ENSC 427: Communication Networks
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Final Project Presentation

Comparison of the Quality of Service (QoS) on the IEEE 802.11e and the 802.11g Wireless LANs

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Roadmap

- Introduction
  - Overview and Motivation
  - What is QoS? What factors determine QoS?
- Background Information
  - IEEE 802.11g and 802.11e WLAN MAC Layer
  - QoS Capabilities Enabled by 802.11e WLAN
- Implementation Details
  - OPNET model
  - Scenarios
- Simulation and Results
  - Simulation Configuration
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- Conclusion

Introduction

- Overview and Motivation
- What is QoS?
- What factors determine QoS?

Introduction

- Overview
  - Comparison of the Quality of Service (QoS) over two specifications of WiFi – IEEE 802.11g and 802.11e
- Motivation
  - Increasing demand in streaming multimedia over wireless networks has made the QoS for 802.11 protocol an important topic in research and development.

What is QoS?

- A method of providing better service for different types of network traffic over various types of packet-switched networks.
- Provides an algorithm for controlling what type of traffic should be given priority to access the network channel.
- The network medium used could be of any type ranging from Ethernet to WiFi (Wireless Fidelity).

What factors determine QoS?

- Packet End-to-End Delay
- Packet Delay Variation
- Packet Loss Ratio
- Throughput

Related Work

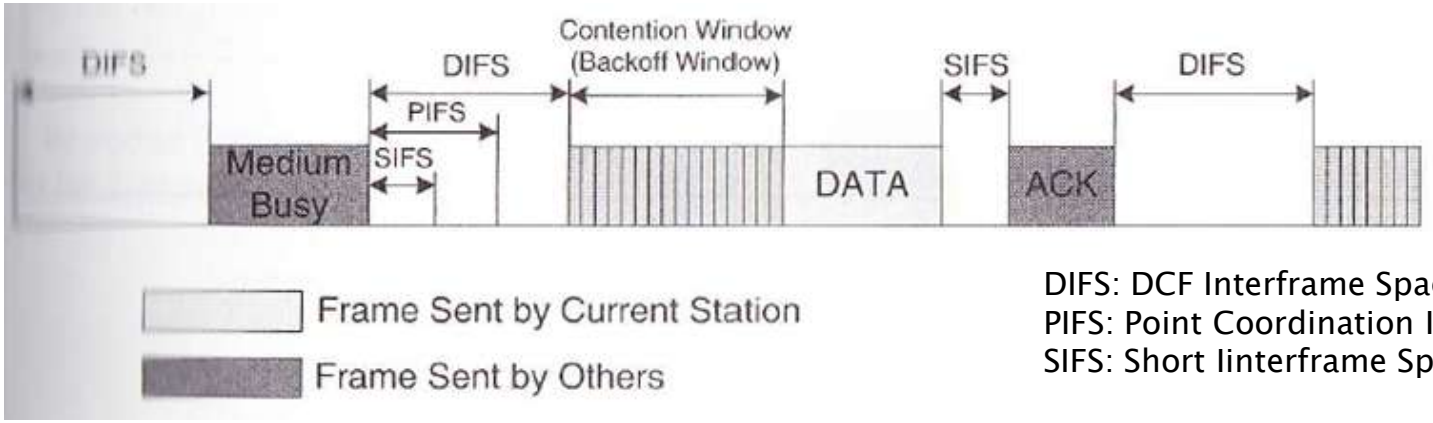
- Effects of packet loss on speech and video quality
- Resource ReSerVation Protocol (RSVP)
- Providing QoS through
  - Statistical multiplexing
  - Bandwidth management mechanisms
  - Differentiated Services (DiffServ)

Background Information

- 802.11g MAC Layer
- 802.11e MAC Layer

802.11g MAC Layer

- Distributed Coordination Function (DCF)
  - Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) mechanism is used.
  - Based on an asynchronous data transfer on a best effort basis only.
  - Contention based channel access



DIFS: DCF Interframe Space
PIFS: Point Coordination Iinterframe Space
SIFS: Short Iinterframe Space

DCF Basic Access Method

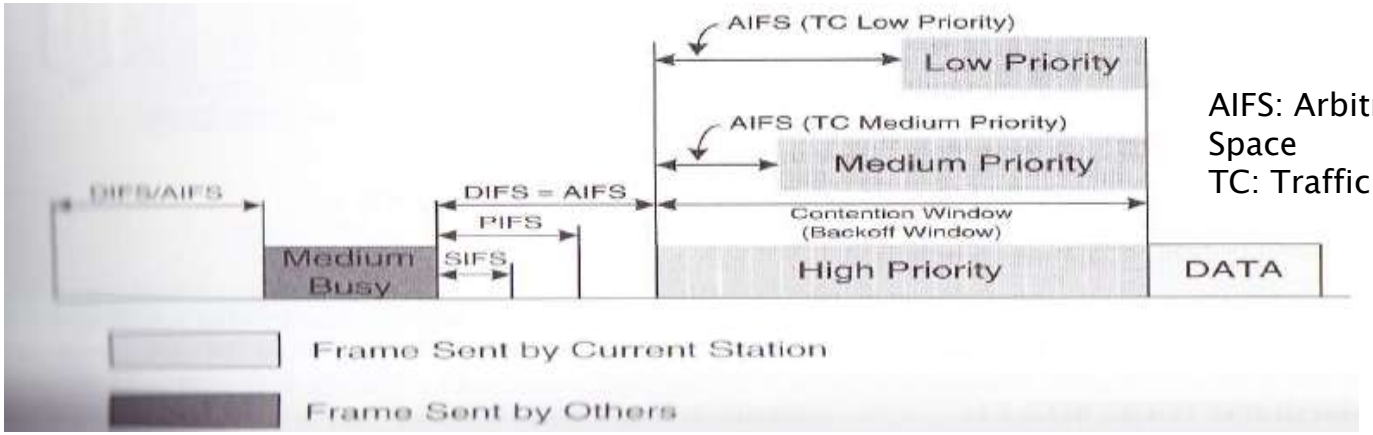
Y-K. R. Kwok and V. K. N. Lau, *Wireless Internet and Mobile Computing: Interoperability and performance*. Hoboken, N.J.: Wiley-Interscience: IEEE Press, 2007, p. 271

QoS Limitations of 802.11g

- The 802.11g specification has no support for:
  - Types of Service (ToS)
  - Admission control
  - User/end stations to communicate QoS requirements to the access point

802.11e MAC Layer

- Hybrid Coordination Function (HCF)
  - Enhanced Distribution Channel Access (EDCA) is used
  - A combination of contention-based and control-based (polling) channel access mechanism
  - Eight different levels of priority



AIFS: Arbitration Interframe Space
TC: Traffic Category

IEEE 802.11e EDCA

Y-K. R. Kwok and V. K. N. Lau, *Wireless Internet and Mobile Computing: Interoperability and performance*. Hoboken, N.J.: Wiley-Interscience: IEEE Press, 2007, p. 279

QoS Capabilities Enabled by 802.11e

Traffic Category	Type	Priority
TC1	Background traffics	1 (Lowest)
TC2	Spare traffics	2
TC0	Best Effort data traffics	3
TC3	Excellent data traffics	4
TC4	Controlled load data traffics	5
TC5	Multimedia traffics with delay less than 100 ms	6
TC6	Multimedia traffics with delay less than 10 ms	7
TC7	Network Control traffics	8 (Highest)

802.11e Prioritization of Traffic

Y-K. R. Kwok and V. K. N. Lau, *Wireless Internet and Mobile Computing: Interoperability and performance*. Hoboken, N.J.: Wiley-Interscience: IEEE Press, 2007, p. 278

Implementation Details

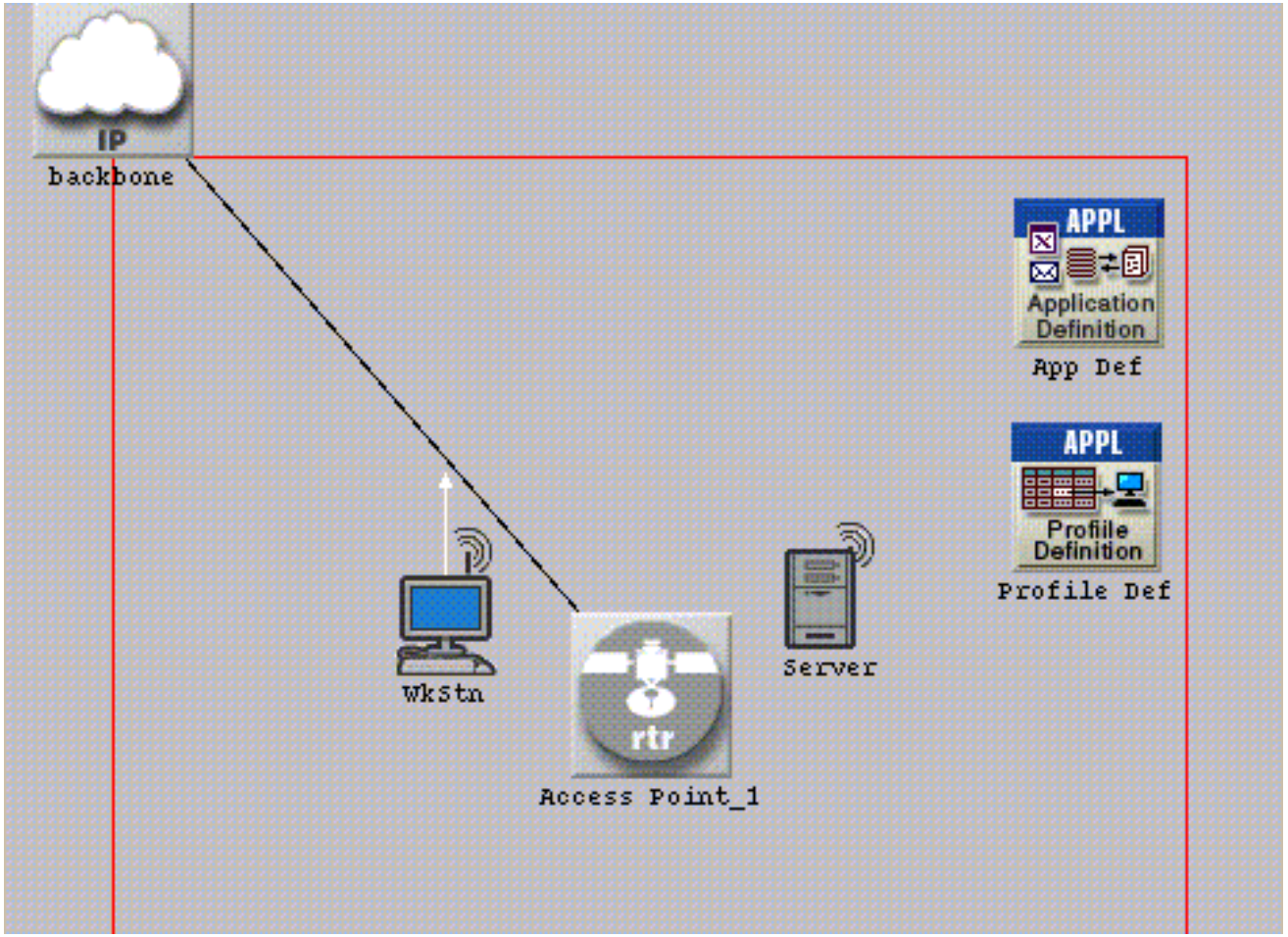
- OPNET model
- Scenarios

Scenarios

- A workstation receives both video and FTP traffic. Simulation results are collected for both to compare QoS determining factors
  - One scenario (802_11g) uses the standard DCF mechanism
  - Another scenario (802_11e) uses the HCF mechanism to prioritize traffic streams

DCF: Distribution Coordination Function
HCF: Hybrid Coordination Function

OPNET model



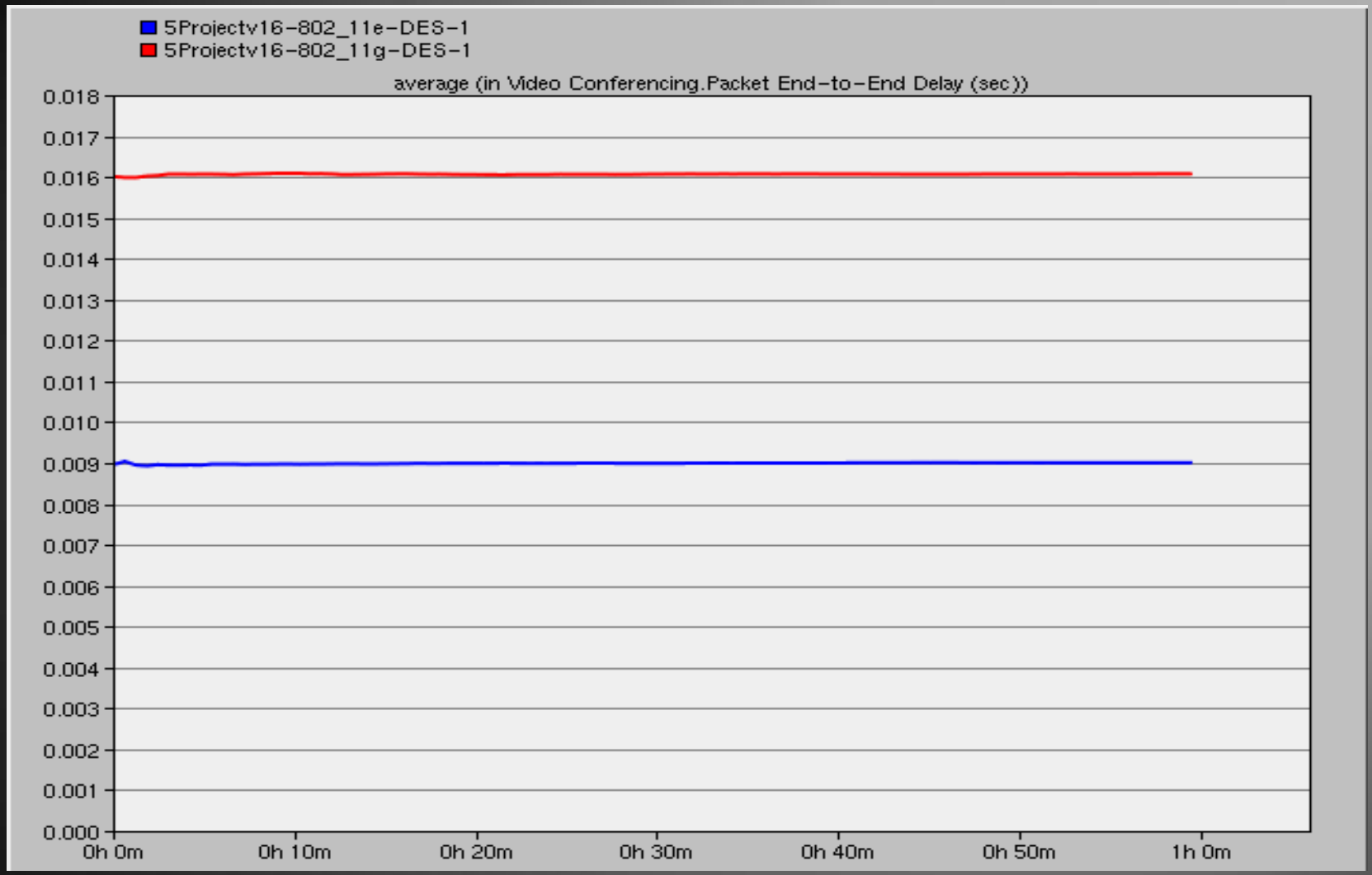
WLAN Network Model

Simulation and Results

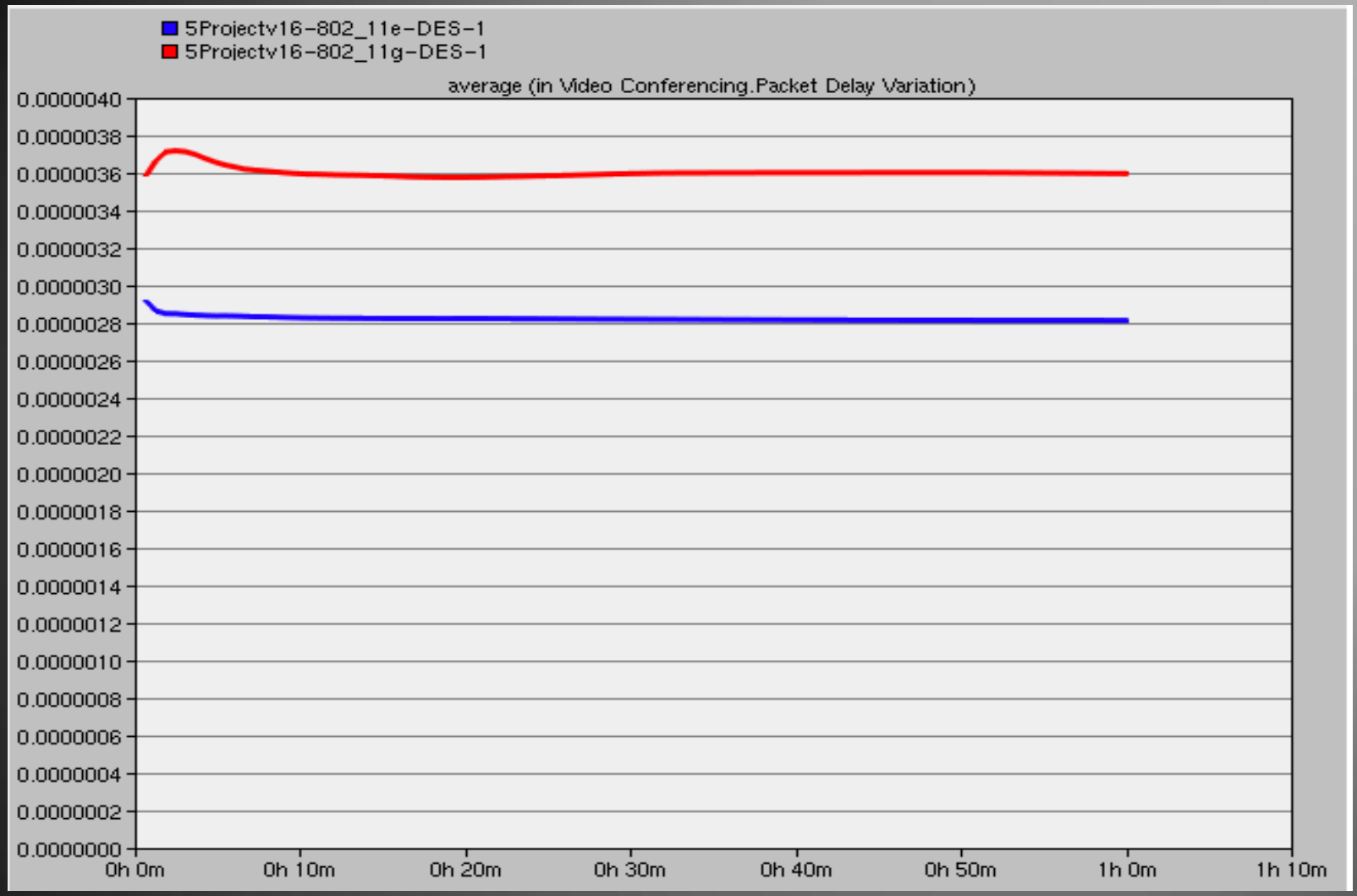
- Simulation Configuration
- Statistics Collected
  - Packet End-to-End Delay
  - Packet Delay Variation
  - Media Access Delay
  - Client FTP Download Response Time

Simulation Properties

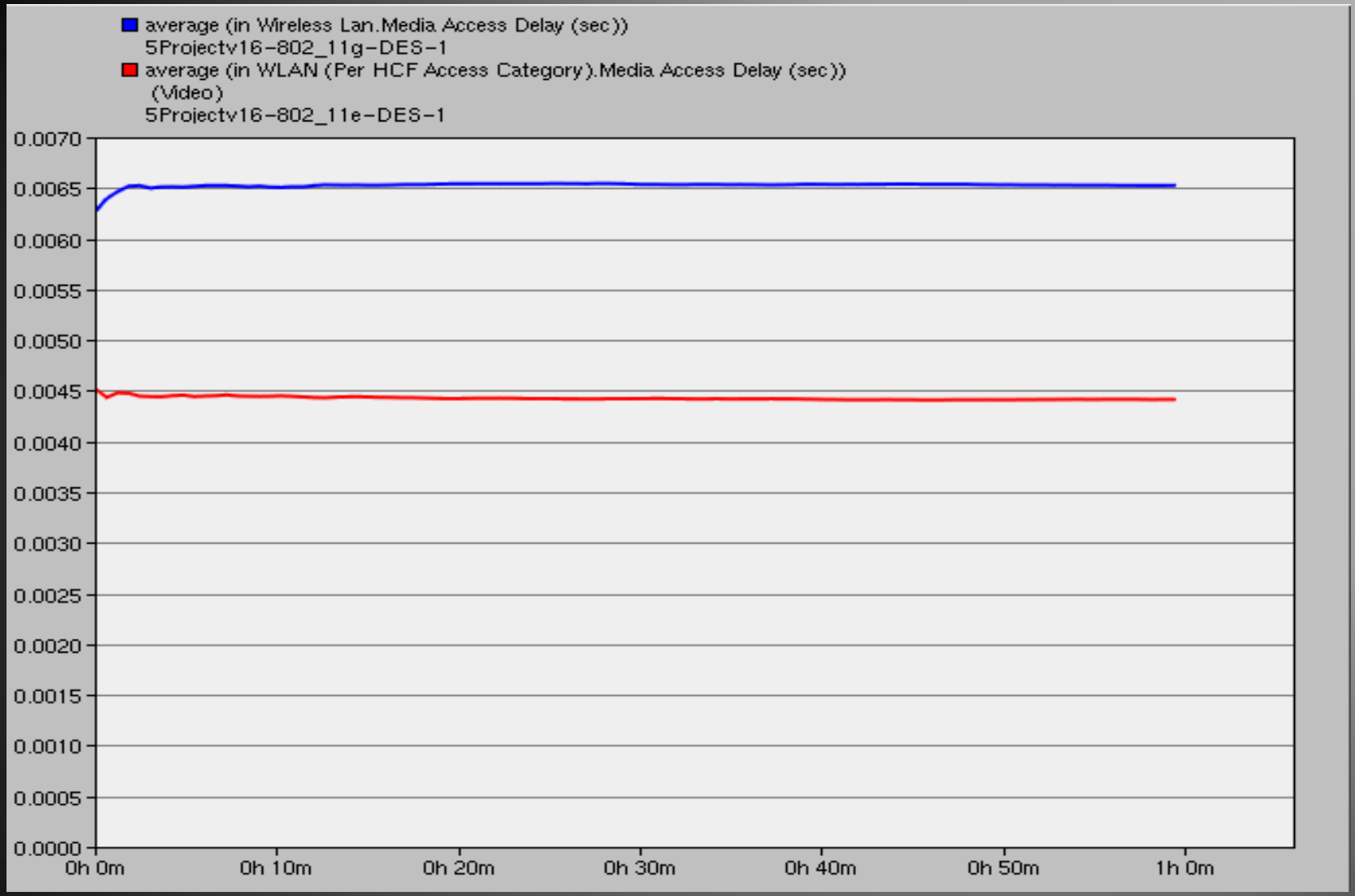
- Simulated Time: 1 hour (3600 seconds)
- Simulation Time: 53 minutes
- Seed: 128
- Streaming Video
  - Low Resolution
  - Poisson Distribution
- FTP Traffic
  - High Load



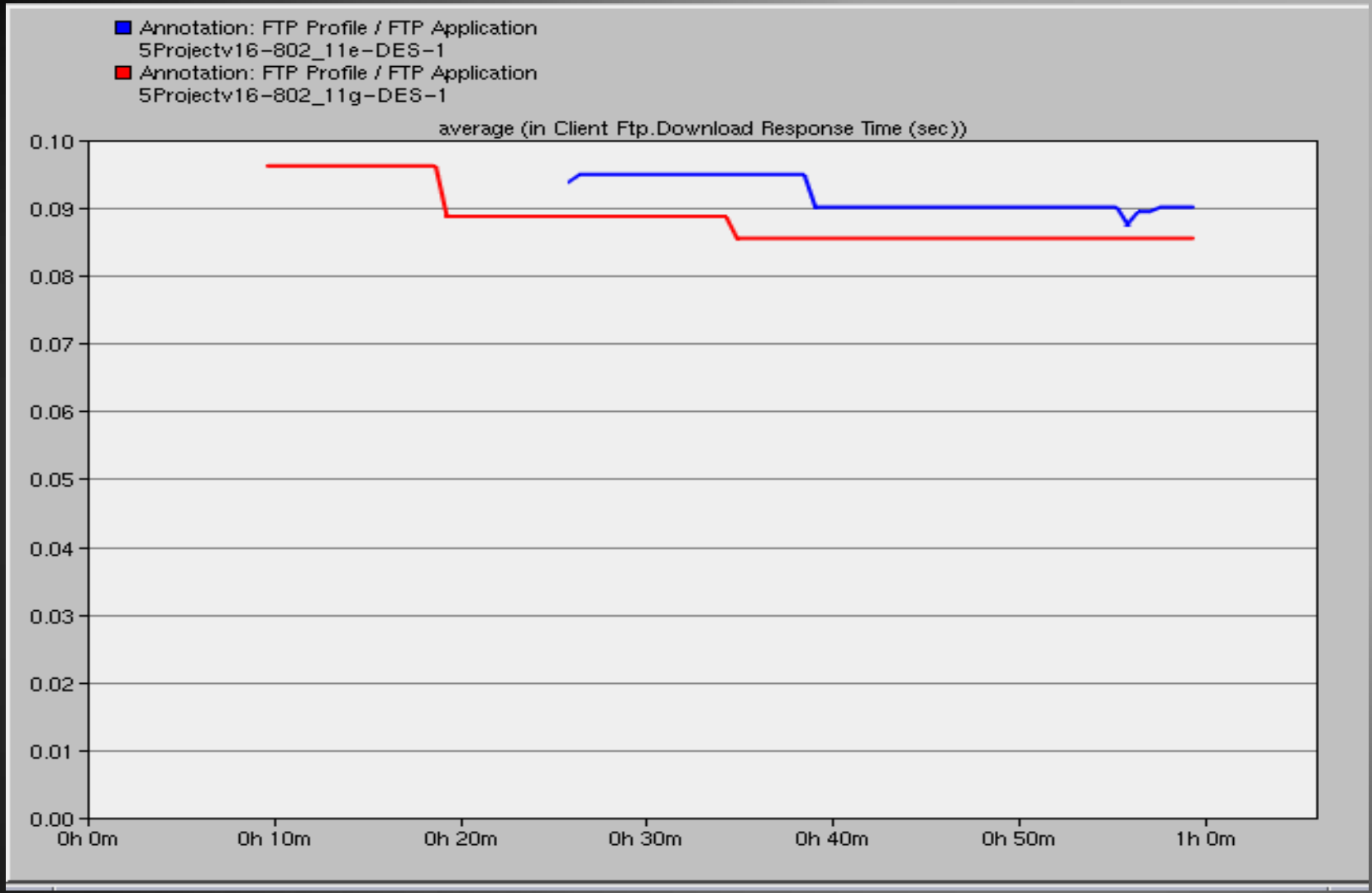
Video Packet End-to-End Delay



Video Packet Delay Variation



Video Media Access Delay



Client FTP Download Response Time

Conclusion

- Comparison of Expected and Simulated Results

Conclusion

- We expected 802.11e to have lower packet delay variance, packet end-to-end delay and media access delay since it has a priority mechanism.
- The simulated results verified our expectations.

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Thank You!