ENSC 427:COMMUNICATION NETWORKS SPRING 2014

FINAL PROJECT PRESENTATION

PERFORMANCE ANALYSIS OF VOICE OVER LTE USING OPNET

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Team 10

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Introduction

- Long Term Evolution (LTE) is successor to 2G and 3G

- Based on 4G standards

- First data-only technology, relies entirely on packet switched networks

Problem

- 2G and 3G used circuit switched networks for making voice phone calls
- No longer possible on LTE networks
- New solution needed

Solution

- Voice-over-IP (VoIP)!
- Proven technology
- Voice calls over Internet Protocol (IP) networks, i.e. Internet

Problems with VoIP

- Operates on a "best effort" basis
- Quality of Service (QoS) cannot be guaranteed
- Susceptible to problems with latency, packet loss, jitter, etc.
  - Especially during times of congestion

Interim Solution

- Fallback

- Use LTE just to provide data services, fall back on 2G or 3G circuit switched networks to make voice calls

- Lame

Real Solution

- Voice over LTE (VoLTE)
- Based on IP Multimedia Subsystem (IMS) network
- Dedicated profiles targeted at voice communications
- The future

Project Goal

- Build LTE network using OPNET 16.0
- Simulate voice calls between mobile phones
- Examine QoS parameters and how they change with varying real world conditions
  - End-to-End delay, jitter, Mean Opinion Score (MOS)

Mean Opinion Score

- Test of user's view of the quality of the network

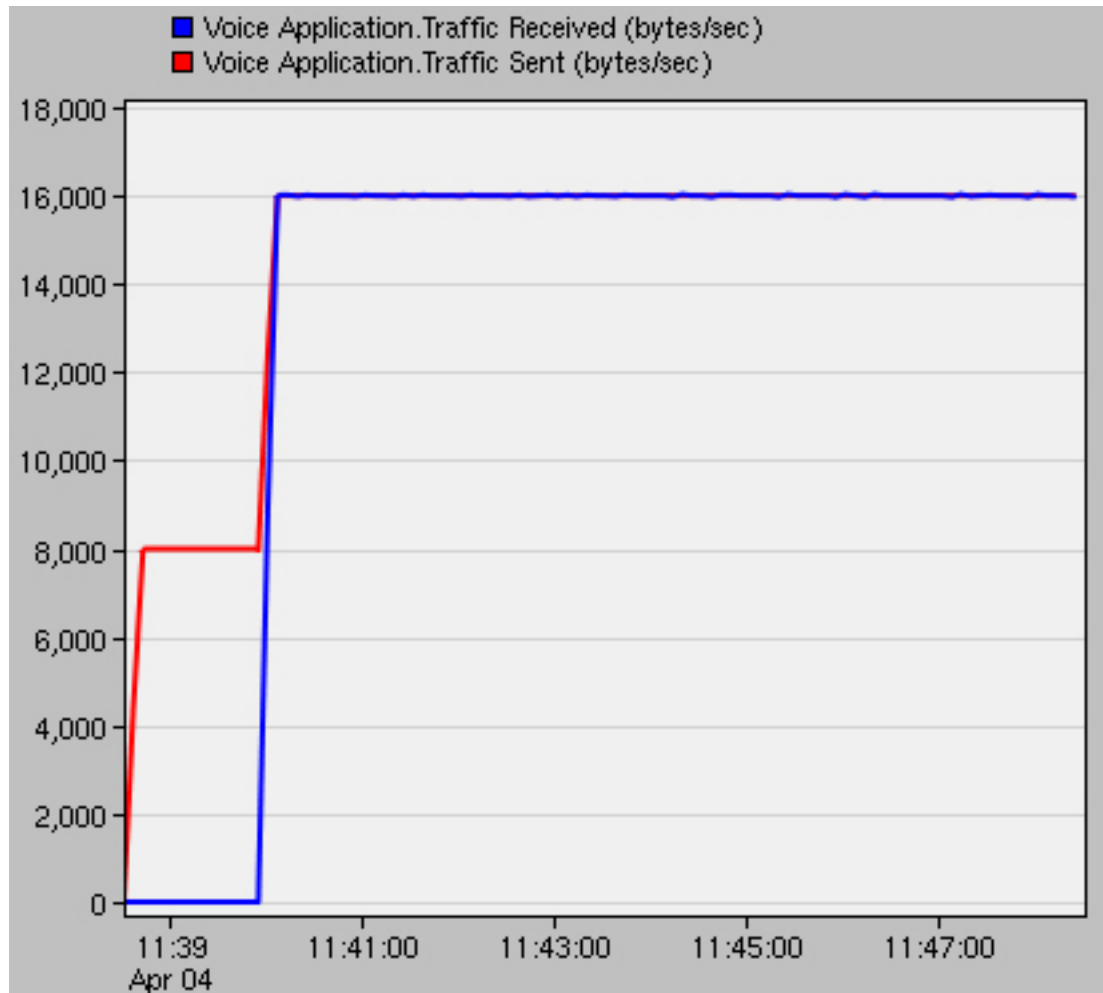| MOS	Quality	Impairment
5	Excellent	Imperceptible
4	Good	Perceptible but not annoying
3	Fair	Slightly Annoying
2	Poor	Annoying
1	Bad	Very Annoying

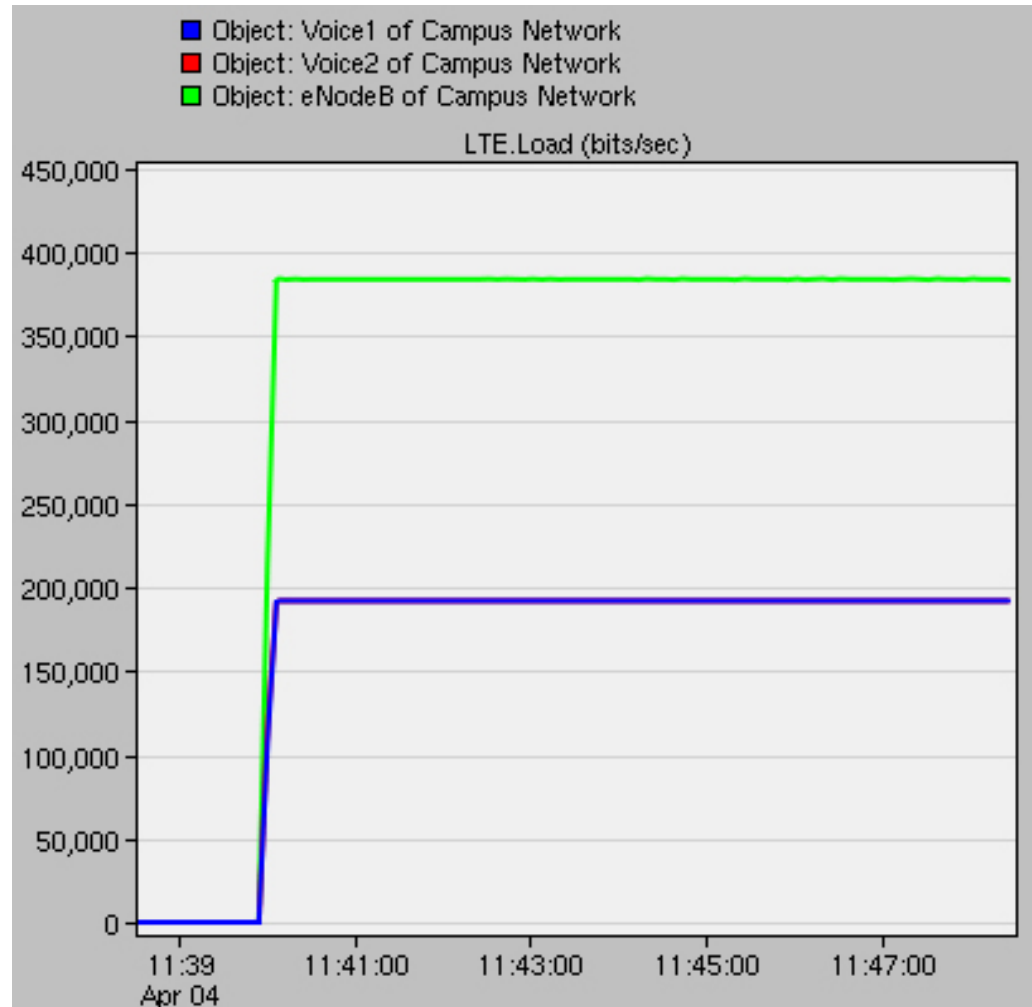# Implementation Details

- Scenario 1 – Only Voice
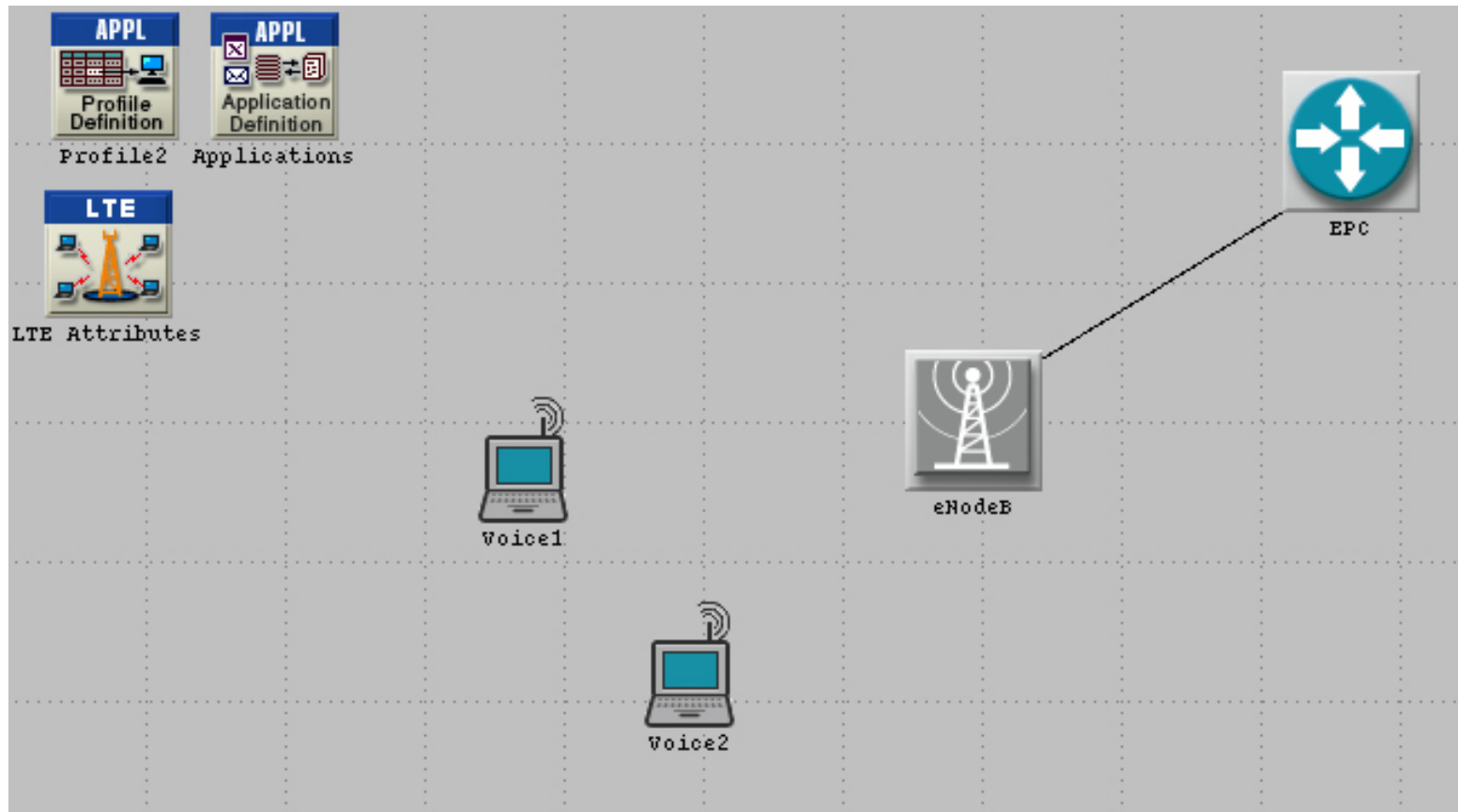
Implementation Details

- Scenario 2 – Added FTP traffic
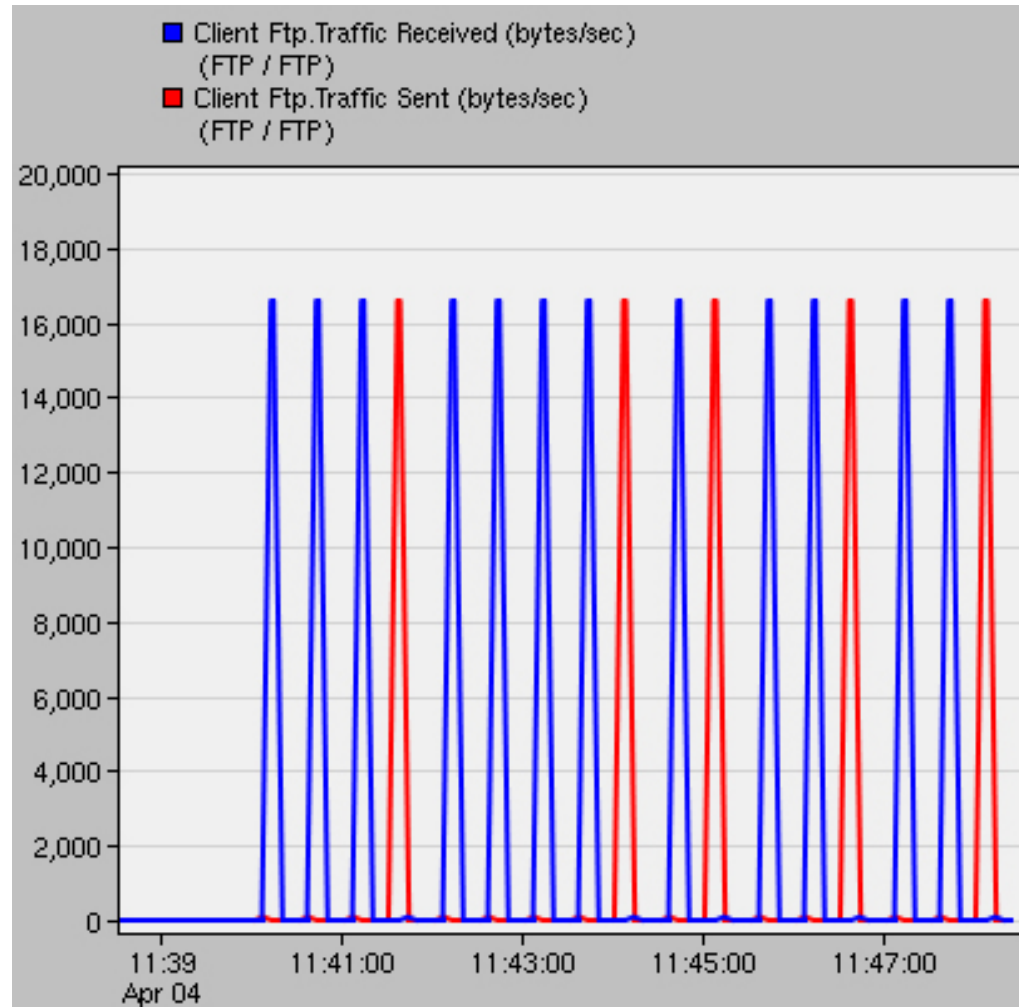 - Third scenario with same topology but increased FTP traffic
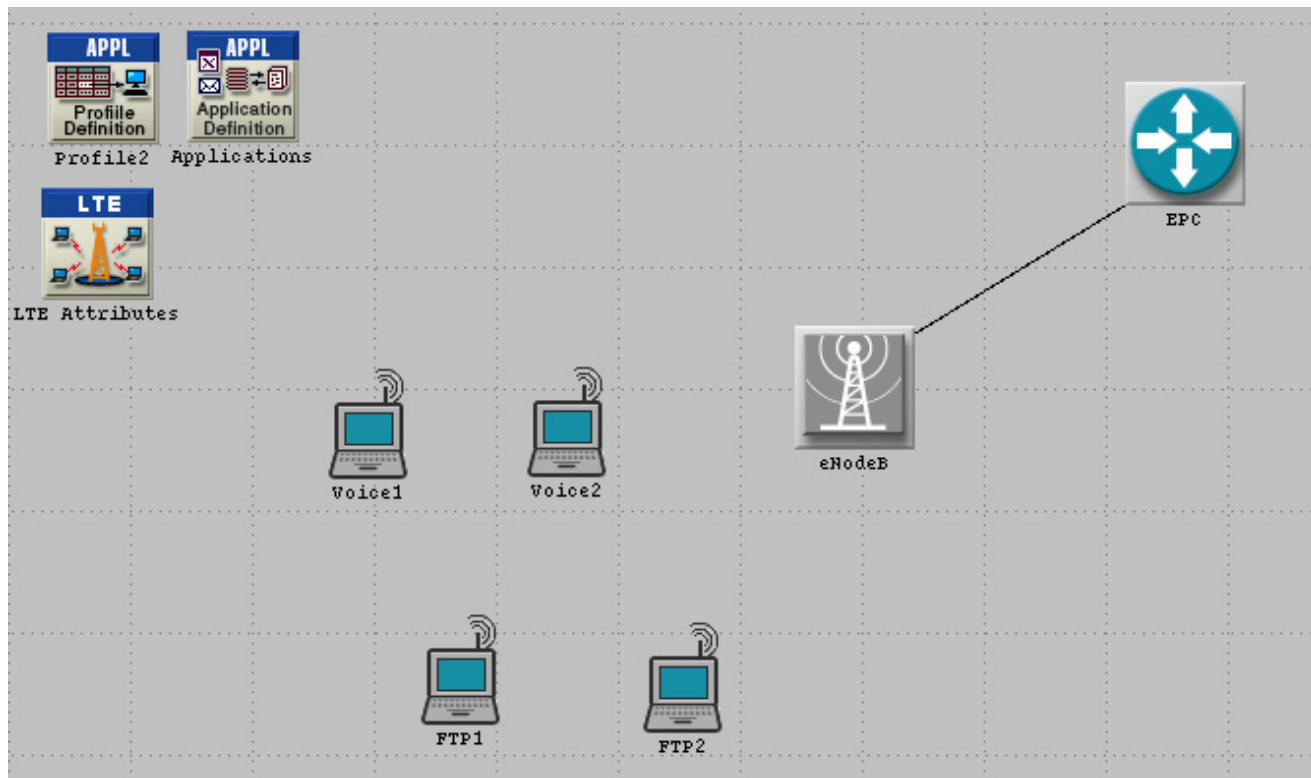
Voice Only - Traffic

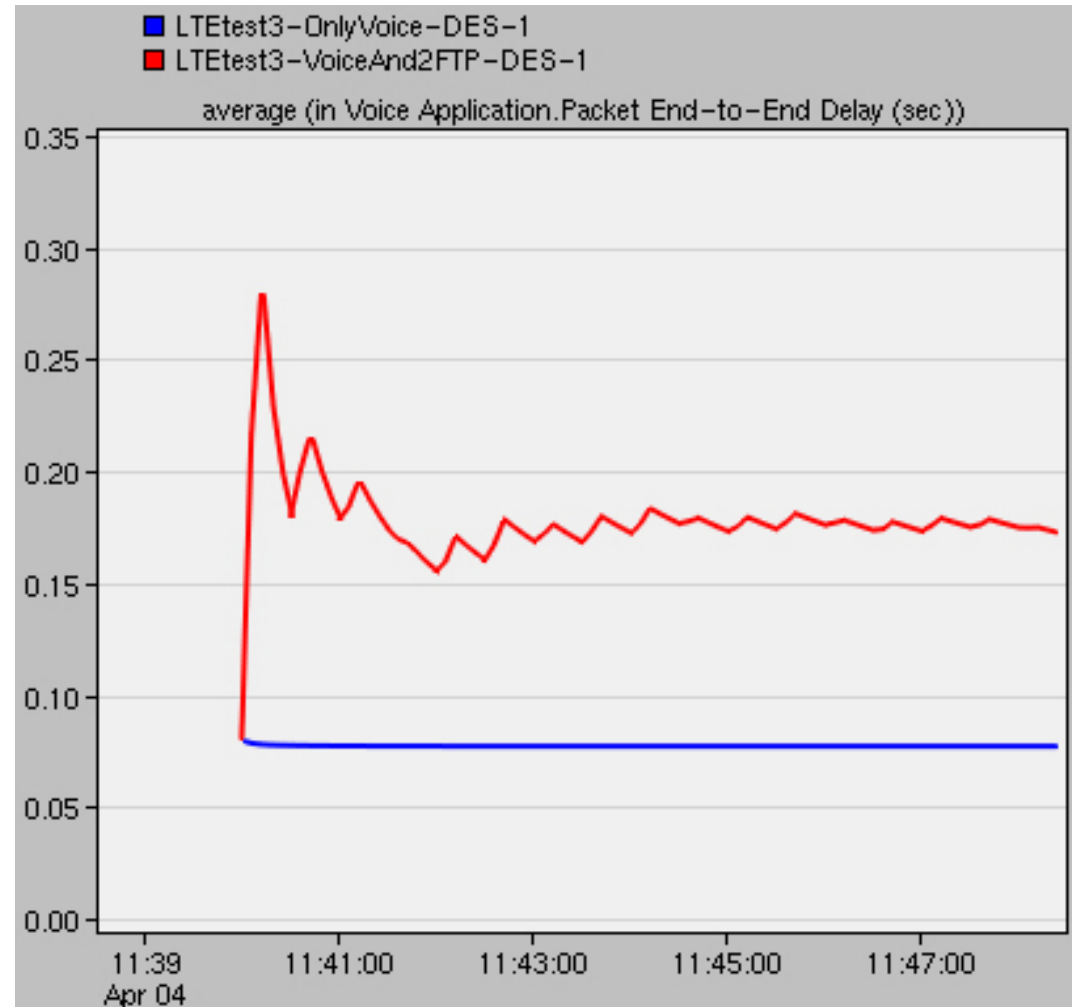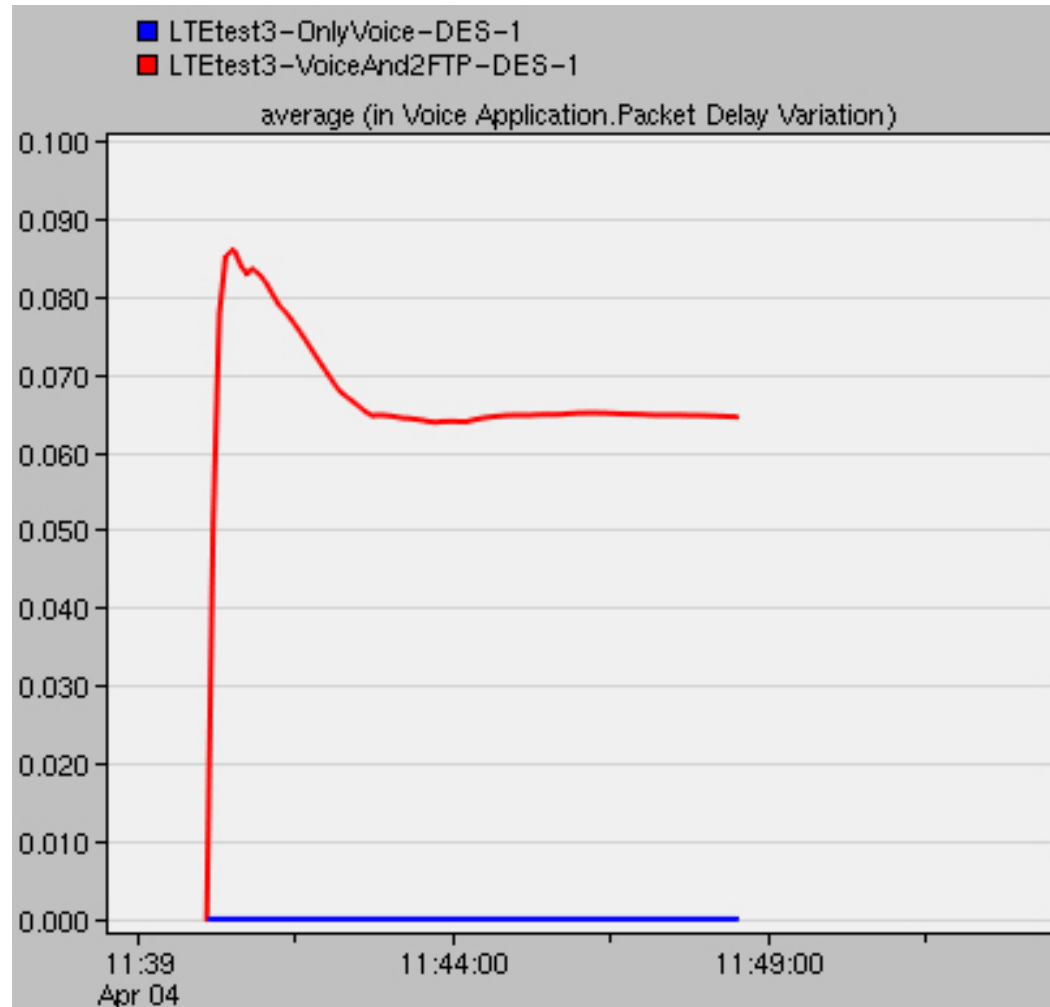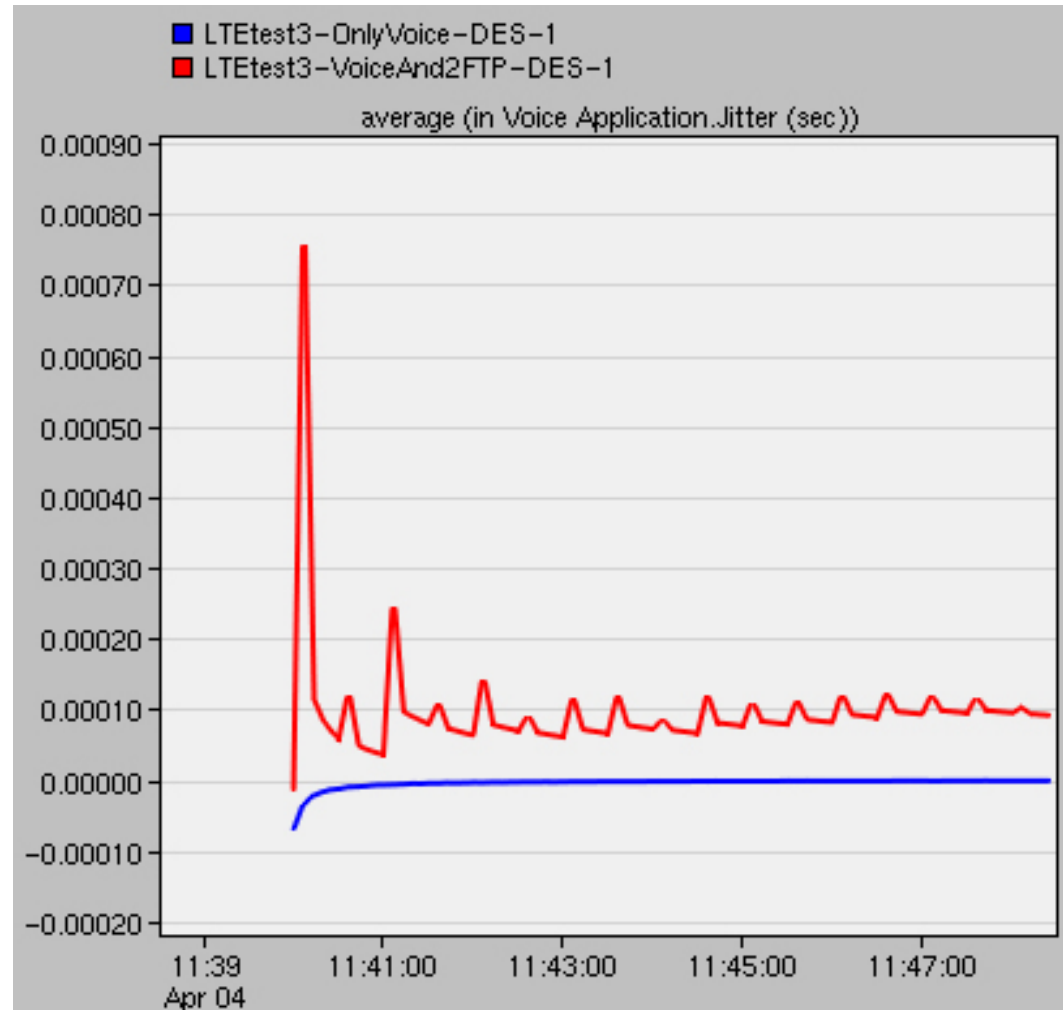# Voice Only - Load
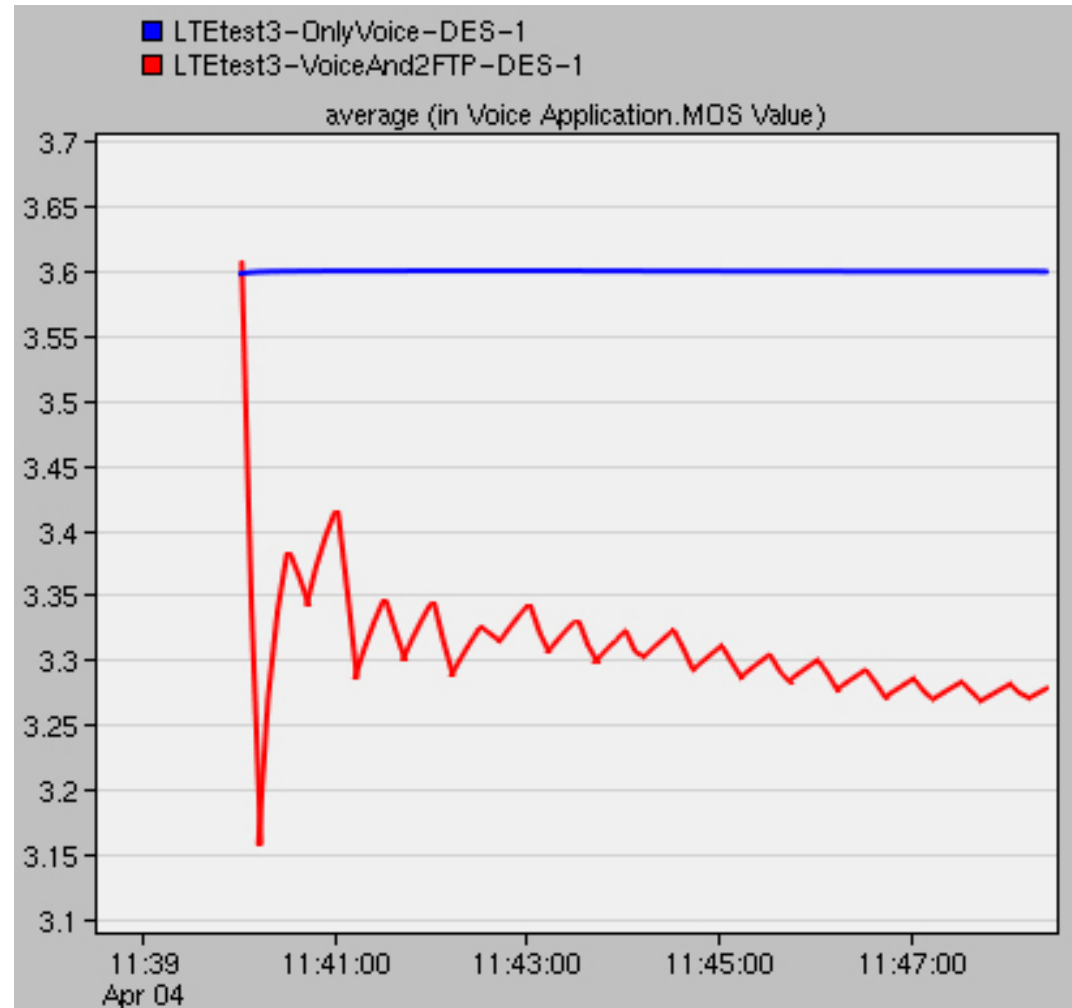
Voice and FTP – FTP Traffic
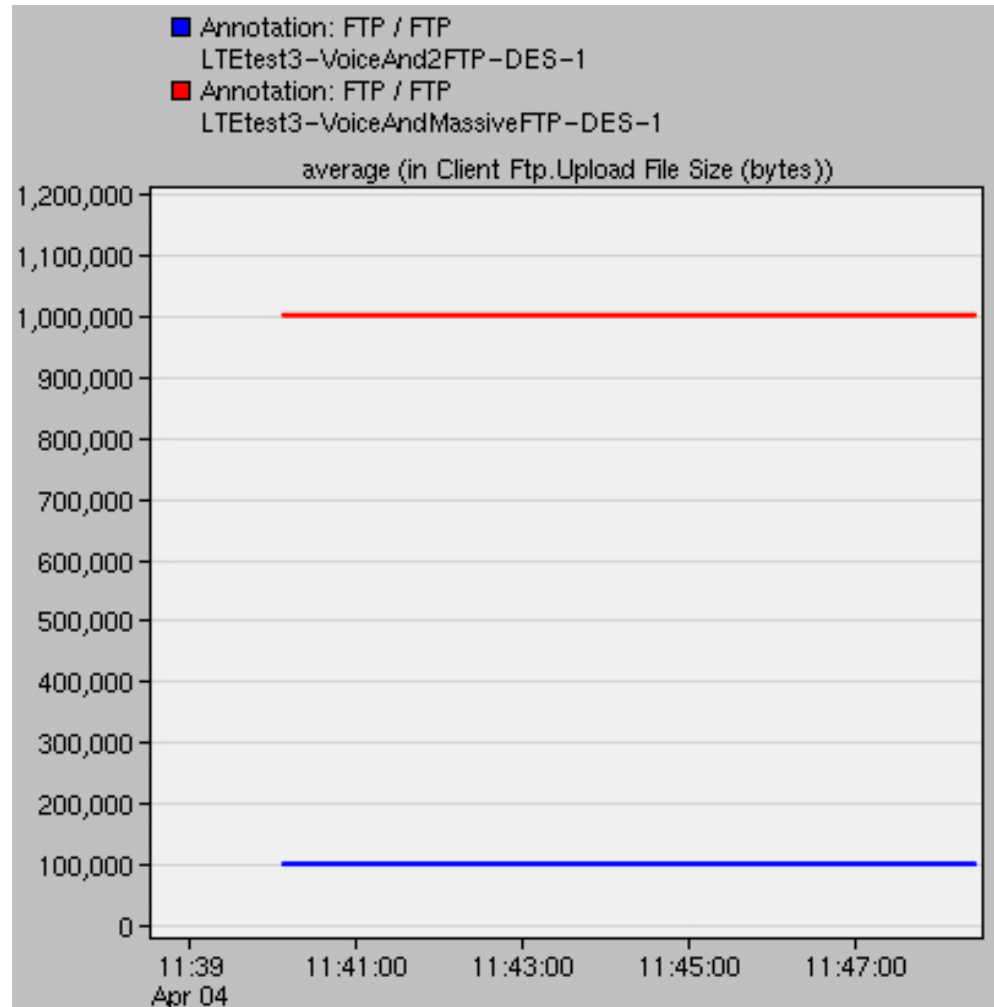
Comparison - Delay

Comparison – Delay Variation

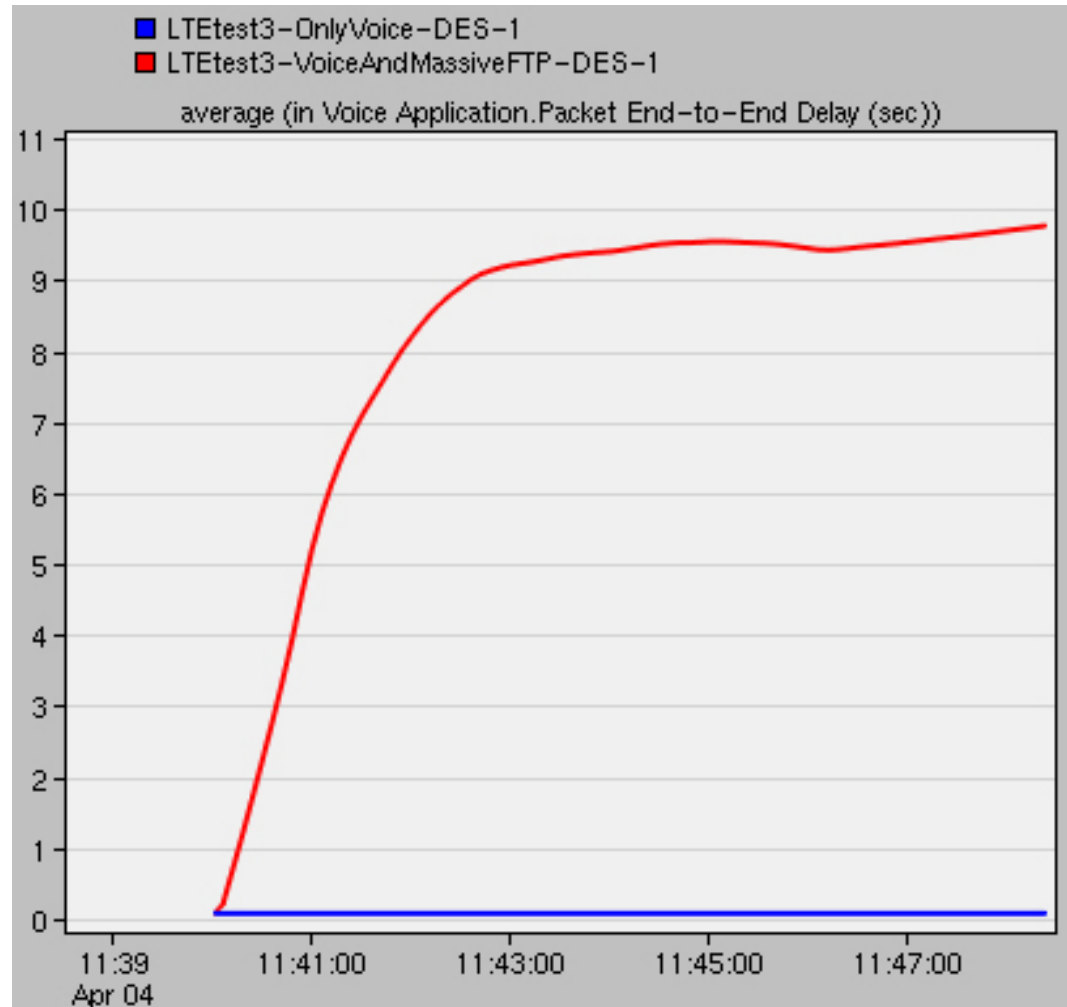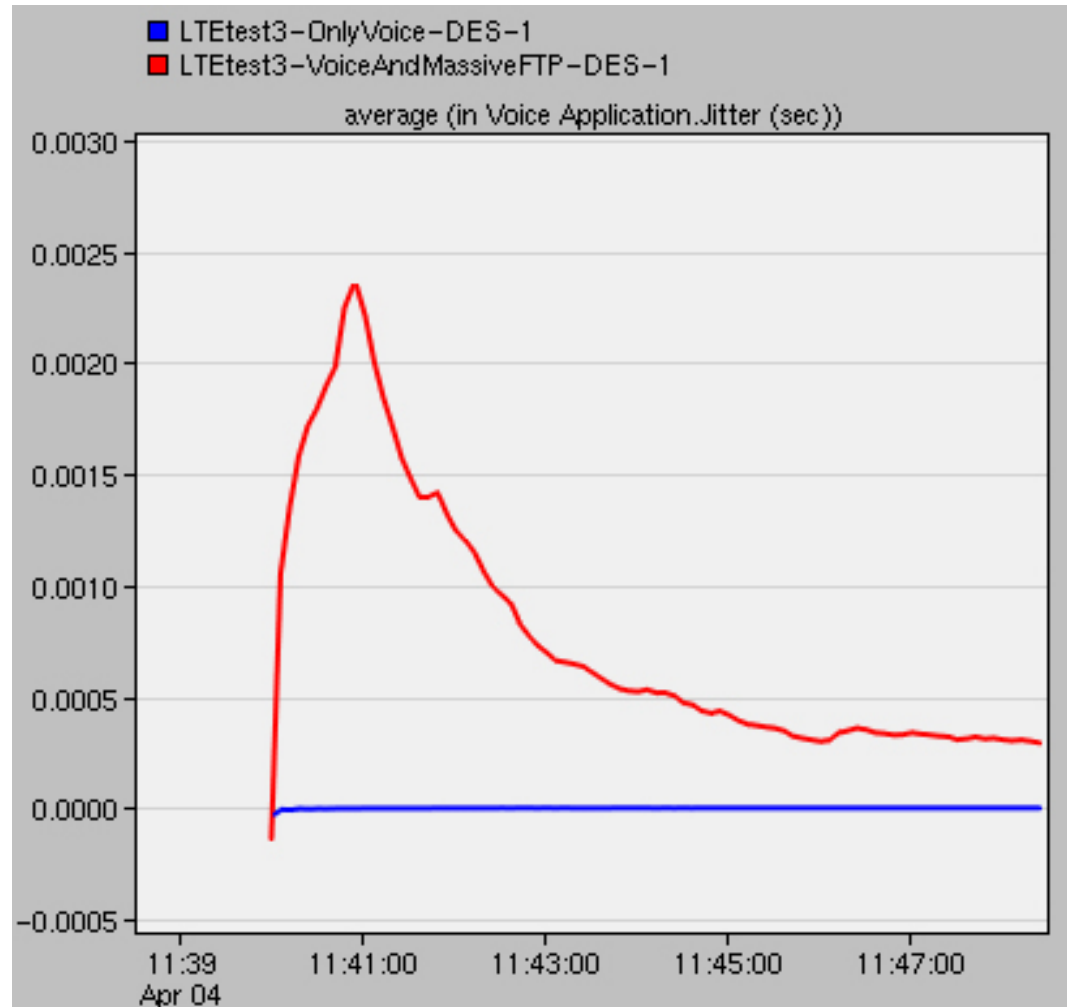# Comparison - Jitter

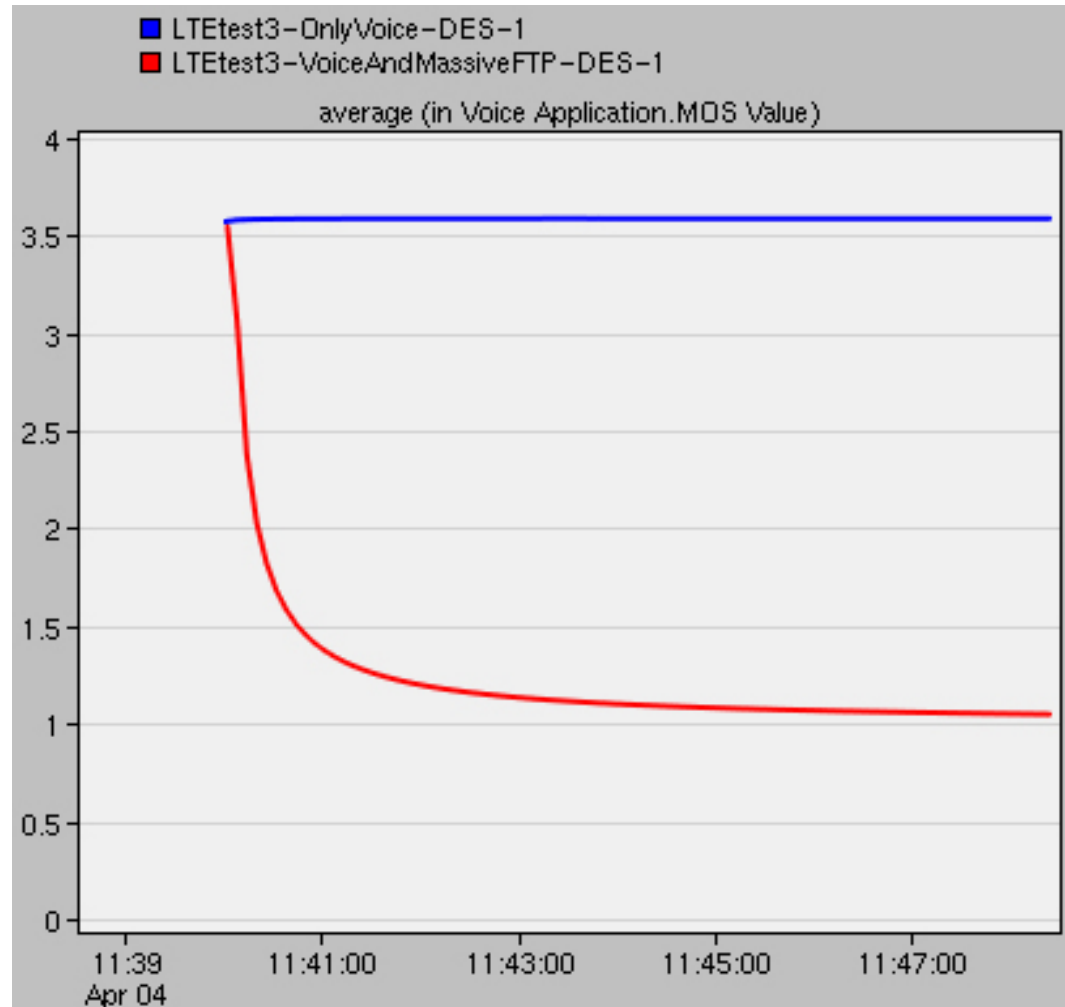# Comparison - MOS

Increase FTP file size

Comparison - Delay

Comparison – Jitter

Comparison - MOS

Discussion

- Challenges
  - Learning OPNET
  - Getting LTE to work
  - Not enough tutorial details on LTE
- Knowledge
  - Learned about LTE/challenges in wireless communications
  - Learned finer points of OPNET configuration and simulation
  - Able to see how network conditions change

Future Work

- Adding trajectory (may add on final report if we get to work on time)
- Switching between base stations

References

- [1] (Feb. 10, 2014) C. Gessner and O. Gerlach, "Voice and SMS in LTE," Rohde & Schwarz, May 2011. [Online]. Available: http://cdn.rohdeschwarz.com/dl_downloads/dl_application/ application_notes/1ma197/1MA197_1e_voice_and_SMS_in_LTE.pdf.

- [2] (Feb. 10, 2014) C. Qunhui, "Evolution and deployment of VoLTE", Huawei Communicate, Sep 2011. [Online]. Available: http://www.huawei.com/en/static/hw-094164.pdf.

- [3] M. Abdullah, and A. Yonis, "Performance of LTE release 8 and release 10 in wirelesscommunications," in *Proc. Cyber Security, Cyber Warfare and Digital Forensic (CyberSec),* 2012. Kuala Lumpur, June 28 2012.

- [4] J. Davidson, J. Peters, M. Bhatia, S. Kalidindi, and S. Mukherjee, *Voice over IP Fundamentals*. Indianapolis: Cisco press, 2007

- [5] (Feb. 10, 2014) Voip-Info.org, "VOIP QoS Requirements". [Online]. Available: http://www.voip-info.org/wiki/view/QoS.
- Special thanks to Team 8 for help getting LTE simulations working

Questions

THANK YOU!!