using OPNET modeler" , 28th National Radio Science Conference, Apr. 2011, pp 1-9. [Online] Available: IEEE Xplore, http://ieeexplore.ieee.org/Xplore/guesthome.jsp [Accessed: 14 February 2014].

[4]E. Boyer and A. Chowdhury, "Analysis of Quality of Service (QoS) for Video Conferencing in WiMAX Networks" [Online]. Available: http://www.sfu.ca/~asc13/ensc427/afrin_eric_final_report_2010.pdf (Accessed: April 10 2014).

[5] X. Jiang, Z. Zhao, and F. Feng , " http://www.sfu.ca/~zza36/report-427.pdfâ€. [Online] Available: http://www.sfu.ca/~zza36/report-427.pdf [Accessed: 01 April 2014].


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Question?