ENSC 427: Communication Networks Spring 2015

Video Streaming over Wi-Fi

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Overview

- **Introduction**
  - Objective
  - Introduction on Wi-Fi
  - Video Streaming Protocols

- **Implementation**
  - Topology
  - Application

- **Simulation & Analysis**
  - Case 1: Increasing Load and Data Rate
  - Case 2: Comparison of 802.11a/g/n
  - Case 3: Effect of Distance

- **Discussion/Conclusion**

Introduction

- ➤ **Objective**

- ➤ **Introduction on Wi-Fi**

- ➤ **Video Streaming Protocols**

Introduction

- **Objective**
  - To analyse the video streaming performance in a typical home Wi-Fi network with various scenarios
  - In terms of delay, throughput, jitter and packet received

- **Introduction on Wi-Fi**
  - WLAN, IEEE 802.11, WPA/WPA2
  - 802.11 a/b/g/n/ac (802.11g most popular)
  - 2.4 & 5 GHz bands
  - Higher power consumption
  - Data rate up to 54 Mbps for 802.11 a/g
  - MIMO capability for 802.11n, data rate up to 600 Mbps
 - Range of 20 meters (66 feet) indoors

Introduction

- **Video Streaming Protocols**
  - High BW and bit rate requirements for smooth streaming
  - 100 Kbps for low quality, over 3 Mbps for HD

  - Streaming stored/live video, video over IP
  - Video compression and quality

  - Delay sensitive & loss tolerance for video conference
  - Delay tolerance of 10 sec for live streaming

  - HTTP & UDP, DASH, RTP
  - Client buffering

Implementation

- ➢ **Topology**

- ➢ **Application**

Implementation

➢ **Topology**
  ➢ WLAN/Ethernet Router, Ethernet Server, 100BaseT Link
  ➢ Users: mobile WLAN workstations
  ➢ Applications: VoIP, Browsing, Video Conferencing (News, Star Wars, Lord of the Rings)
  ➢ **User of interest**: Video User - News
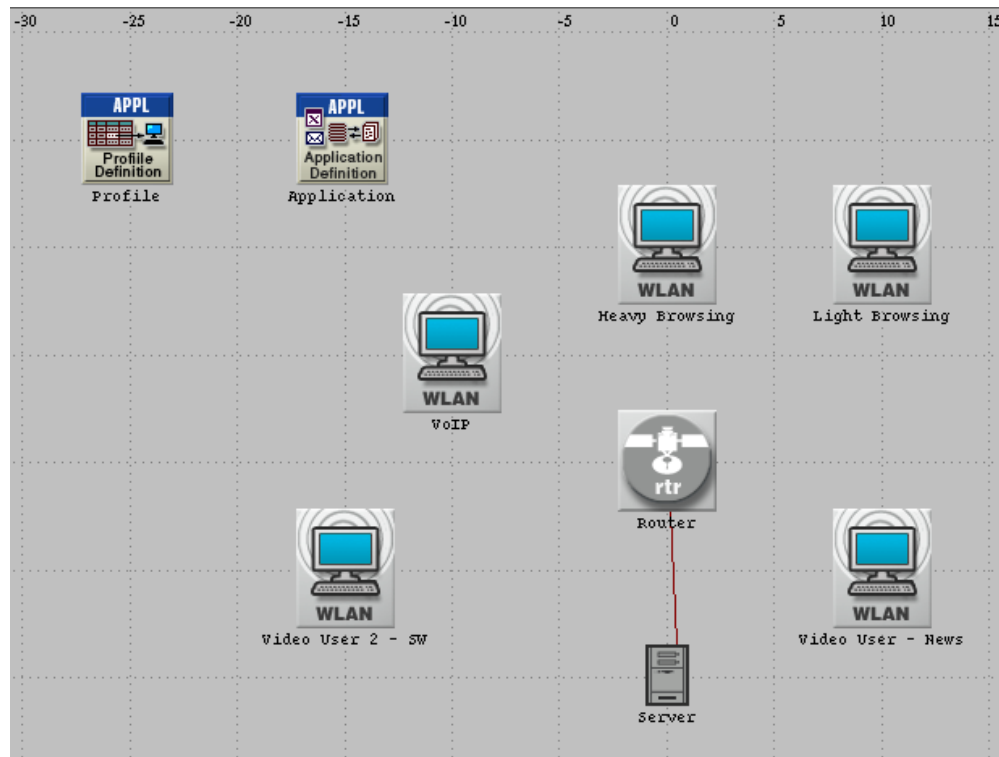
Implementation

➤ **Application**
  ➤ Video trace files e.g. News broadcast at 30 FPS
  ➤ Default VoIP and browsing applications
  ➤ Throughput shown below (right) – pink is LOTR
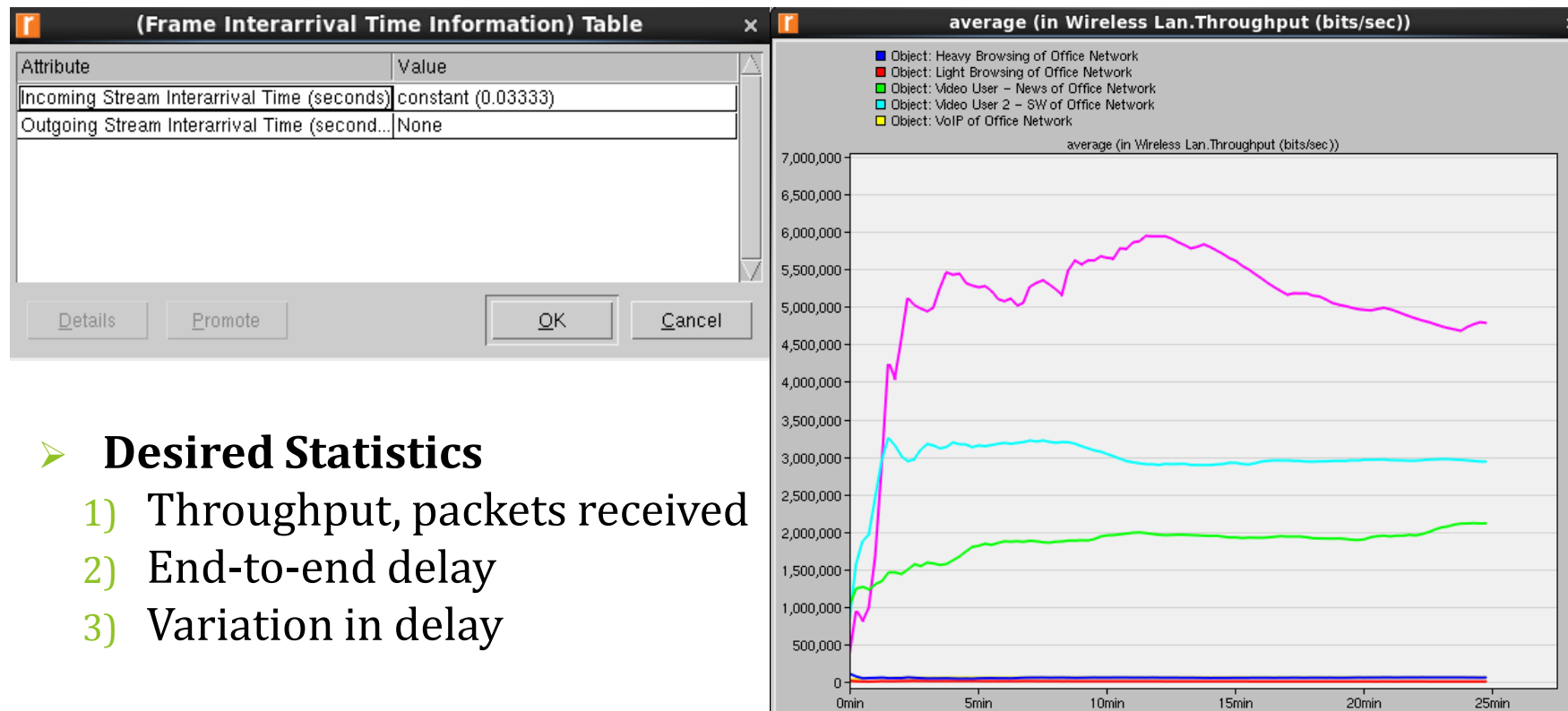

➤ **Desired Statistics**
  1) Throughput, packets received
  2) End-to-end delay
  3) Variation in delay

Simulation & Analysis

➢ **Case 1: Increasing Load and Data Rate**

➢ **Case 2: Comparison of 802.11a/g/n**

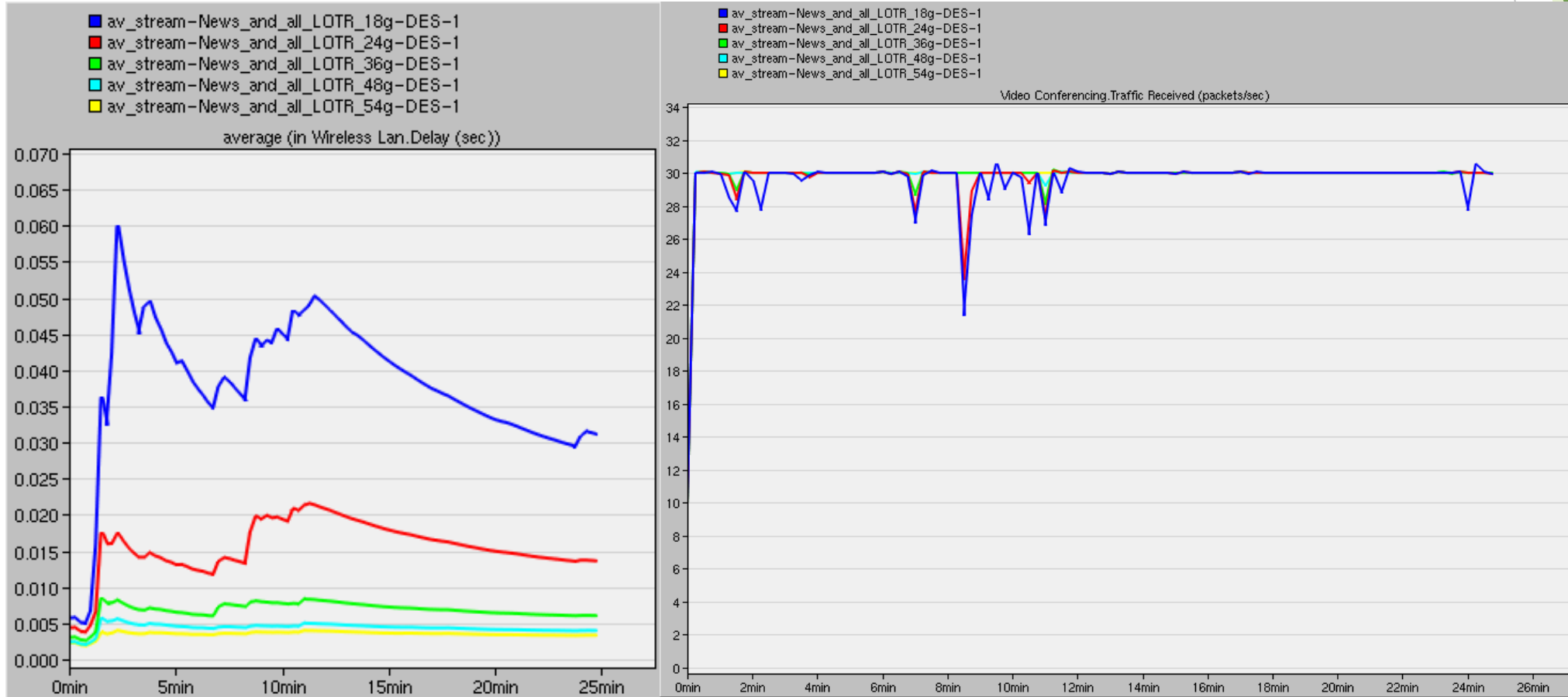➢ **Case 3: Effect of Distance**

Simulation & Analysis

➢ **Case 1: Increasing Load (802.11g, 18 Mbps)**
  ➢ News user with added clients (Light/Heavy Browsing, VoIP, LOTR)
  ➢ Start seeing packet loss for News user – stuttering video if no buffer exists
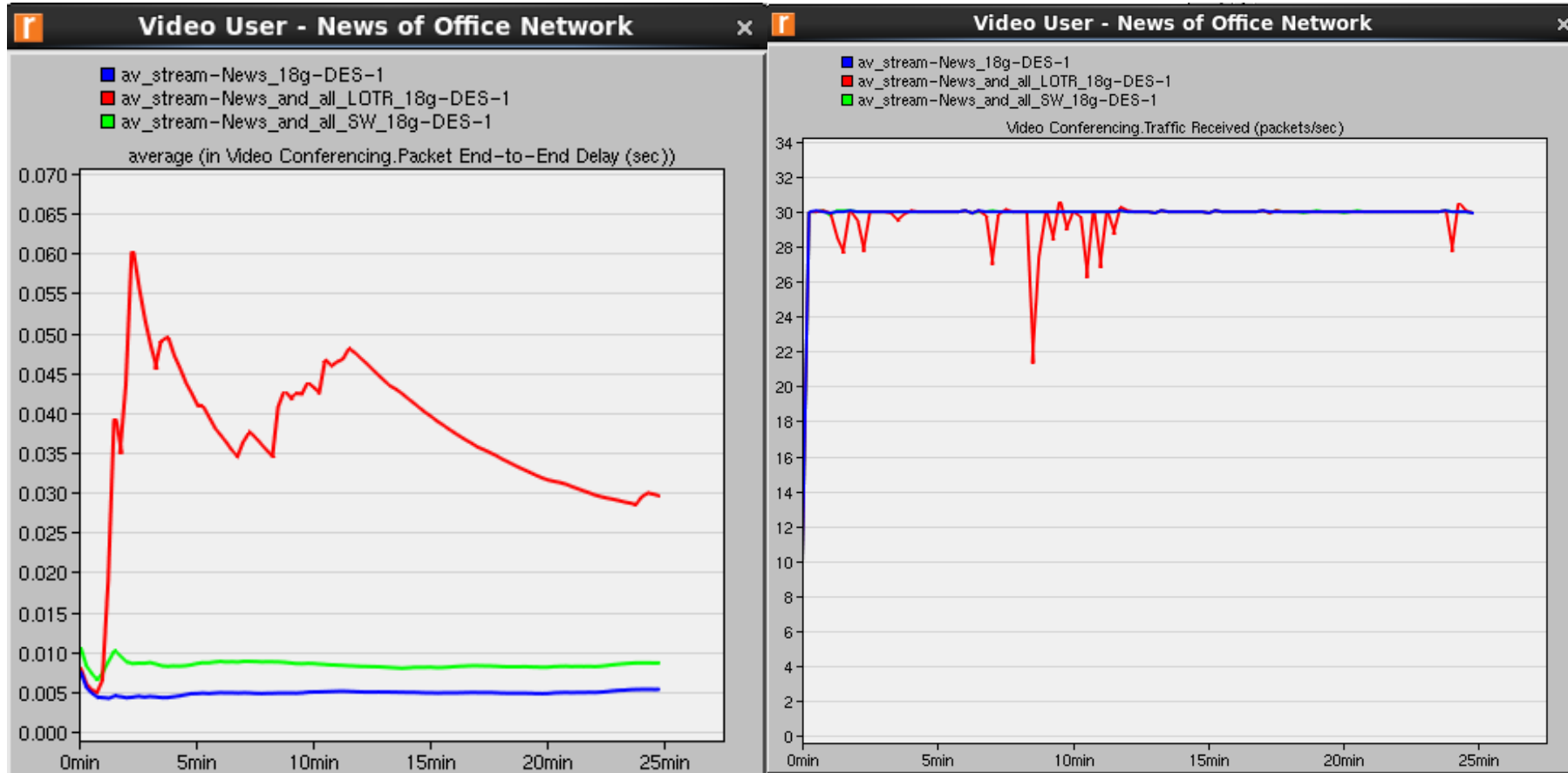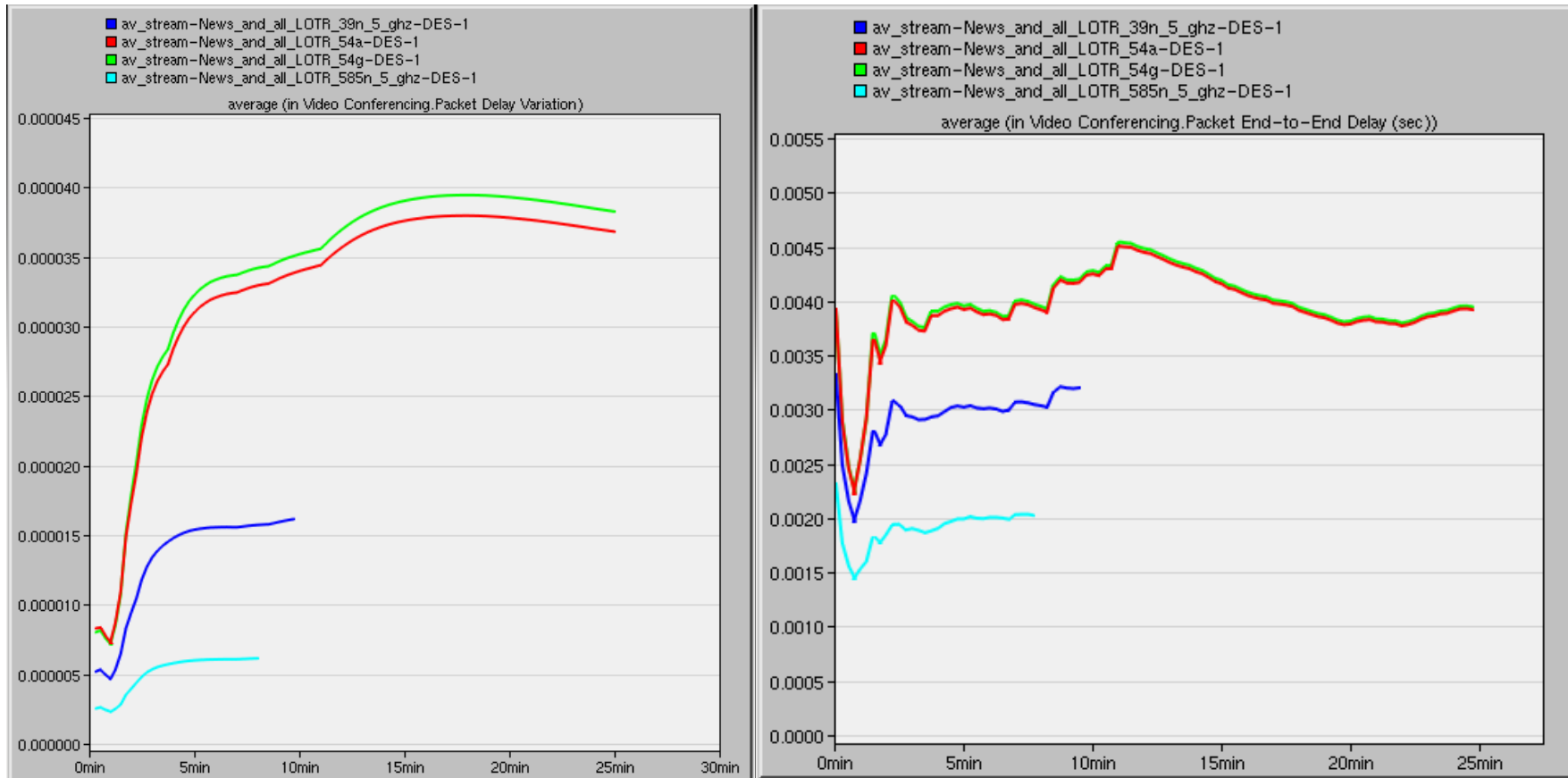
Simulation & Analysis

➢ **Case 1: Increasing Data Rate (802.11g, 18-54 Mbps)**

   ➢ Increasing data rate lowers end-to-end delay and improves throughput

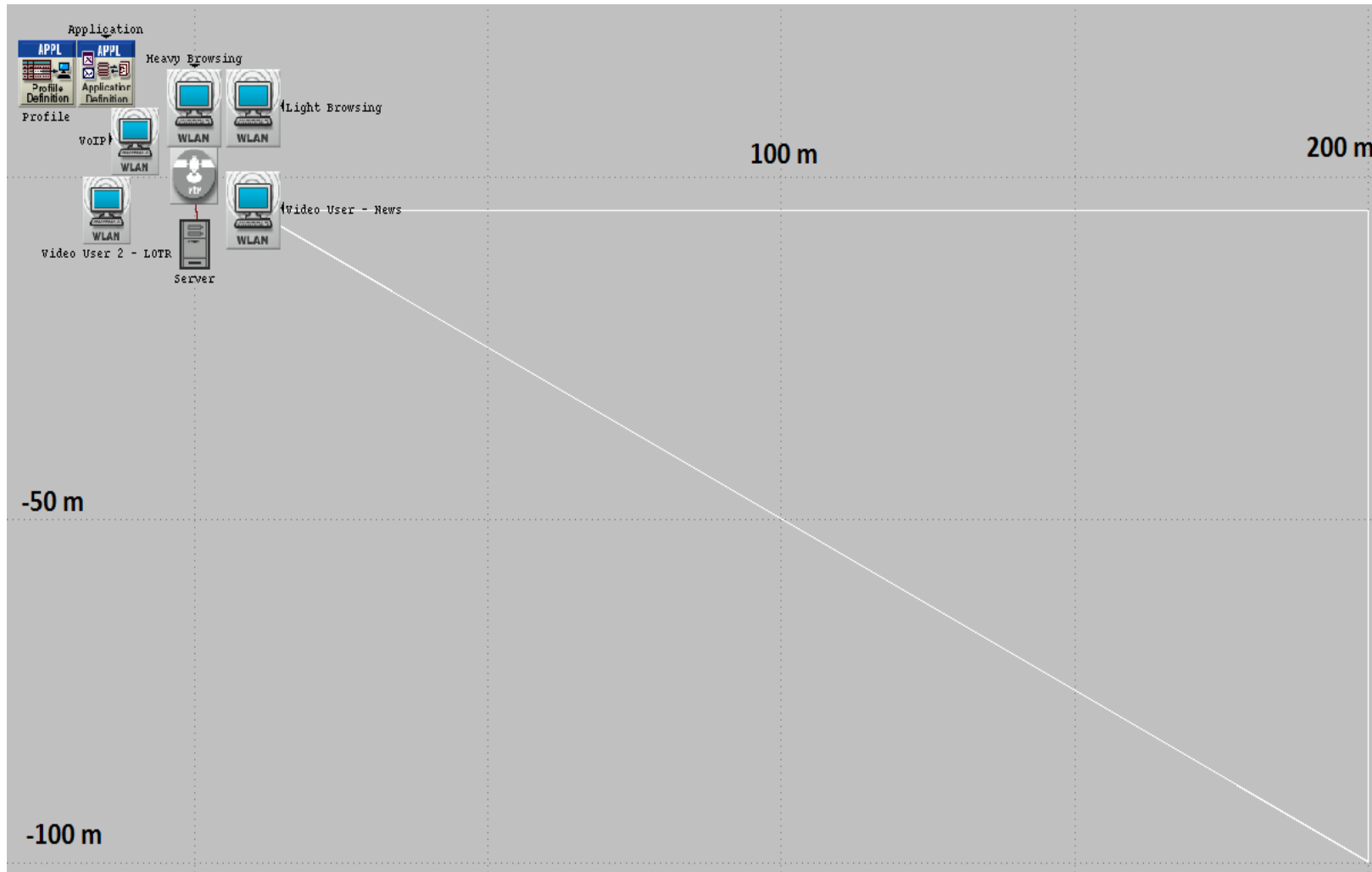   ➢ Based on results and given situation - recommend at least 48 Mbps

Simulation & Analysis

- **Case 2: Comparison of a, g & n standards**
  - n: 39 & 58.5 Mbps with 5 GHz band, g/a: 54 Mbps
  - Simulation issues with 802.11n scenarios, but general idea is captured
  - 802.11n outperforms others
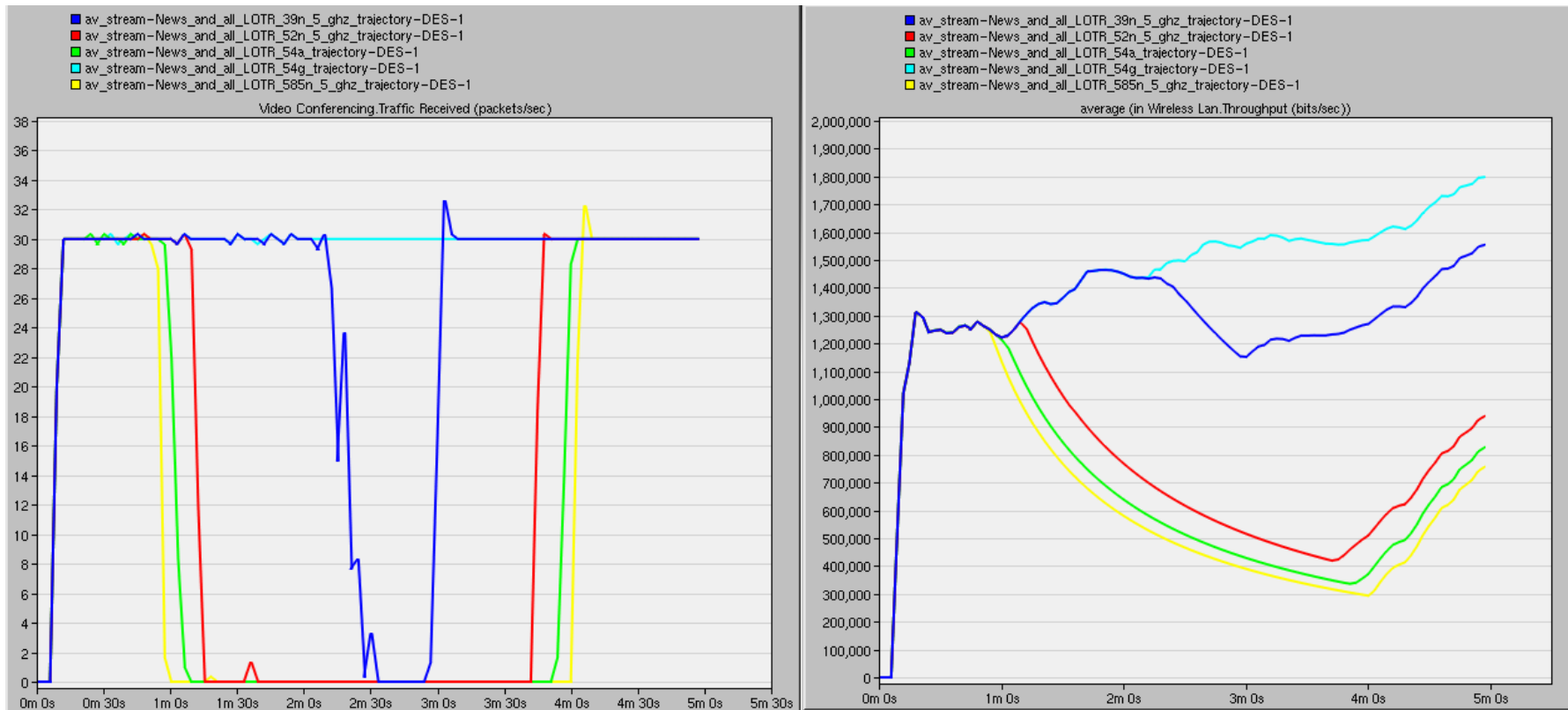
Simulation & Analysis

➢ **Case 3: Effect of Distance**
  ➢ News user moving along path below

Simulation & Analysis

➢ **Case 3: Effect of Distance**
- ➢ Trade off between 5 GHz band & range
- ➢ Trade off between data rate & range
- ➢ Shortest range with 802.11n (58.5 Mbps, 5 GHz), longest range with 802.11g (54 Mbps, 2.4 GHz)

Discussion/Conclusion

➤ **Difficulties**
  ➤ Were unfamiliar with Modeler's video conferencing, browsing, and VoIP applications
  ➤ Decisions on topology, scenarios, and test cases

➤ **Future Work**
  ➤ Simulate 802.11ac and compare to 802.11n
  ➤ Wi-Fi's competitors
    ➤ HiperLAN (European 802.11)
    ➤ Ethernet
  ➤ Add more throughput intensive applications

➤ **Things learned**
  ➤ High throughput applications have the most effect on a network
  ➤ Typical characteristics of video: high bit rate and throughput, sensitive to delay
  ➤ Higher rate of transmission increases throughput and decreases delay
  ➤ Standards using 2.4 GHz band have longer range than 5 GHz band
  ➤ Trade-off between higher data rate vs. shorter range

Thank you for listening!

Questions?

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