



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/>

April 9th, 2014

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**?
Making Networks and Applications Perform™
 - 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



Roadmap

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



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

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



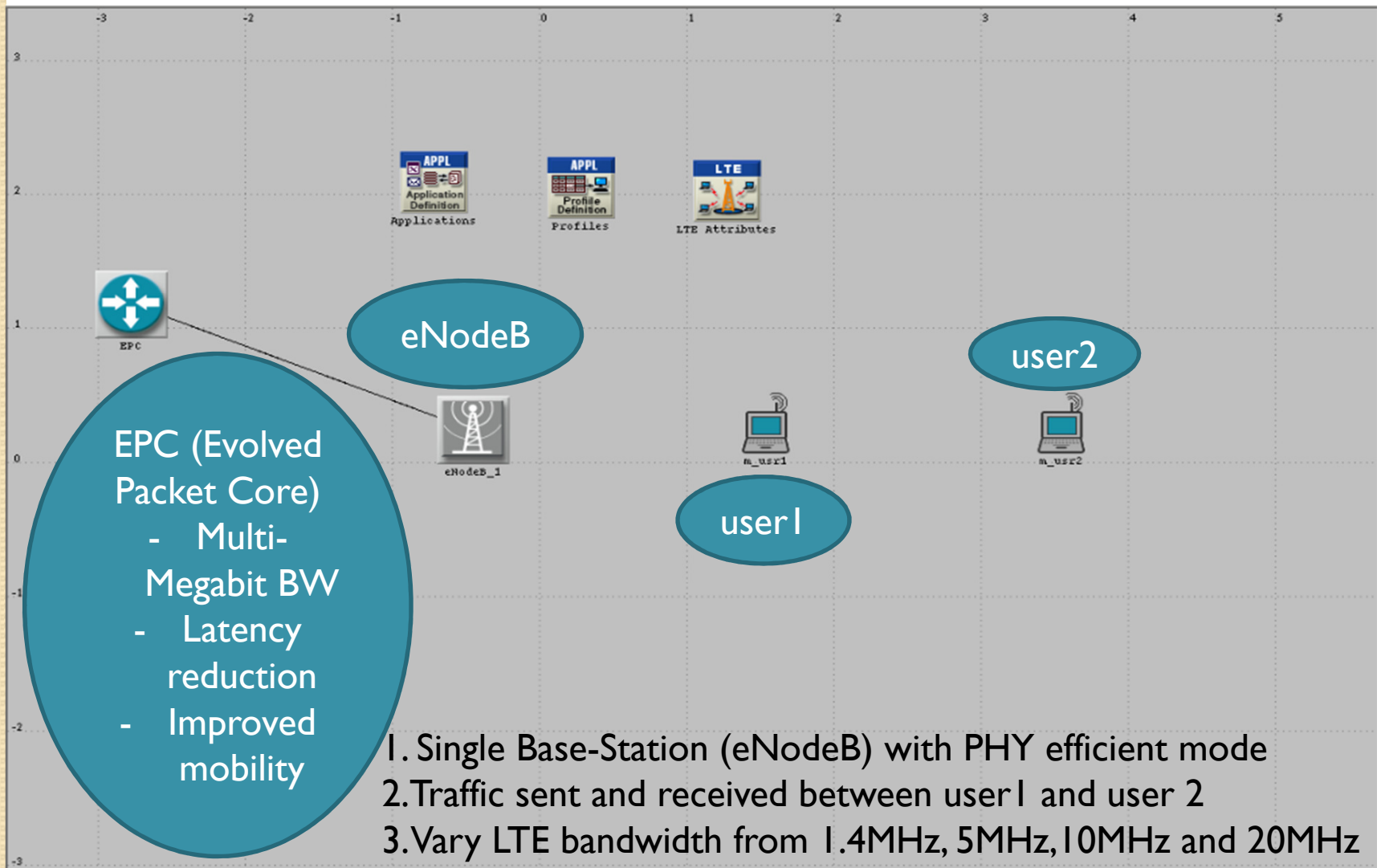
Roadmap

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



Simulation Design

Case I - Scenario I (Bandwidth)





Simulation Design

Case I – Scenario 2 (Distance)

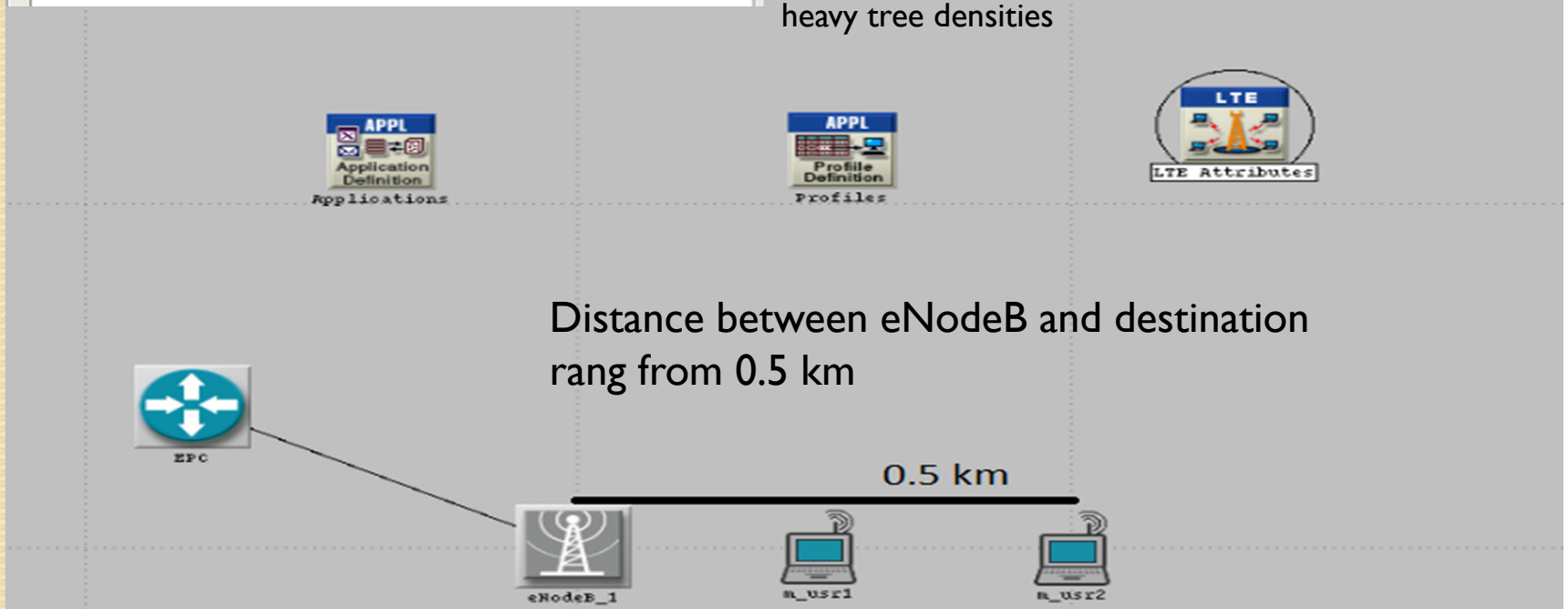
(LTE Attributes) Attributes

Type: Utilities

Attribute	Value
[-] name	LTE Attributes
[+] EPS Bearer Definitions	(...)
[+] Efficiency Attributes	Physical Layer Enabled
[+] LTE PHY Profiles	(...)

[-] Battery Capacity	5.0
[-] Maximum Transmission Power...	0.5
[-] Modulation and Coding Sche...	9
[-] Multipath Channel Model	Disabled
[-] Operating Power	100mW
[+] Pathloss Parameters	(...)
[-] Pathloss Model	Suburban Fixed (Erceg)
[-] Terrain Type (Suburban Fix...	Terrain Type A
[-] Shadow Fading Standard D...	Disable Shadow Fading

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)

(LTE Attributes) Attributes

Type: Utilities

Attribute	Value
[-] name	LTE Attributes
[+] EPS Bearer Definitions	(...)
[+] Efficiency Attributes	Physical Layer Enabled
[+] LTE PHY Profiles	(...)

[-] Battery Capacity	15.0
[-] Maximum Transmission Power...	0.5
[-] Modulation and Coding Sche...	9
[-] Multipath Channel Model	Disabled
[-] Operating Power	100mW
[-] Pathloss Parameters	(...)
[-] Pathloss Model	Suburban Fixed (Erceg)
[-] Terrain Type (Suburban Fix...	Terrain Type A
[-] Shadow Fading Standard D...	Disable Shadow Fading

Applications

Profiles

LTE Attributes

EPC

eNodeB_1

a_usr1

m_usr2

Distance between eNodeB and destination rang from 0.75 km

0.75 km



Simulation Design

Case I – Scenario 2 (Distance)

The screenshot displays the configuration interface for an LTE simulation. At the top, three icons represent 'Applications', 'Profiles', and 'LTE Attributes'. The 'LTE Attributes' panel is open, showing a list of parameters and their values. Below this, a network diagram shows an eNodeB connected to two users (n_usr1 and n_usr2) over a 1 km distance. The EPC is also shown connected to the eNodeB.

Attribute	Value
[-] name	LTE Attributes
[+] EPS Bearer Definitions	(...)
[+] Efficiency Attributes	Physical Layer Enabled
[+] LTE PHY Profiles	(...)

[-] Battery Capacity	5.0
[-] Maximum Transmission Power...	0.5
[-] Modulation and Coding Sche...	9
[-] Multipath Channel Model	Disabled
[-] Operating Power	100mW
[+] Pathloss Parameters	(...)
[-] Pathloss Model	Suburban Fixed (Erceg)
[-] Terrain Type (Suburban Fix...	Terrain Type A
[-] Shadow Fading Standard D...	Disable Shadow Fading

Distance between eNodeB and destination rang from 1 km

1 km



Simulation Design

Case I – Scenario 2 (Distance)

The screenshot displays the LTE simulation software interface. At the top, there are two configuration panels:

- (LTE Attributes) Attributes**: A table with columns 'Attribute' and 'Value'.

Attribute	Value
--name	LTE Attributes
⊕ EPS Bearer Definitions	(...)
⊕ Efficiency Attributes	Physical Layer Enabled
⊕ LTE PHY Profiles	(...)
- Pathloss Parameters**: A table with columns for parameter names and values.

--Battery Capacity	5.0
--Maximum Transmission Power...	0.5
--Modulation and Coding Sche...	9
--Multipath Channel Model	Disabled
--Operating Power	100mW
⊖ Pathloss Parameters	(...)
--Pathloss Model	Suburban Fixed (Erceg)
--Terrain Type (Suburban Fix...	Terrain Type A
--Shadow Fading Standard D...	Disable Shadow Fading

Below the configuration panels, there are three icons: 'Applications' (APPL), 'Profiles' (APPL), and 'LTE Attributes' (LTE).

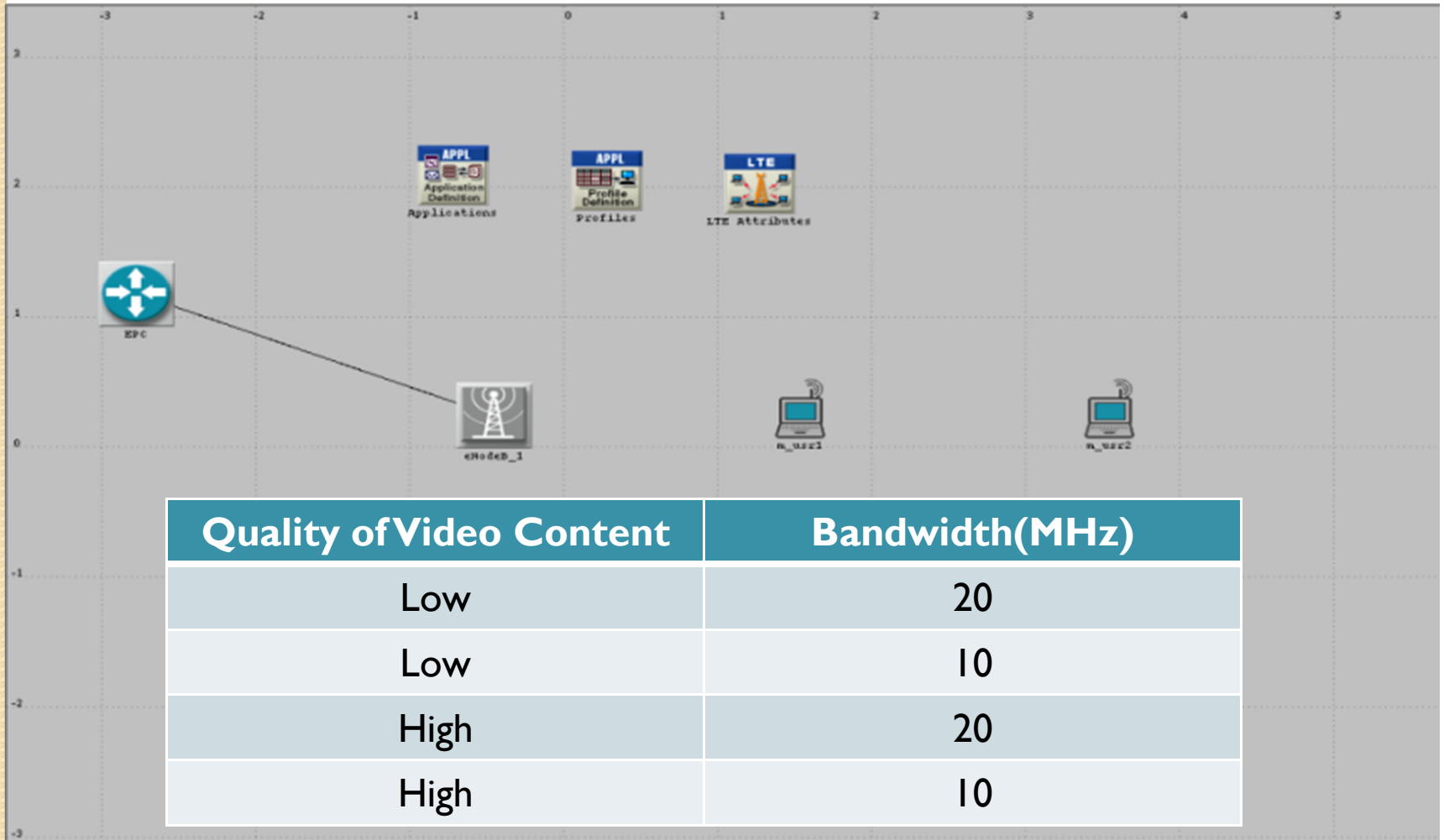
The main diagram area shows a network topology. On the left, an 'EPC' icon is connected to an 'eNodeB_1' icon. A horizontal line represents the distance between 'eNodeB_1' and 'n_usr2', labeled '1.5km'. Another 'n_usr2' icon is shown on the far right.

Distance between eNodeB and destination rang from 1.5 km



Simulation Design

Case I – Scenario 3 (Video Quality)

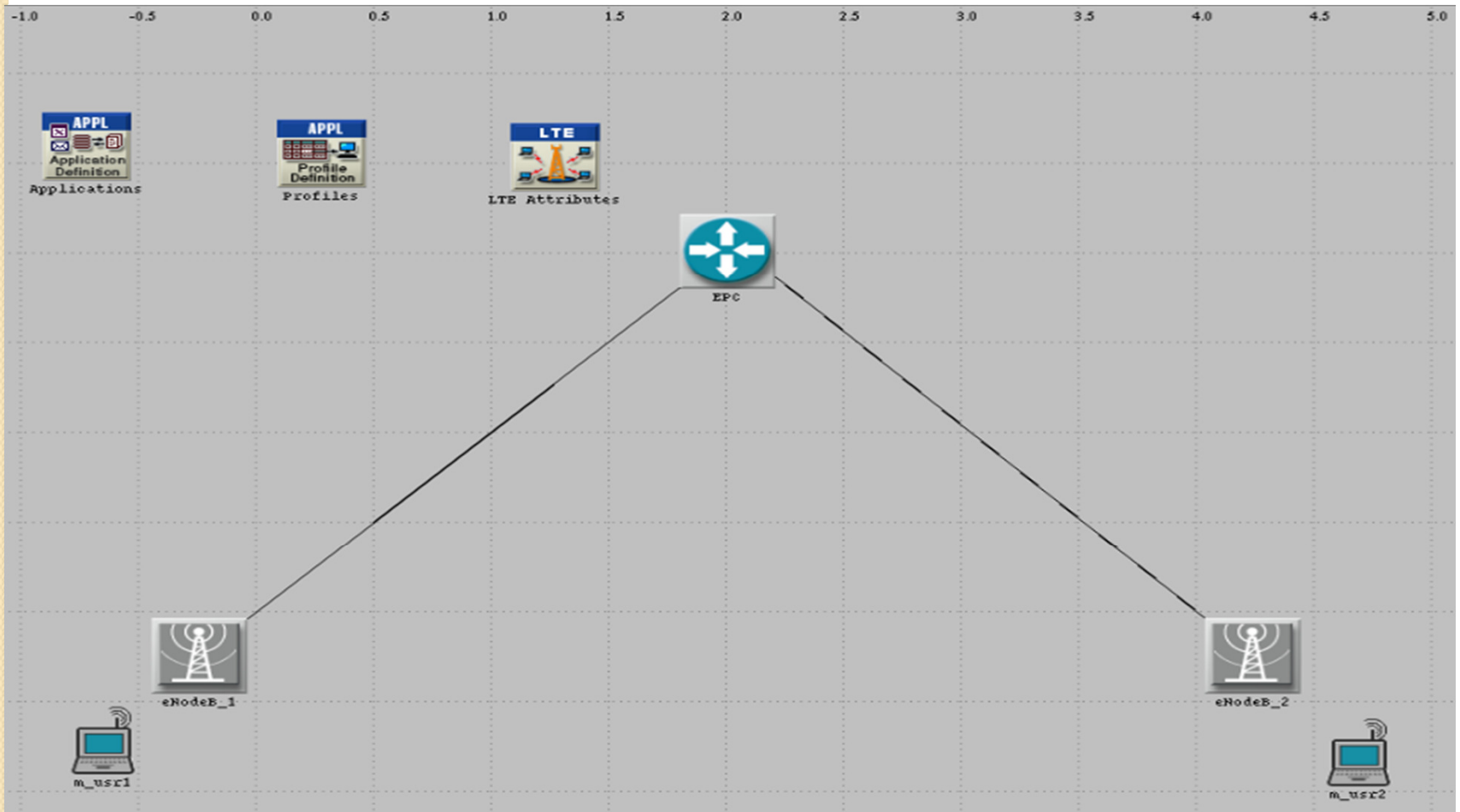




Simulation Design

Case II – Scenario I

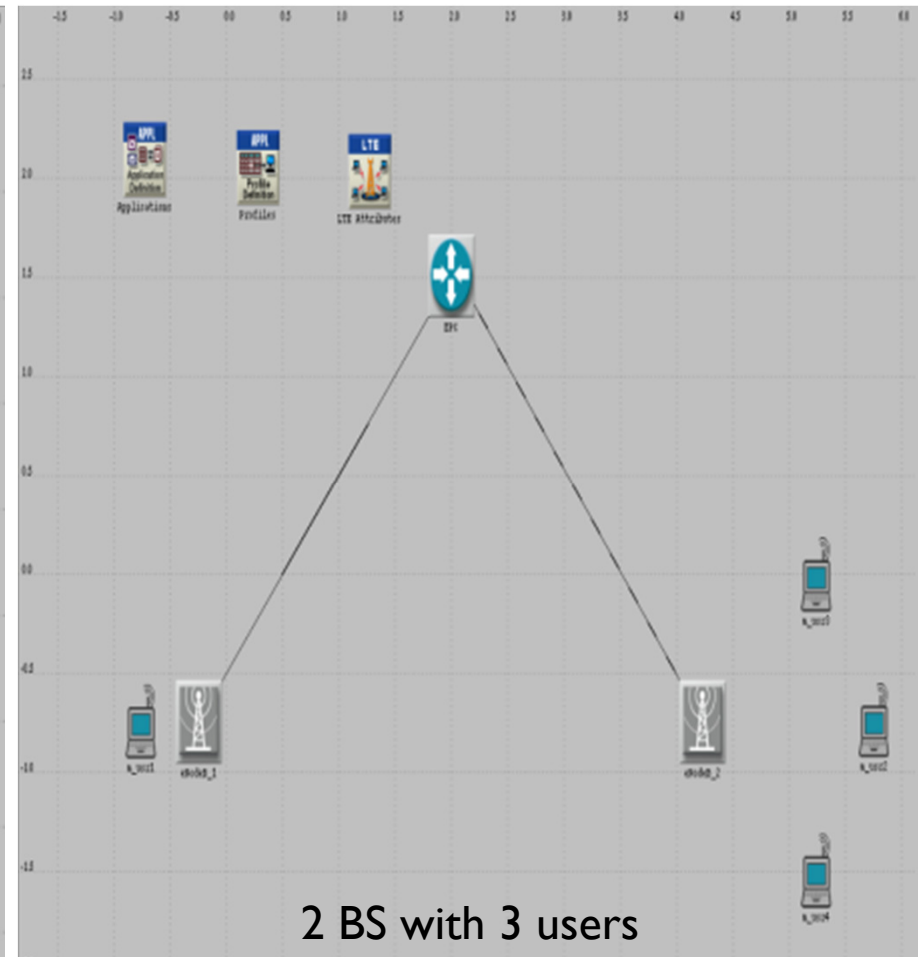
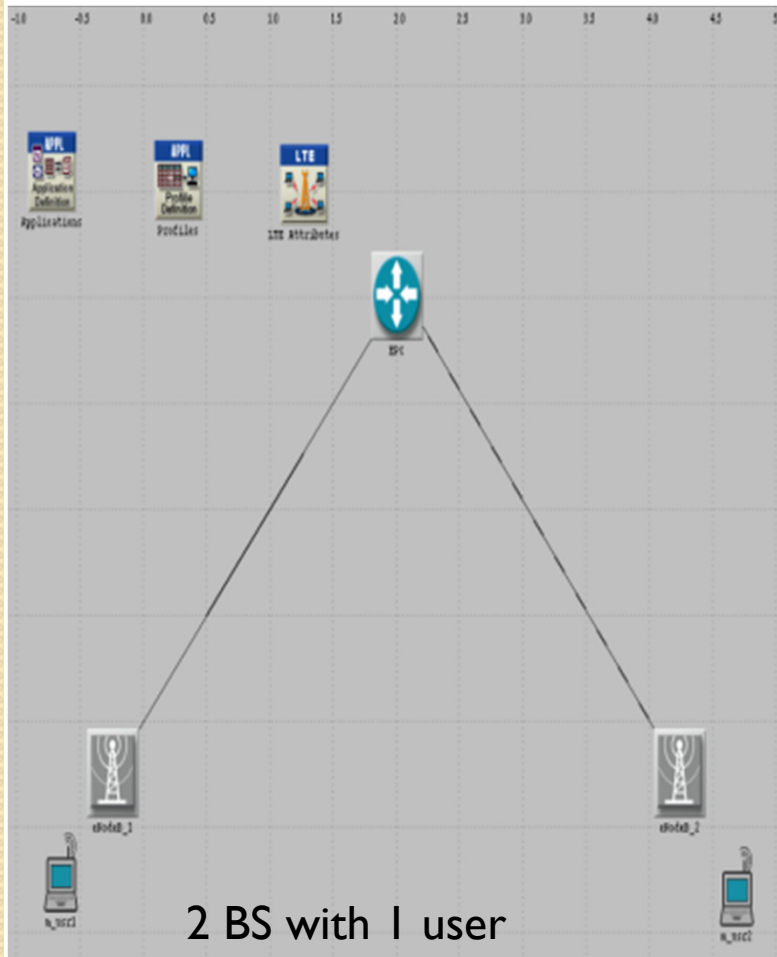
(Single Base Station vs. Multiple Base Stations)





Simulation Design

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





Roadmap

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



Results Analysis

Case I – Scenario I – E2E delay

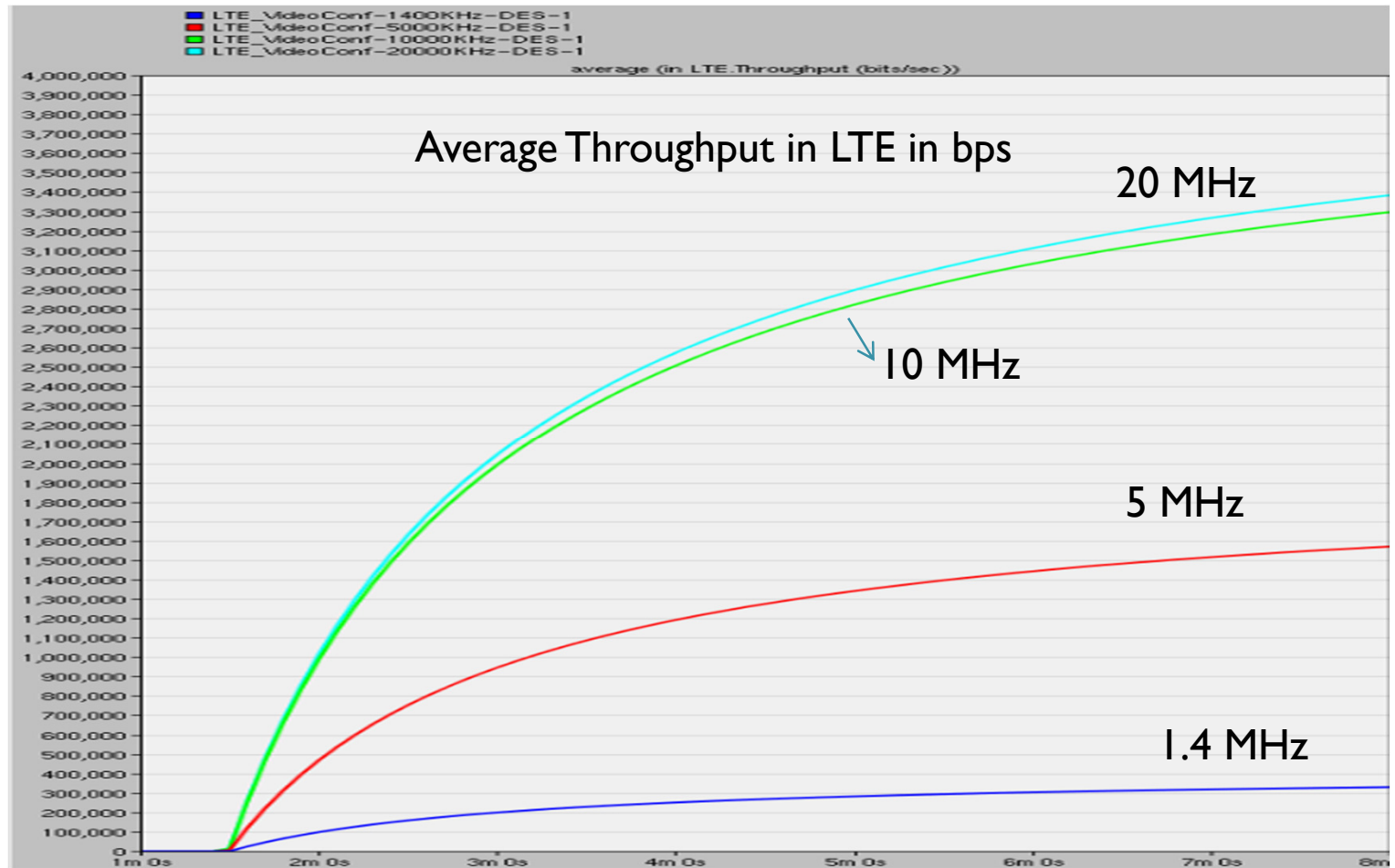
Bandwidth (MHz)	E2E delay at peak (s)
1.4	≈ 22
5	≈ 3.8
10	≈ 3.4
20	≈ 0.036





Results Analysis

Case I – Scenario I – Throughput

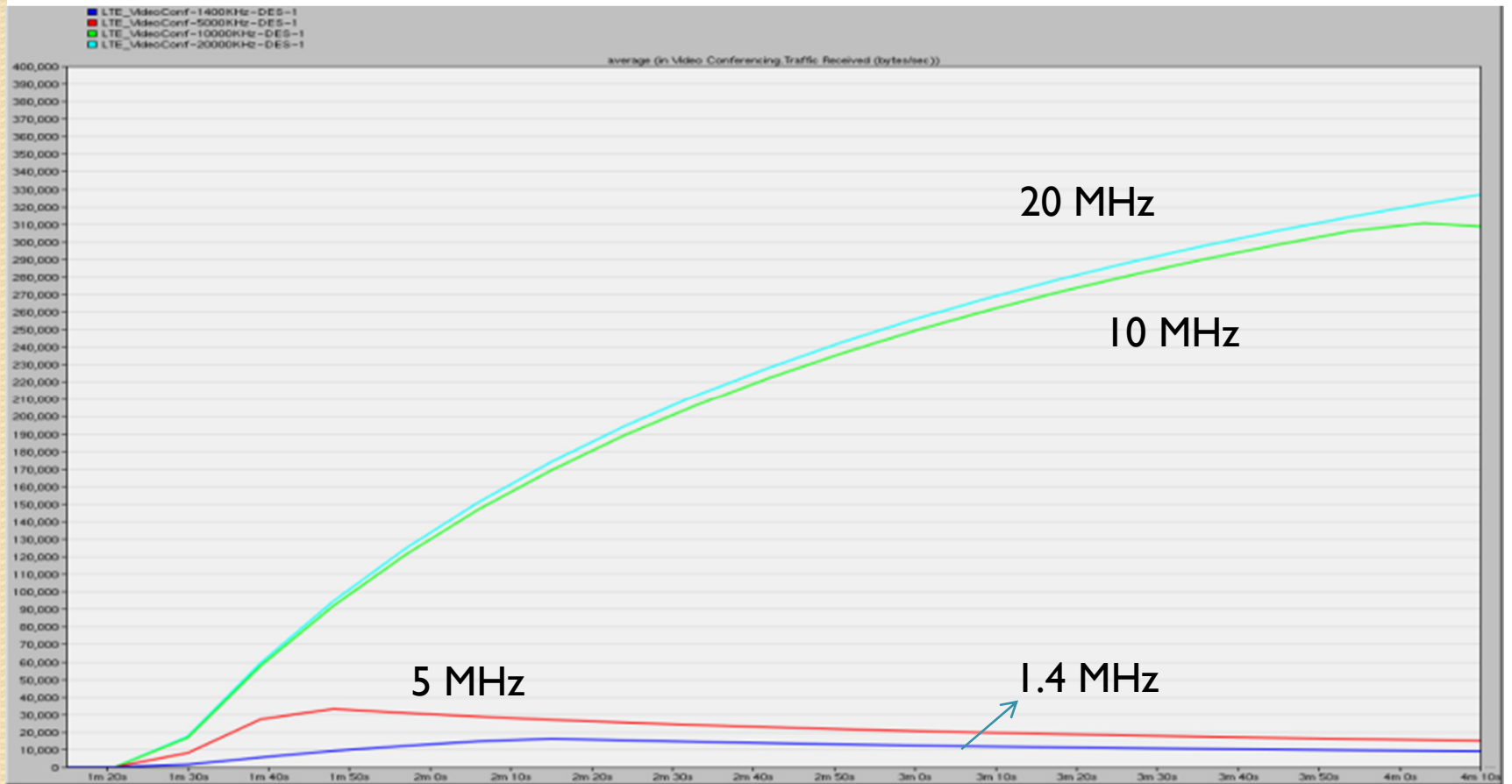


Comparing with 20MHz and 1.4MHz, 20 MHz has the greatest throughput, while 1.4 MHz, the throughput drops dramatically. However, there is not large difference Between 10 and 20 MHz of the throughput.



Results Analysis

Case I – Scenario I – Traffic Received



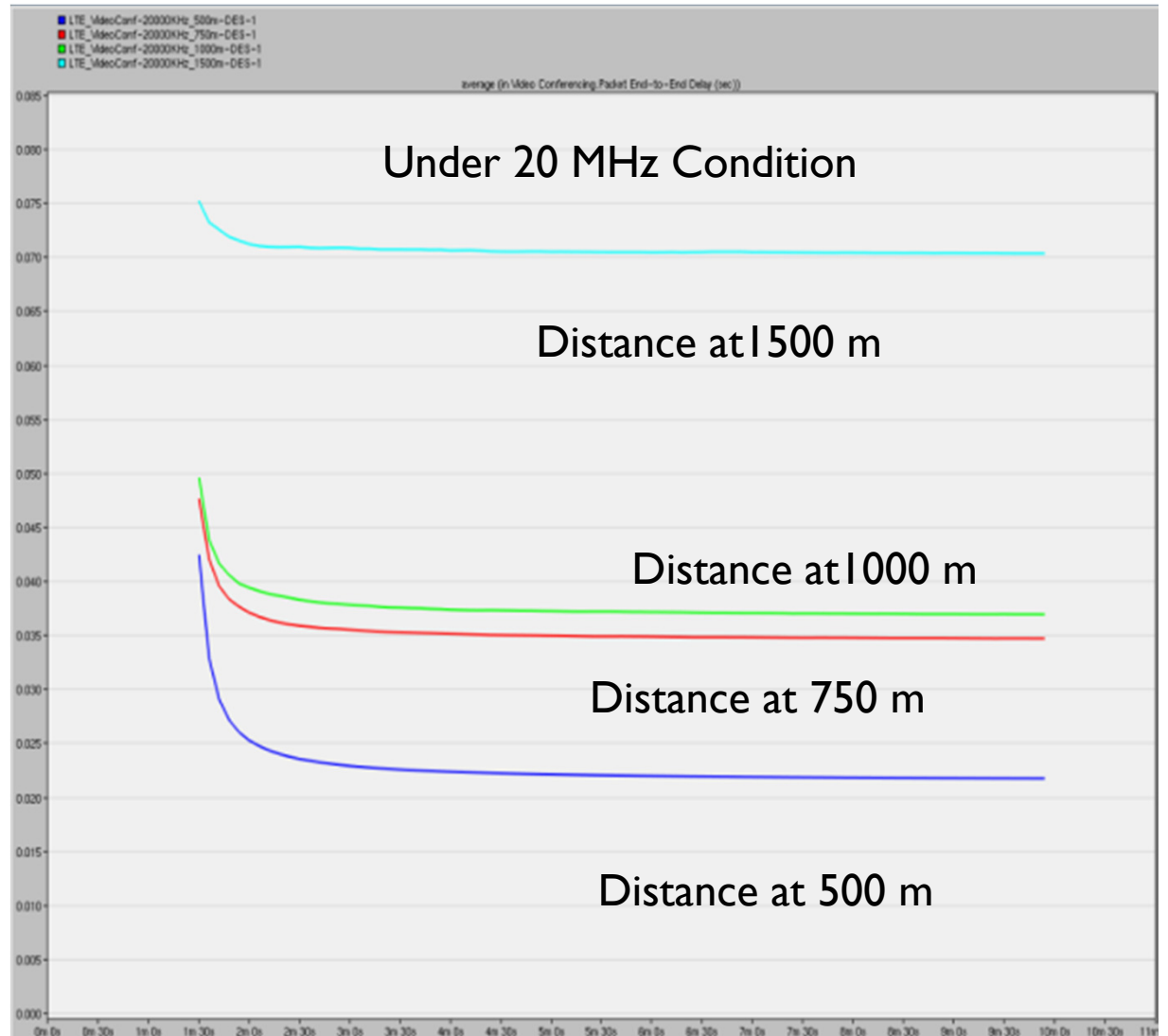
Comparing 20MHz and 10 MHz in traffic received, the traffic received (bps) of 10 MHz just slightly differs with 20 MHz traffic received (bps).



Results Analysis

Case I – Scenario 2 – E2E delay

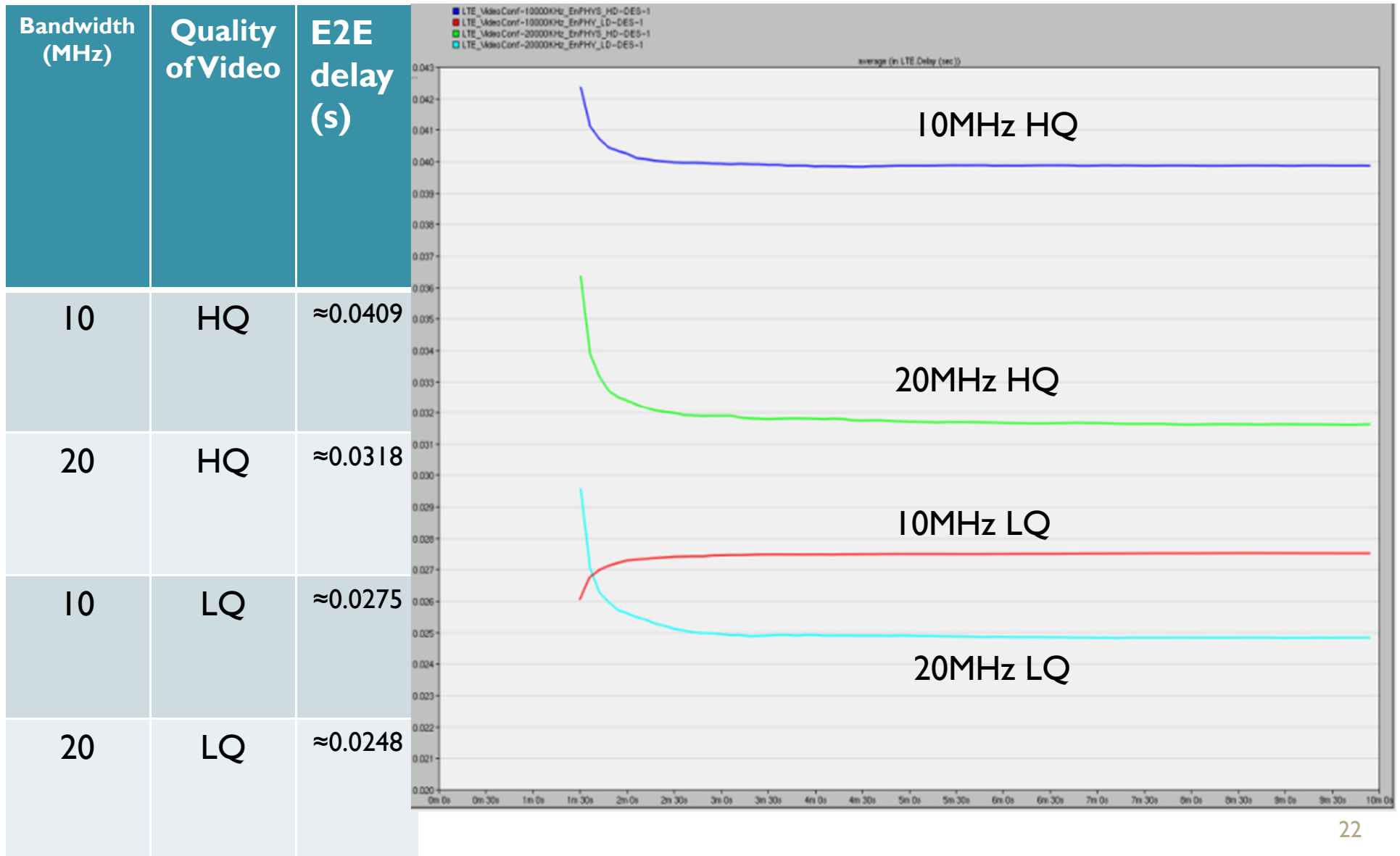
Distance (m)	Average E2E delay (s)	At the Beginning (s)
1500	0.071	0.075
1000	0.038	0.050
750	0.035	0.048
500	0.022	0.043





Results Analysis

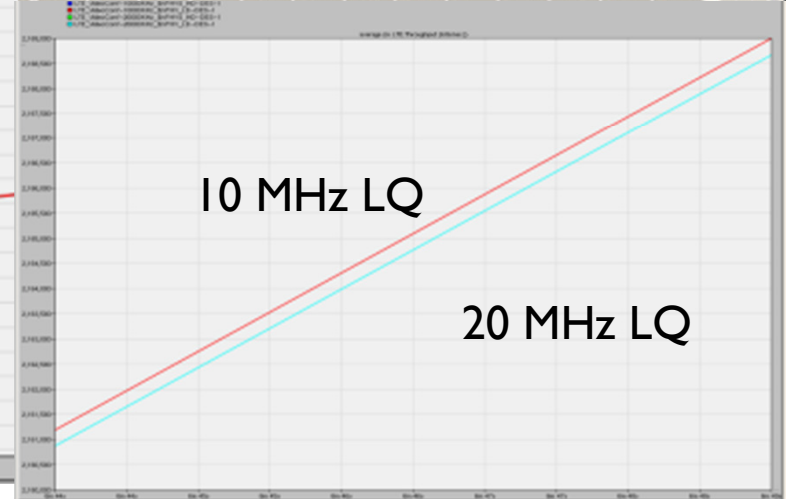
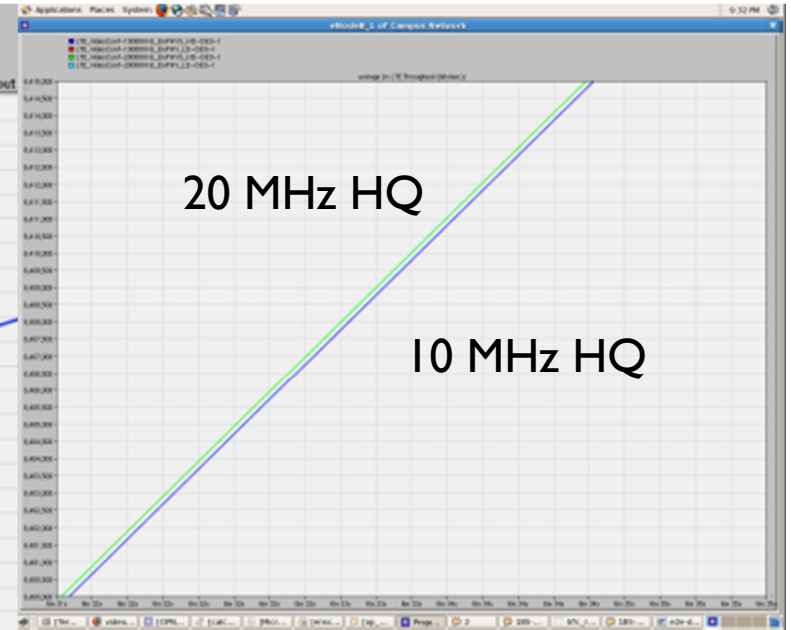
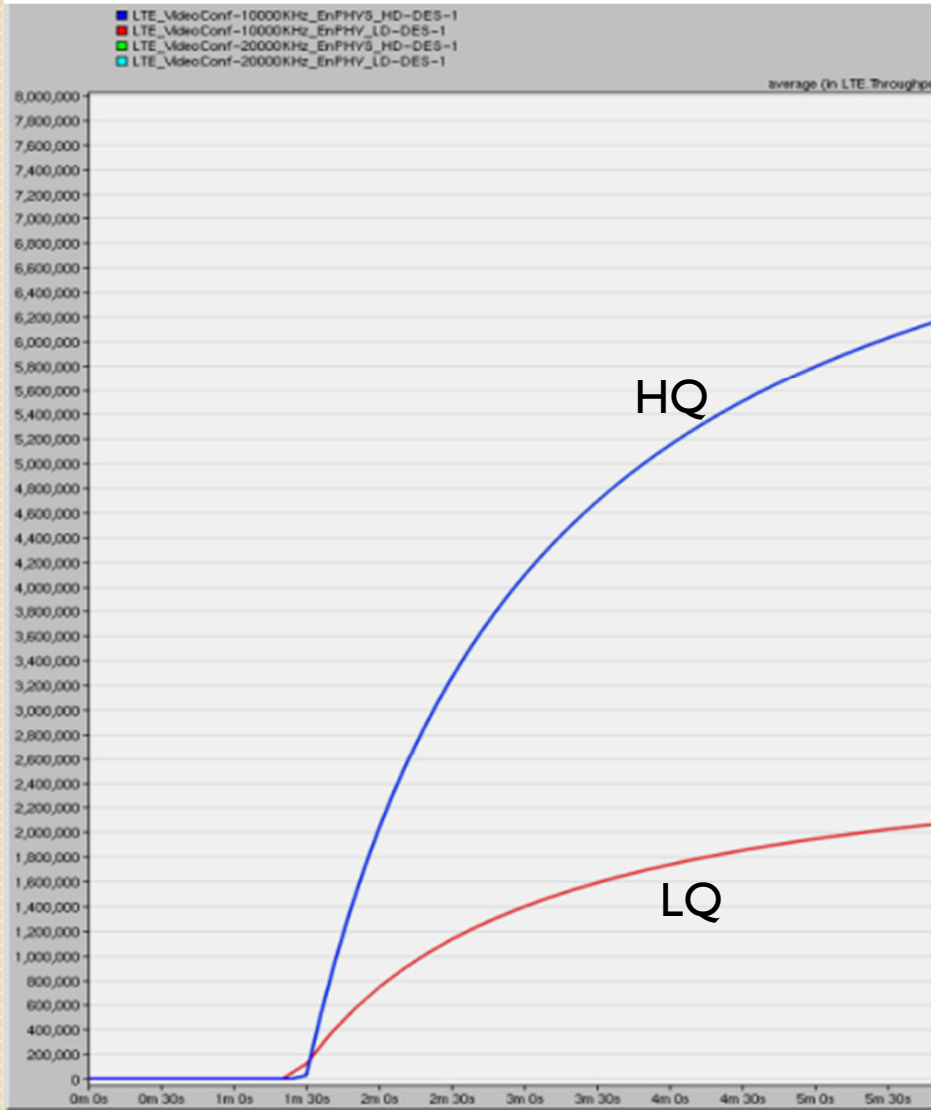
Case I – Scenario 3 – E2E delay





Results Analysis

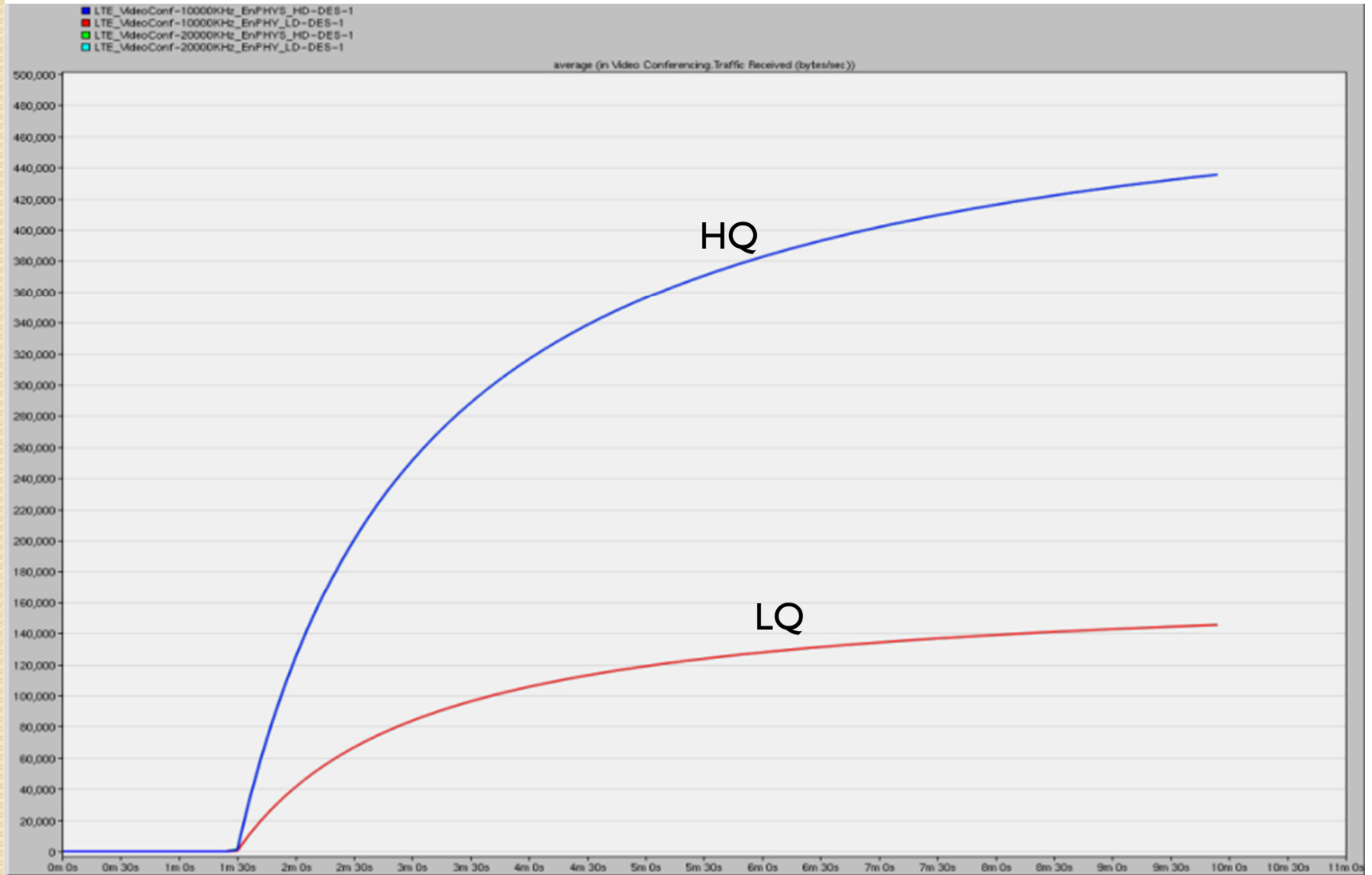
Case I – Scenario 3 – Throughput (bps)





Results Analysis

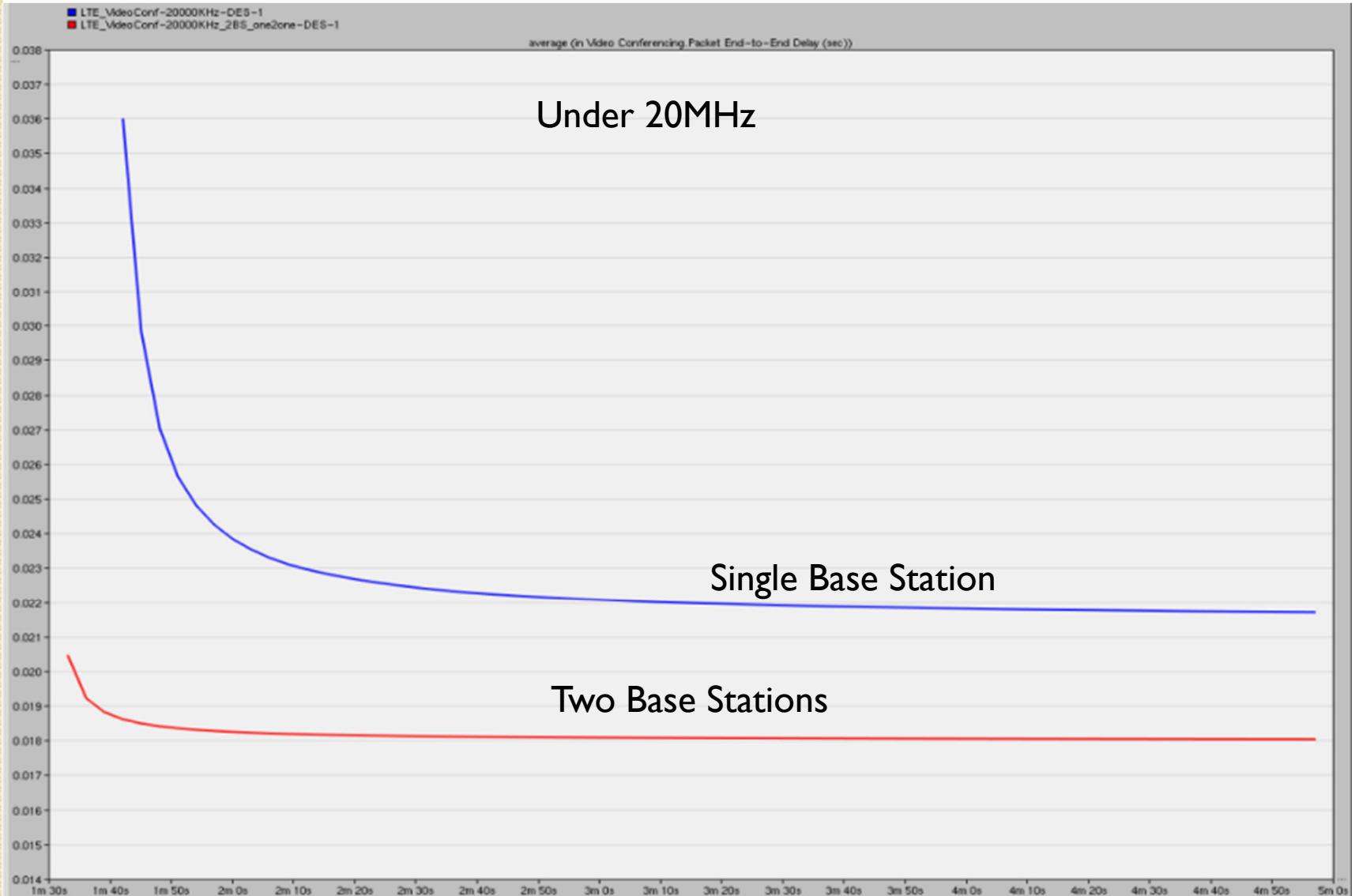
Case I –Scenario 3– traffic received





Results Analysis

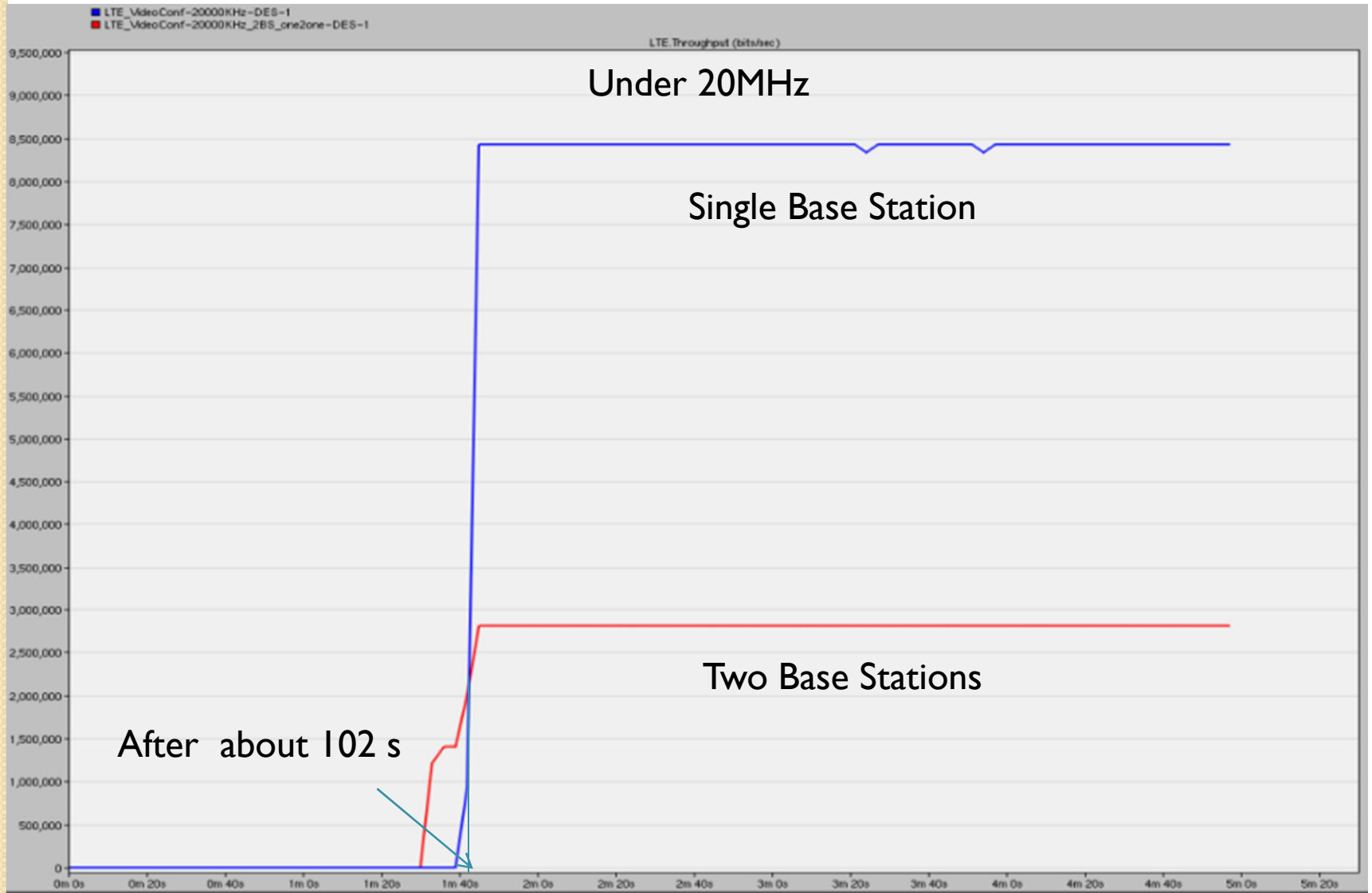
Case II-Scenario I - E2E Delay





Results Analysis

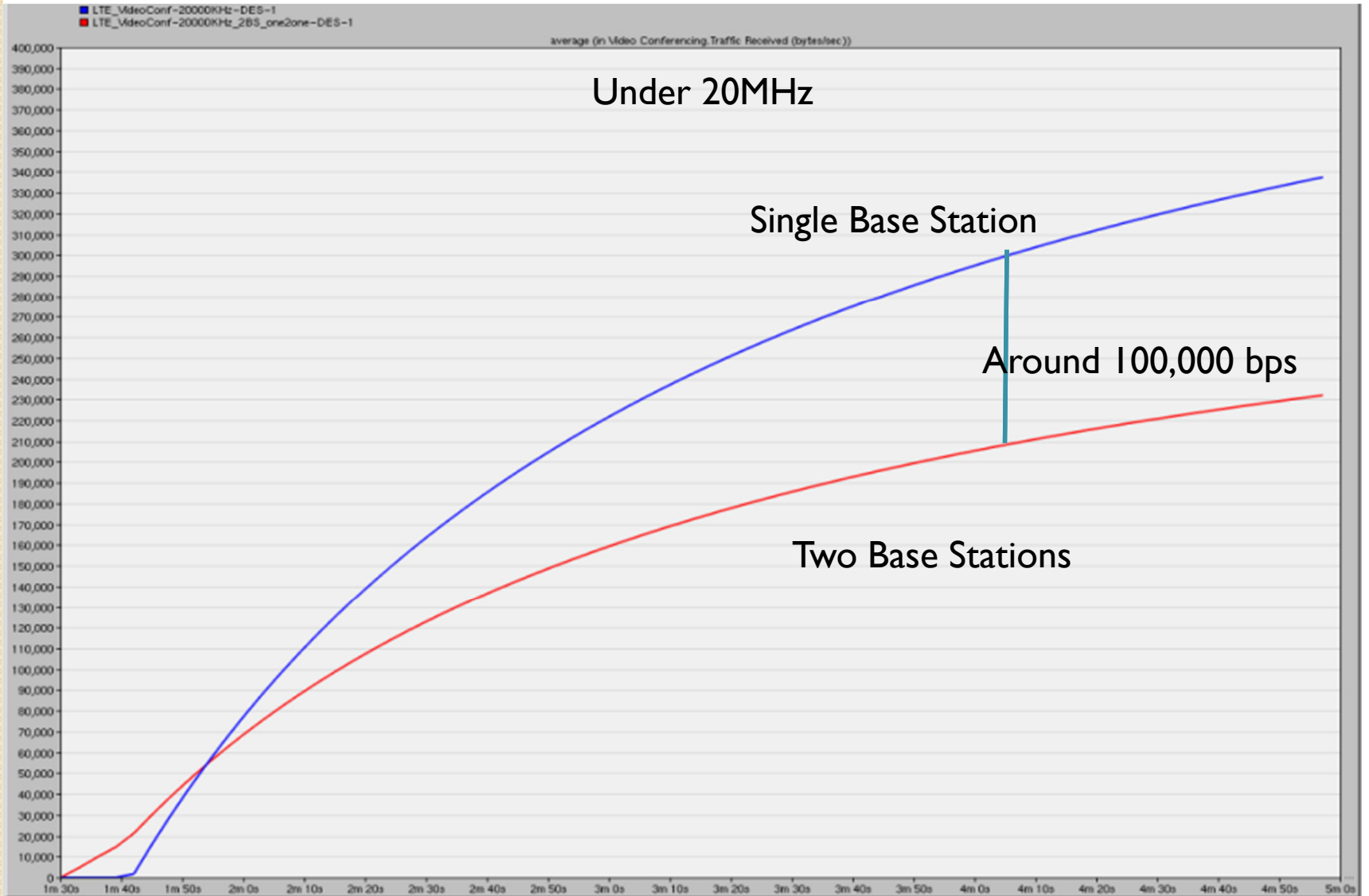
Case II-Scenario I - Throughput (bps)





Results Analysis

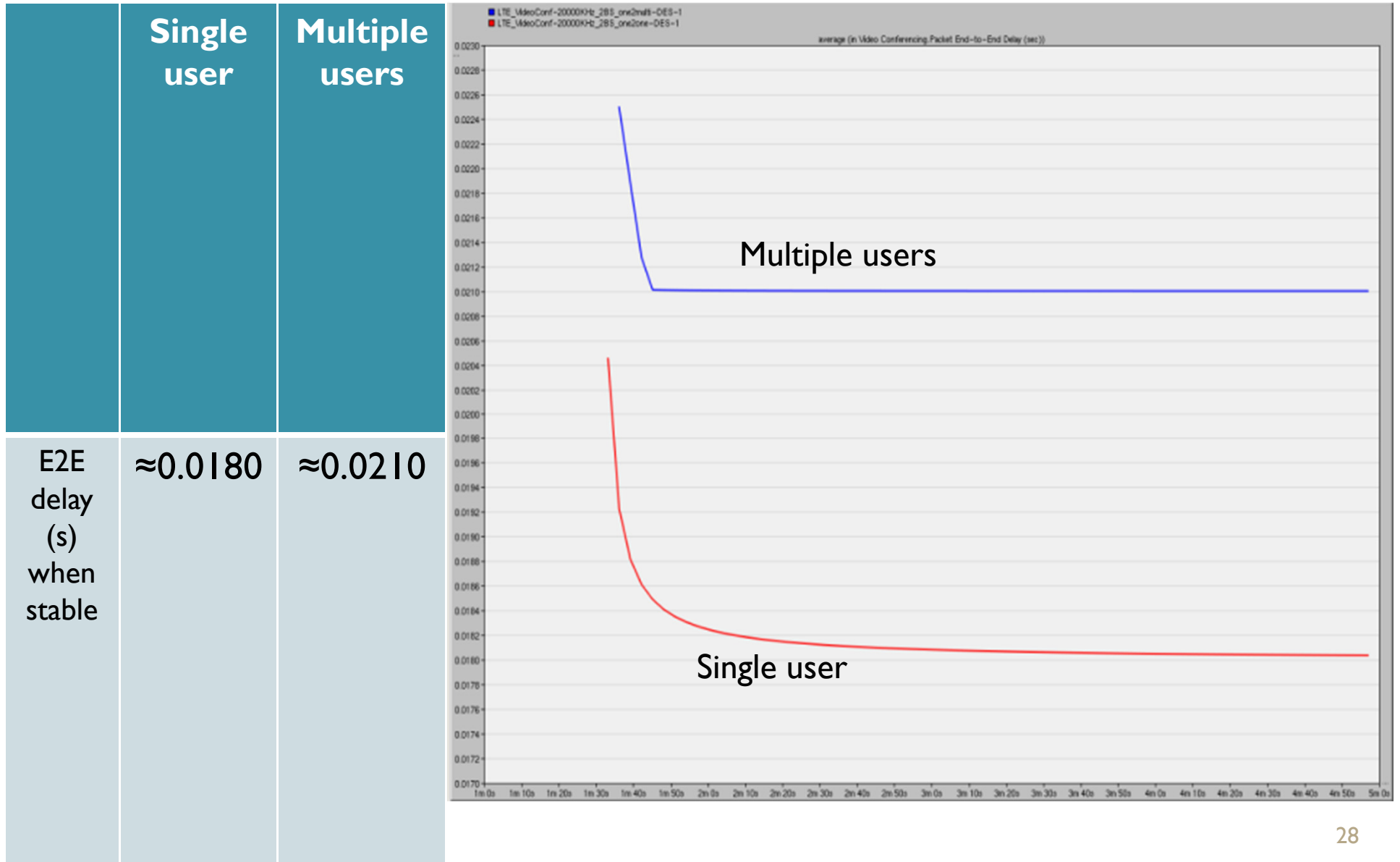
Case II-Scenario I-Traffic Received (bps)





Results Analysis

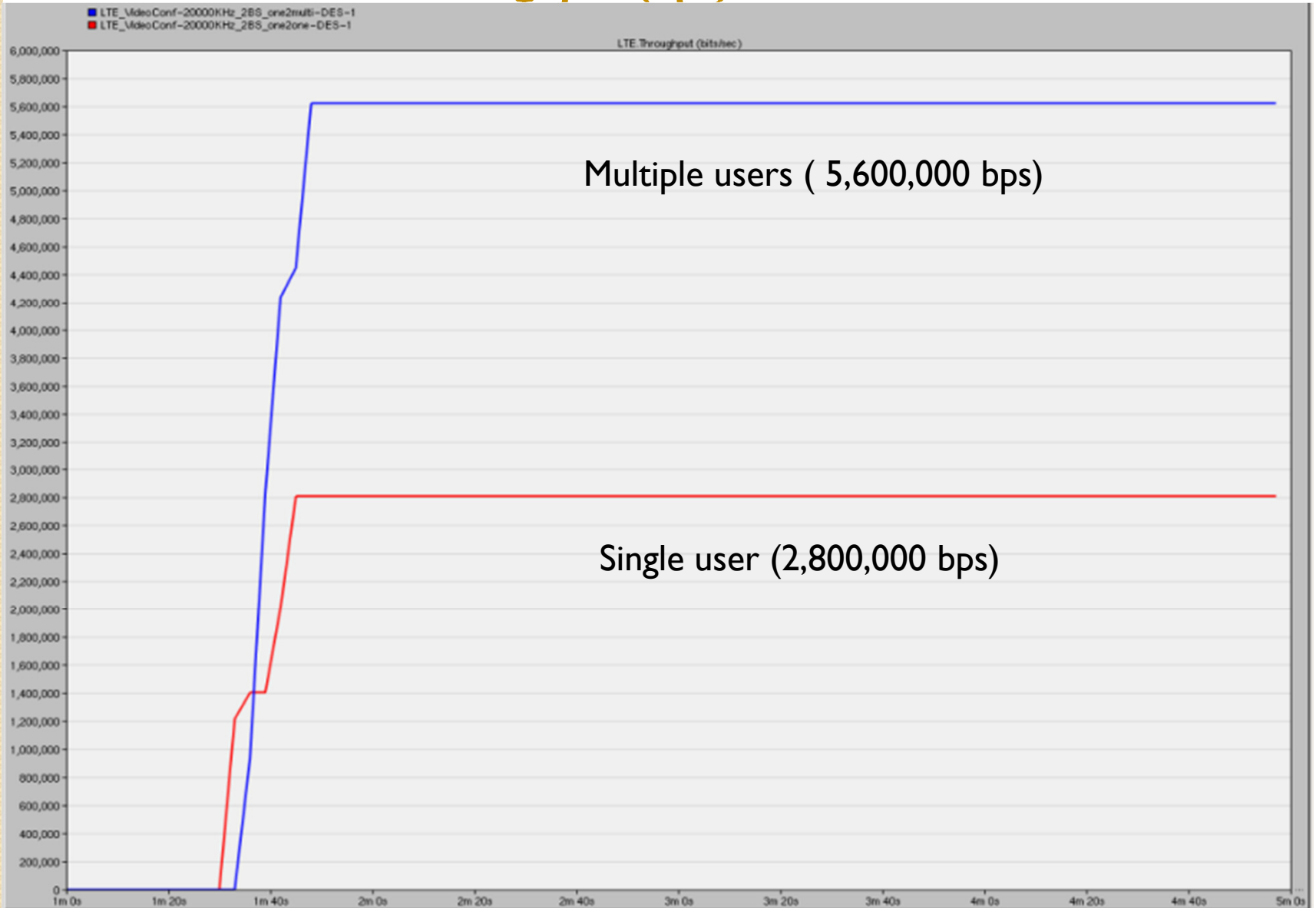
Case II-Scenario 2- E2E delay





Results Analysis

Case II-Scenario 2-Throughput (bps)





Roadmap

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



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)



Roadmap

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



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 February 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.pdf>â€¢. [Online] Available: <http://www.sfu.ca/~zza36/report-427.pdf> [Accessed: 01 April 2014].





Question