

ENSC-894 Communication Networks Spring 2014

Analysis of Enhanced Distributed Channel Access (EDCA) in Wireless LAN using OPNET.

Team #2

Syed, Aitizaz Uddin

(asyed@sfu.ca)

Shen, Shiou-Min

(eshen@sfu.ca)

Link: www.sfu.ca/~eshen/894projweb.htm

OVERVIEW

- Background Knowledge.
- Introduction.
- Carrier Sensing Multiple Access with Collision Avoidance (CSMA/CA).
- Type of Service (ToS).
- Enhanced Distributed Channel Access (EDCA).
- OPNET Architecture Design and Details.
- Simulation Results.
- Conclusion and Future Work.
- References.

Background Knowledge

- 802.11 (1997 first release) - Frequency Hop Spread Spectrum (FHSS).
- 802.11b - Direct Spread Sequence Spectrum. (DSSS)
- 802.11a - Orthogonal Frequency Division Multiplexing. (OFDM)
- Basic WLAN connection mechanisms: DCF, PCF, HCF.
- Quality of Service.
- Type of Service.

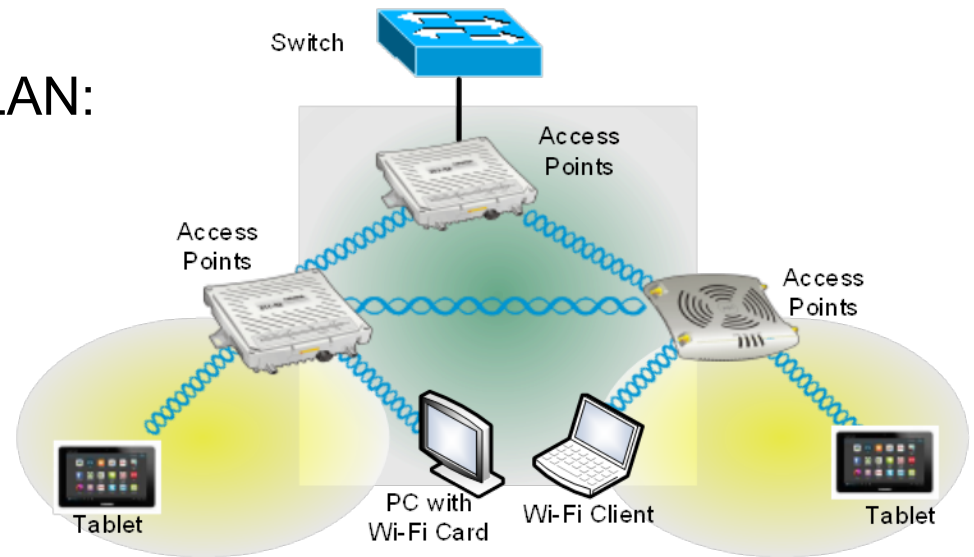
INTRODUCTION

Wireless LAN Contrast to Wired LAN:

- Half Duplex Communication.
- Shared Media.
- License Free band.

Co-ordination functions available at Data Link Layer:

- Distributed Coordination Function. (uses CSMA/CA)
- Point Coordination Function. (PCF)
- Hybrid Coordination Function. (uses EDCA)

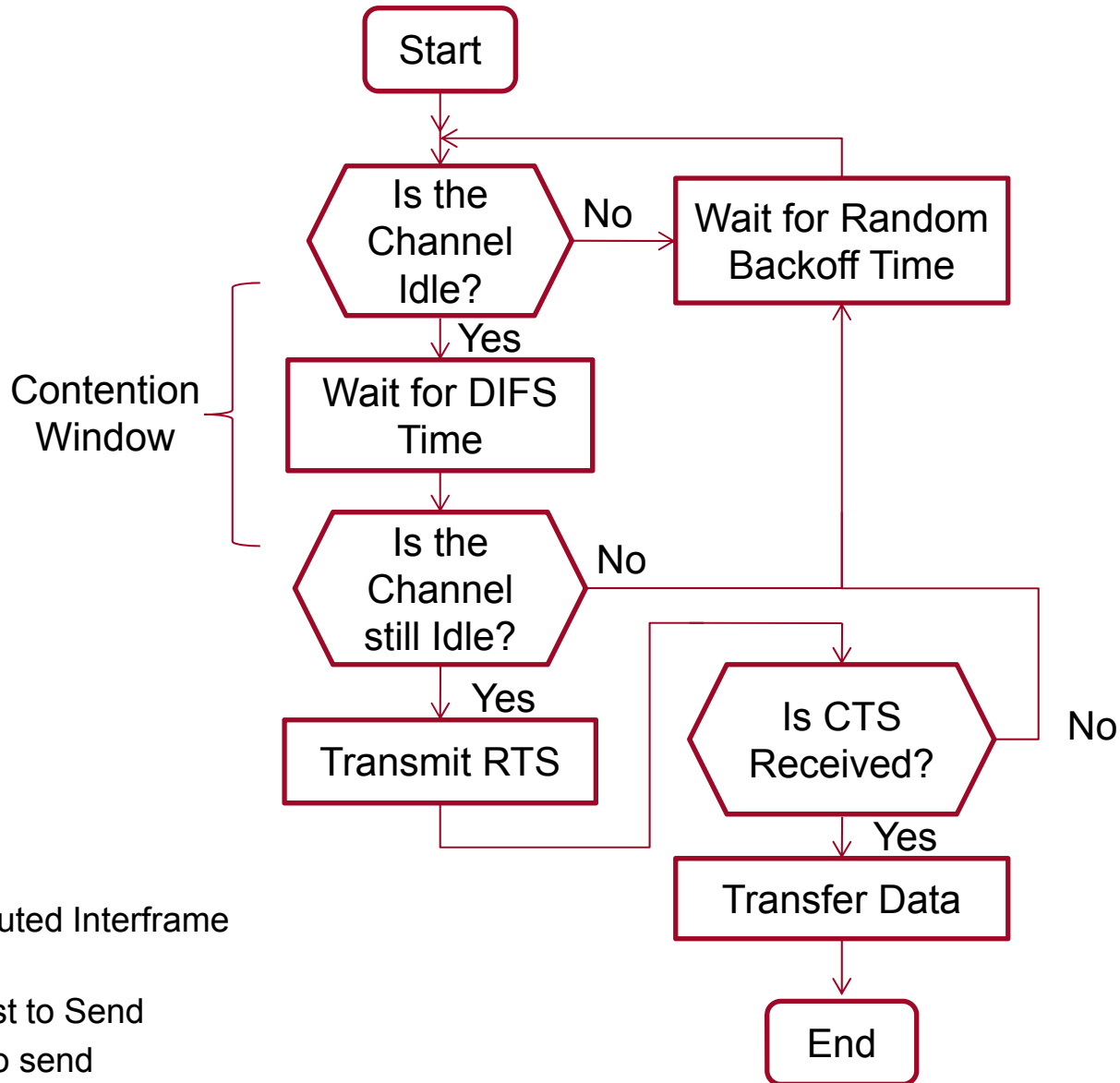


Carrier Sense Multiple Access with Collision Avoidance

- Distributed Coordination Function (DCF) is an asynchronous data transmission function.
- It implements (CSMA/CA) with binary exponential back-off algorithm.

Draw Backs:

- Nodes share channel resources between equally.
- Latency-sensitive video and audio services compete for channel in the same manner with other applications.



- DIFS – Distributed Interframe Spacing
- RTS – Request to Send
- CTS – Clear to send

Type of Service

- In Wired LANs, for QoS traffic is tagged in packet header in Type of Service (ToS) field.
- Based on these tags at every hop, packets are treated differently.
- This QoS method circumvents the delay and jitter problem in wired networks.
- Tags consist of 3 bits and they represent following classes:

001 (Background)

010 (Standard)

000 (Best Effort)

011 (Excellent Effort)

100 (Streaming Multimedia)

101 (Interactive Multimedia)

110 (Interactive Voice)

111 (Unreserved)

Ver.	Header Length	Type of Service	Total Length	
Identification			Flags	Offset
Time To Live	Protocol		Checksum	
Source Address				
Destination Address				
Options and Padding				

Packet Header

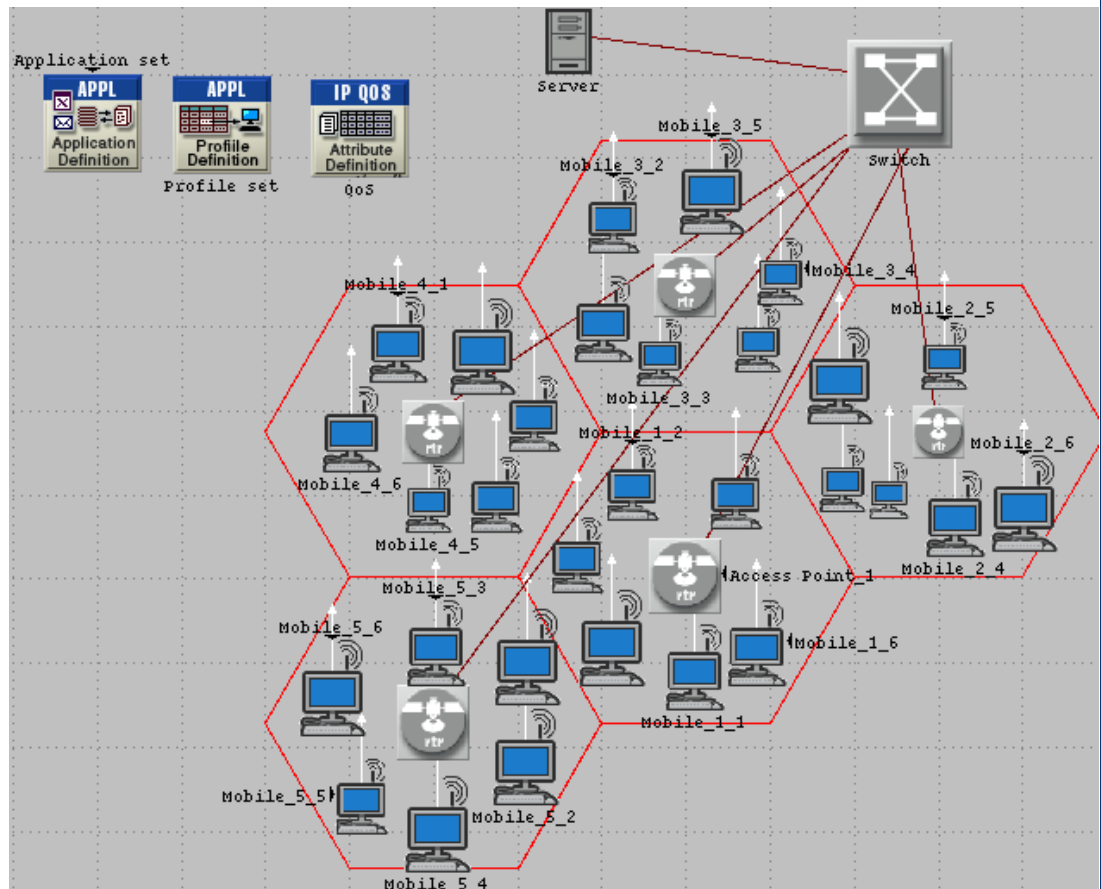
Enhanced Distributed Channel Access (EDCA)

- Introduced in 2005 in 802.11e amendment.
- Purpose is to incorporate wired LANs QoS mechanism in Wireless media.
- Incoming Type of Service classes are divided into 4 Access Categories.
- Provides preference to Access Categories via 2 mechanisms:
 - Shorter DIFS and Contention Window.
 - Transmit opportunity (TXOP).
- Types of Services tags are mapped to the Access categories as follow:

ToS Tag	AC	CWmin	CWmax	TXOP
Background(001), Standard(010)	Background	15	1023	0
Best Effort(000)	Best Effort	15	1023	0
Excellent Effort (011) Streaming Media (100) Interactive Media (101)	Video	7	15	3.008 ms
Interactive Voice (110) Unreserved (111)	Voice	3	7	1.504ms

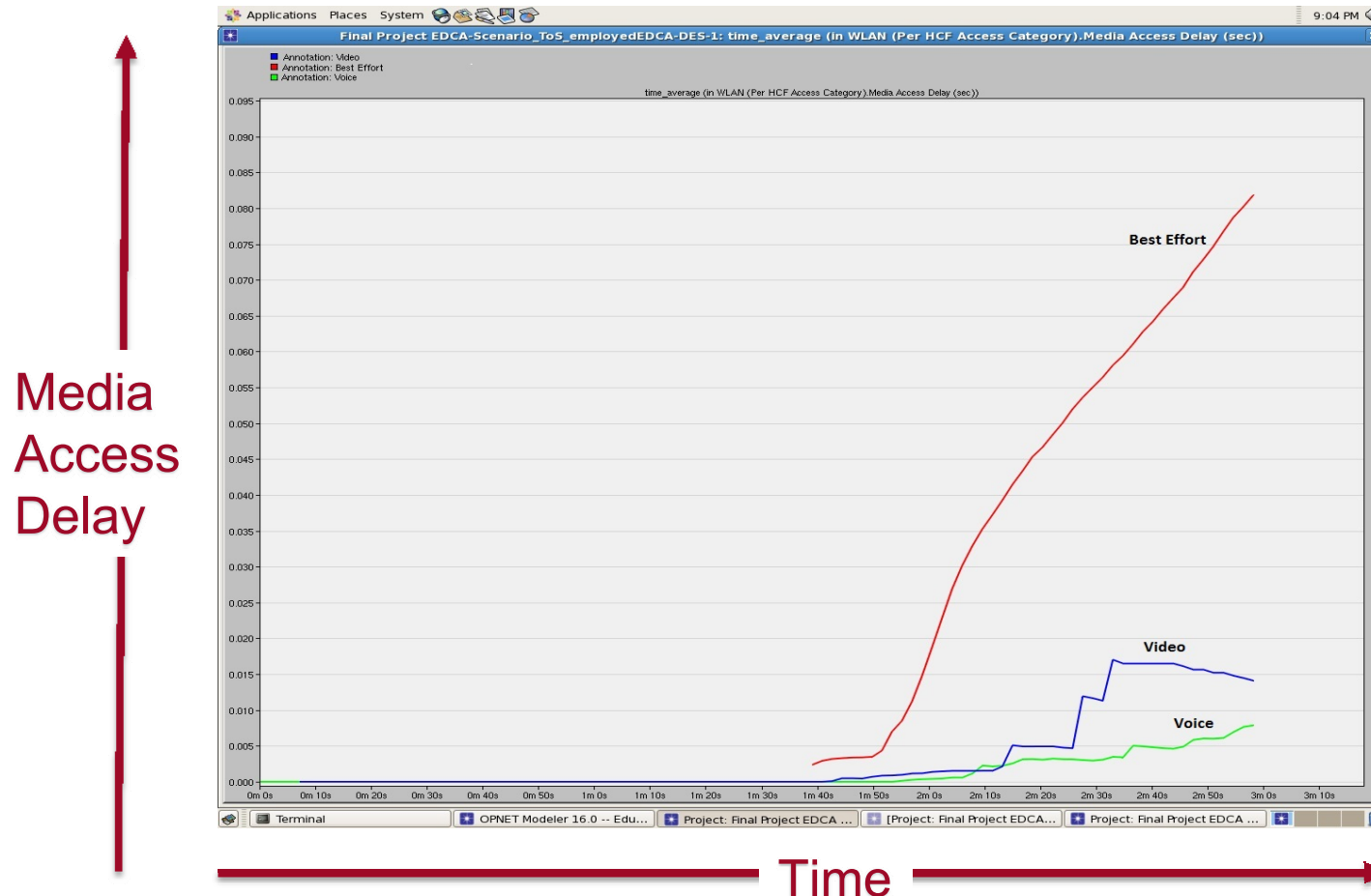
OPNET Network Design and Details

- □ Campus WLAN setting with 5 access points and 30 workstations.
- 2 Groups of Data
 - Video Streaming & Voice
 - TCP Traffic
- Simulation scenarios:
 - No QoS.
 - ToS in LAN.
 - ToS & EDCA.
 - EDCA with higher TXOP for Voice.



OPNET Simulation Results

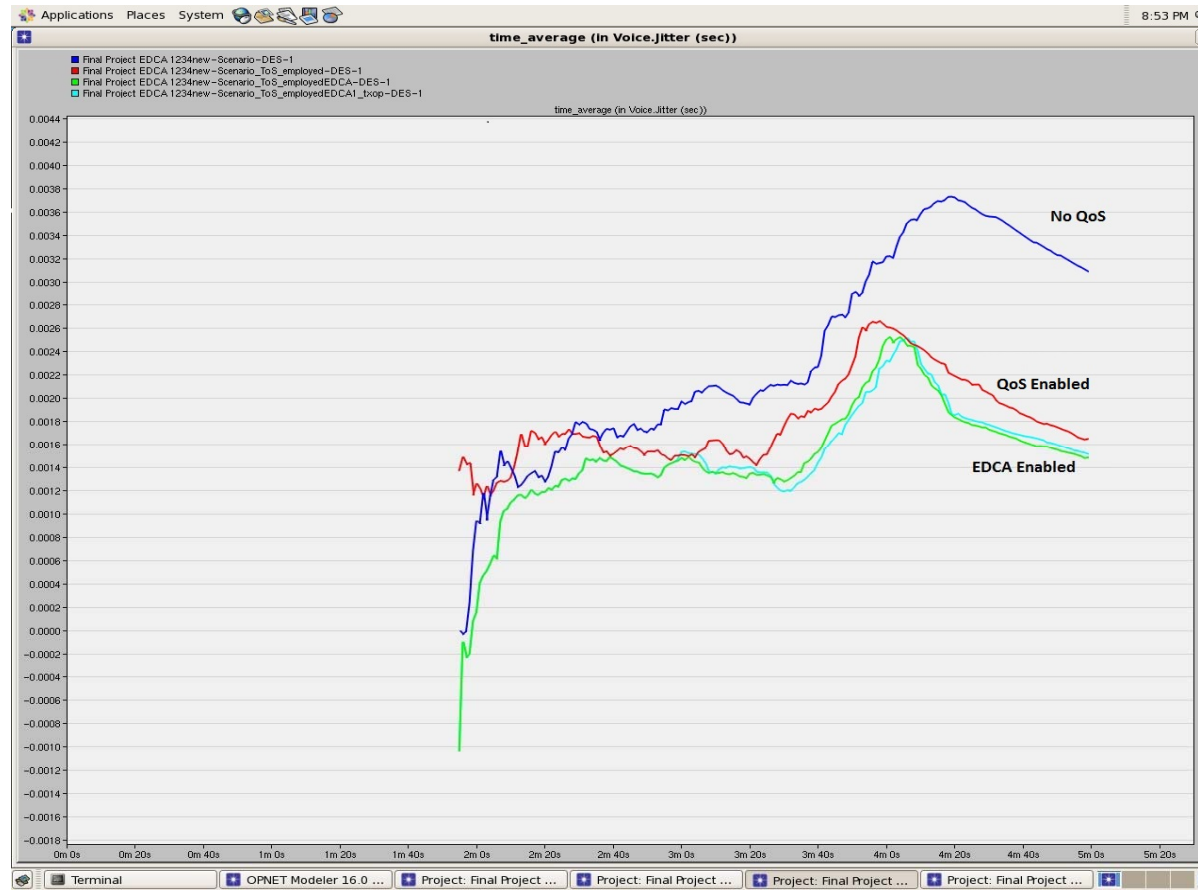
- Media Access Delay of the Access Categories after EDCA is enabled



OPNET Simulation Results

- Jitter in Voice traffic

Voice
Jitter

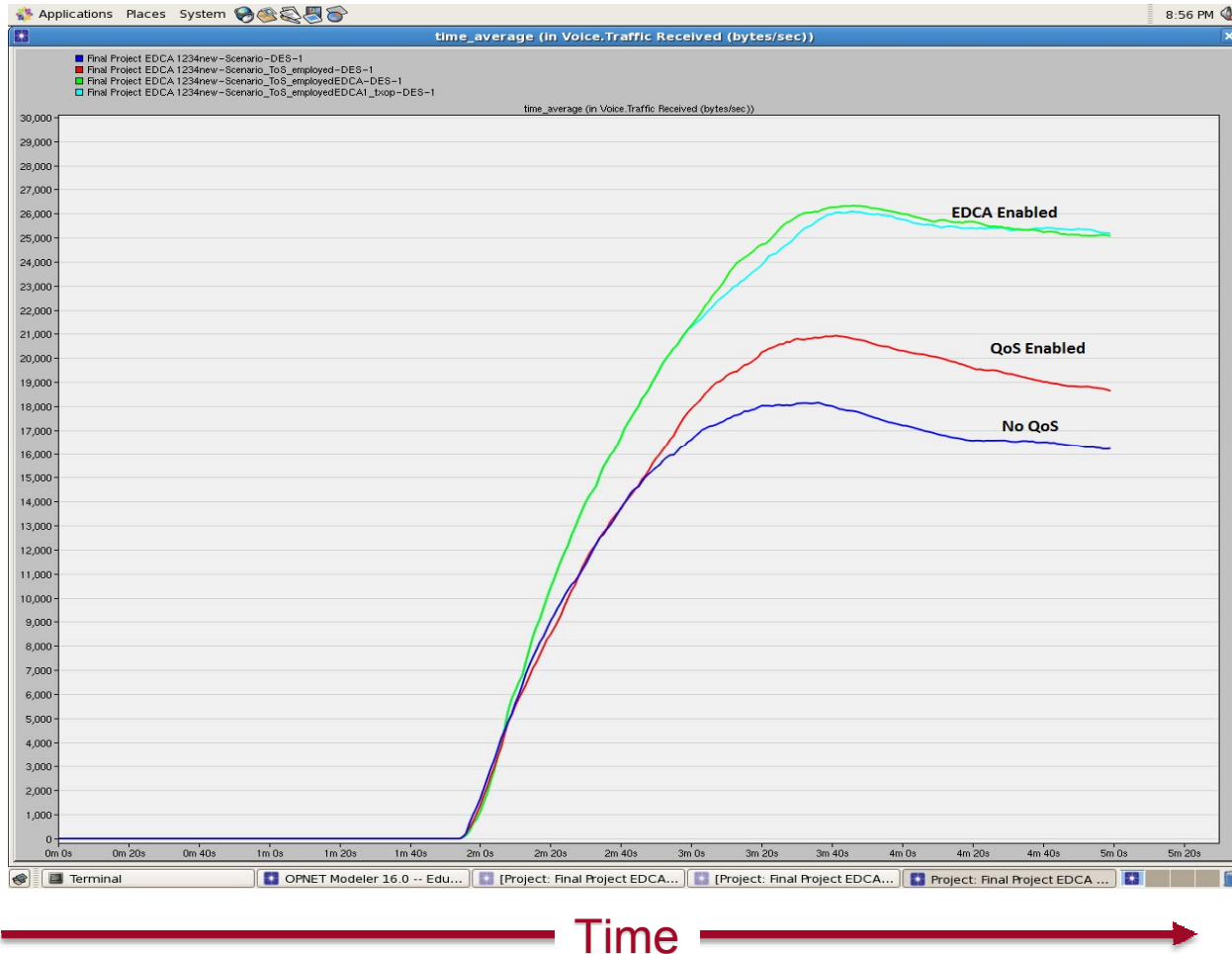


Time

OPNET Simulation Results

- Voice Traffic Received

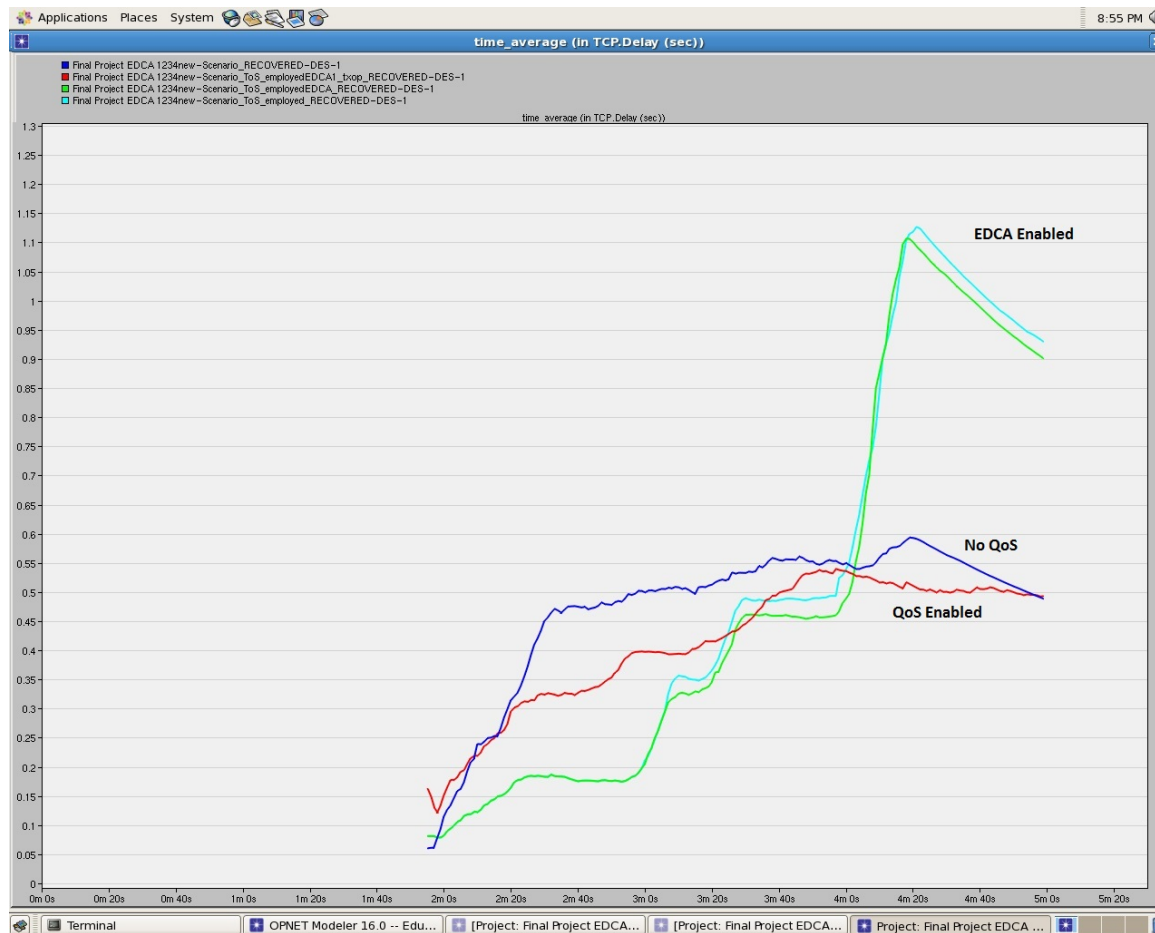
Voice Traffic Received



OPNET Simulation Results

■ Delay in TCP Traffic

↑
Delay in
TCP
Traffic
↓



→ Time

Conclusion

- EDCA works perfectly in providing the desired level of QoS in Wireless LANs complied to the QoS infrastructure of the Wired LANs.

Future Work

- Conduct comprehensive analysis of networks and characterize more parameters of LANs.
- Analyze performance of Interactive Multimedia and Streaming Multimedia on enabling EDCA.

References

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