Video Streaming over WiFi using Riverbed Modeler 18.0

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Group #1

Overview

- Purpose
- WiFi and Wireless LAN (WLAN)
- WiFi in Home Networks
- Network Topology
- Simulated Applications
  - Heavy Browsing
  - Light Browsing
  - Video Streaming
- Streaming a Movie
  - Effect of Frame Rate
  - Effect of Data Rate
  - Movie Content
- Conclusion
- Q&A

Purpose

- Simulating and analyzing a home network system with multiple clients.
- To determine how the network is affected by various levels of activity.
- Viewing modern applications of WiFi usage, like streaming over the Internet or connecting to a local media server.
- Observing how data rate, frame rate, and the movie content affects the Quality of Service (QoS) for the user.

WiFi and Wireless LAN (WLAN)

- WiFi is a technology that allows devices to connect to a Wireless LAN (WLAN) network.
- WiFi is based on IEEE 802.11 standards.
- WiFi standard g is used in our project due to its popularity.
- Gives advantage of mobility and flexibility.

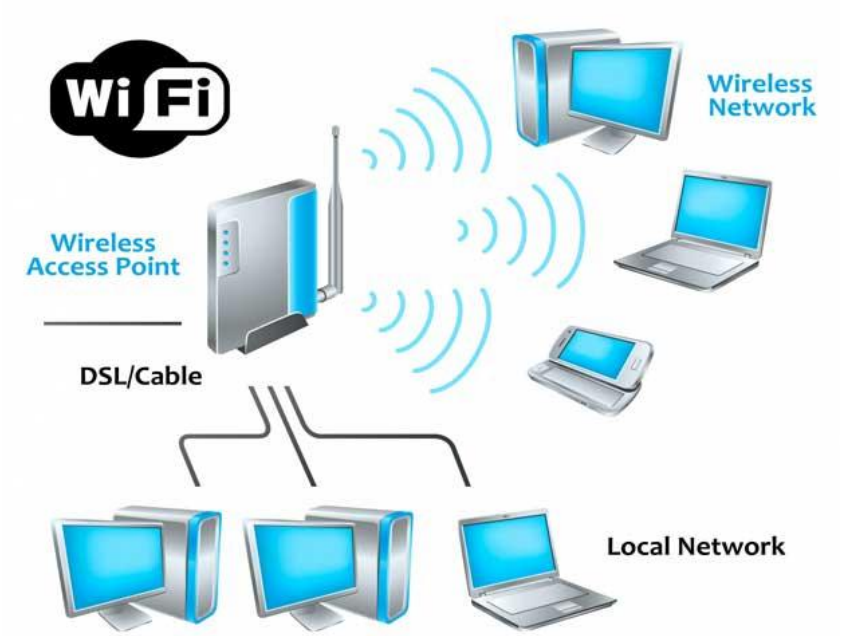


Image Reference: http://duinorasp.hansotten.com/wp-content/uploads/2015/12/WLAN-encryption.jpg

WiFi in Home Networks

- WiFi is the most commonly used technology in home networks.
- Grants Internet access to all devices on the network, wirelessly.
- WiFi as a standard feature in computers, laptops, and smartphones.

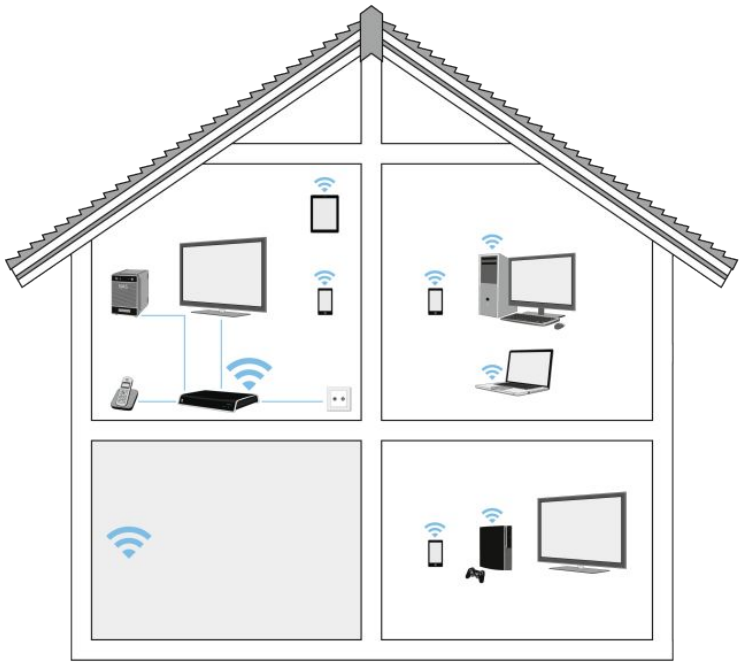
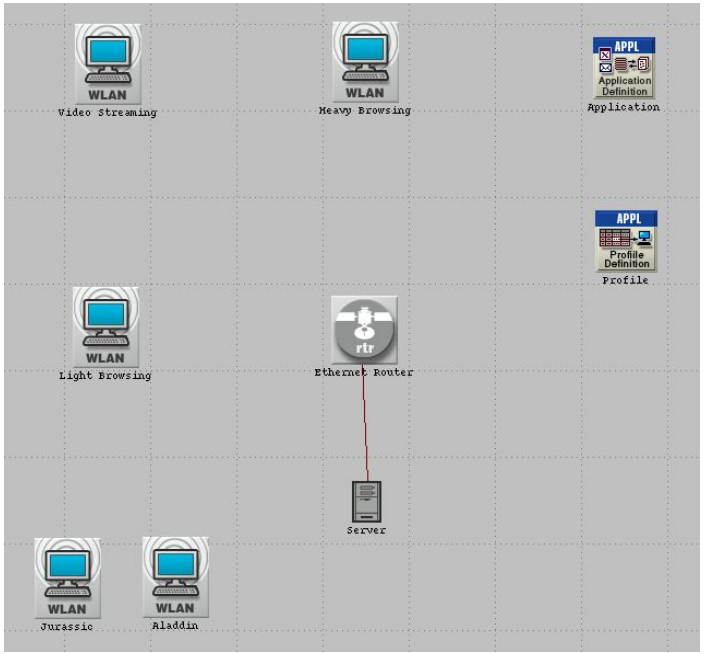


Image Reference: https://support-en.upc-cablecom.ch/app/answers/detail/a_id/6073/~/horizon%3A-setting-up-your-home-network

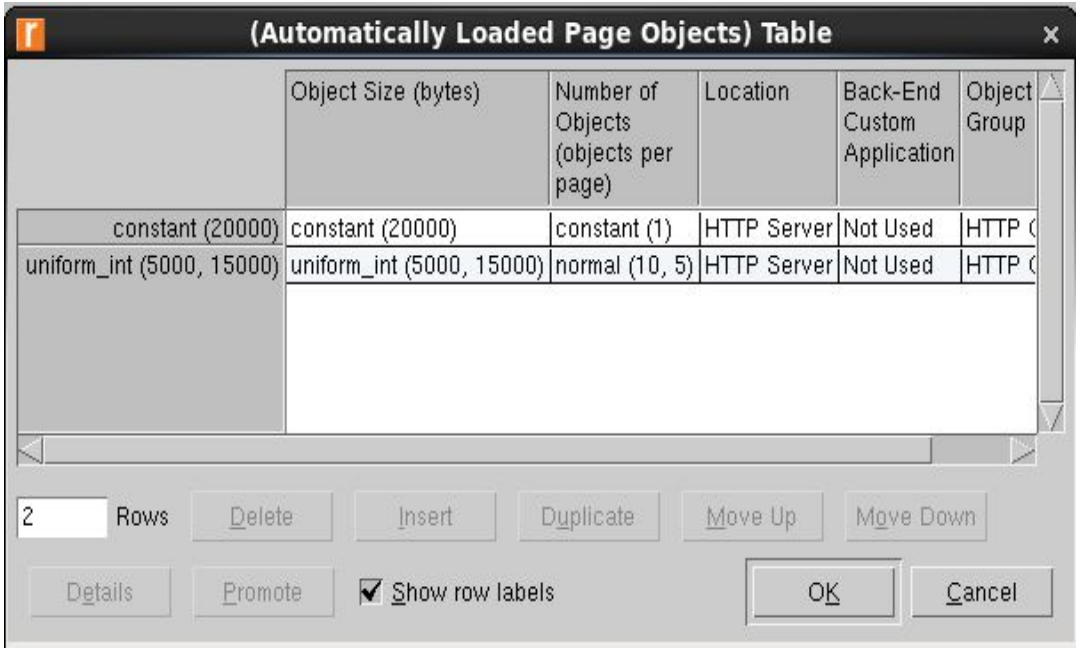
Network Topology

- A WLAN Router connected to an Ethernet Server by a 1000BaseX Link
  - 5 WLAN workstations each simulating different applications.
  - 2 workstations browsing the Internet.
  - 1 workstation streaming a video from the Internet.
  - 2 workstations streaming a movie from a home network server.



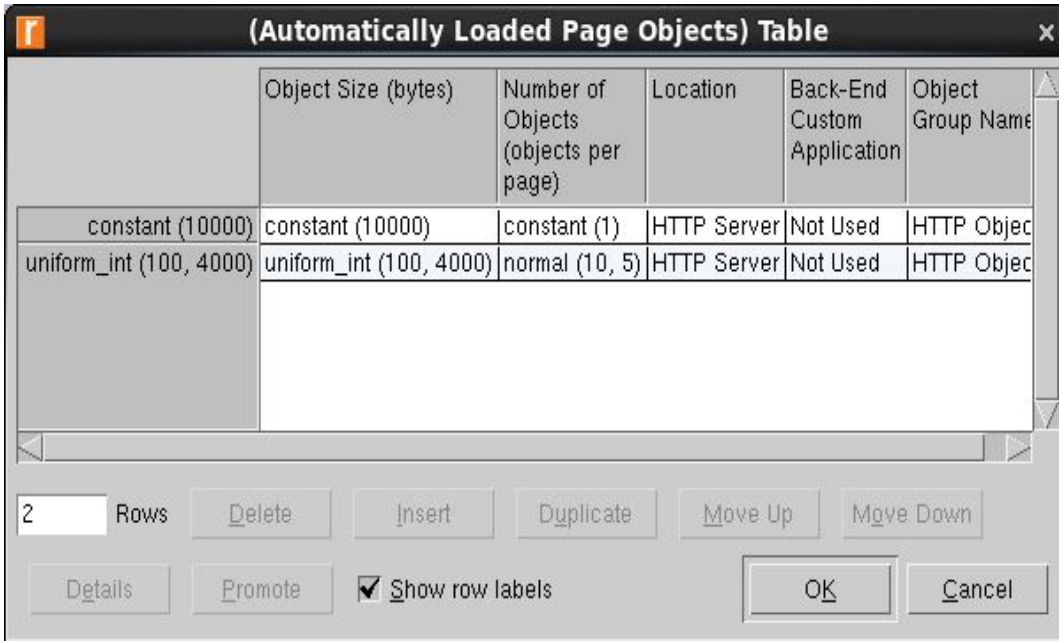
Simulated Application - Heavy Browsing

- The Heavy Browsing application has a large object size to simulate websites with large data costs. E.g. DeviantArt or reddit.



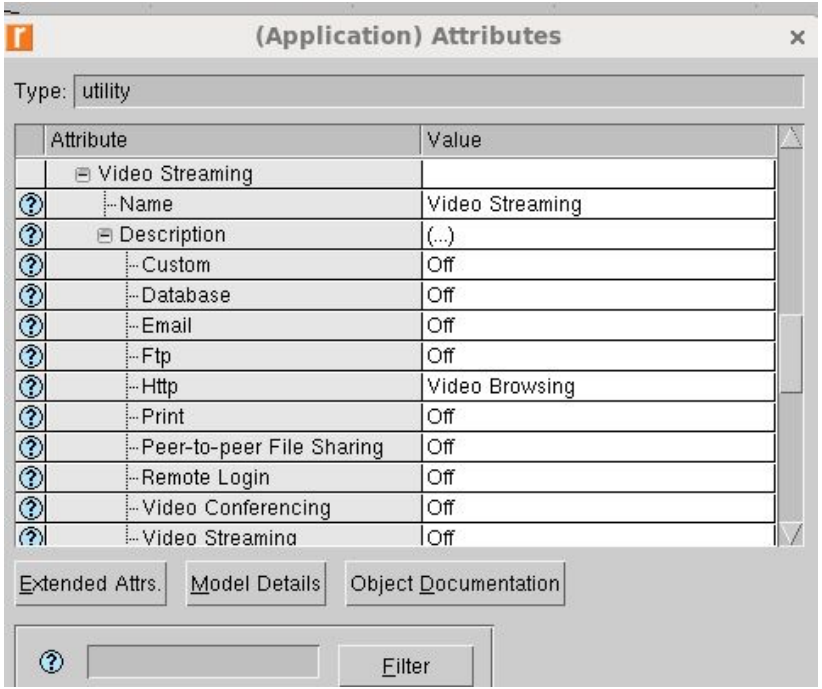
Simulated Application - Light Browsing

- The Light Browsing application has an small object size to simulate websites with a small amount of content. E.g. Email, Google, and class webpages



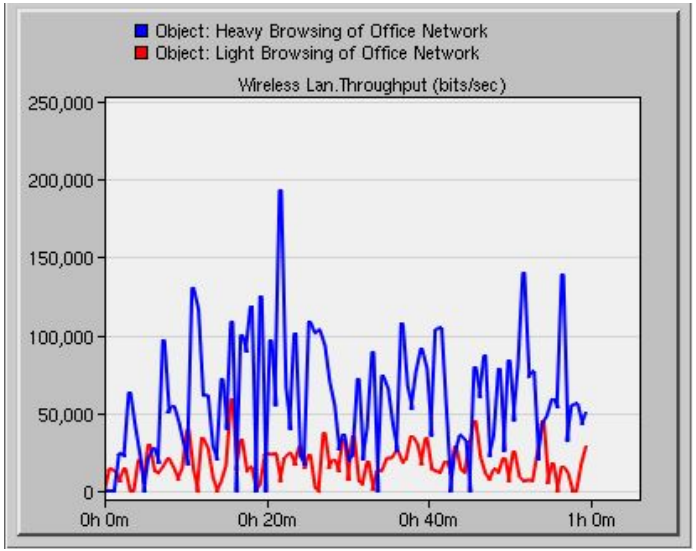
Simulate Application - Video Streaming

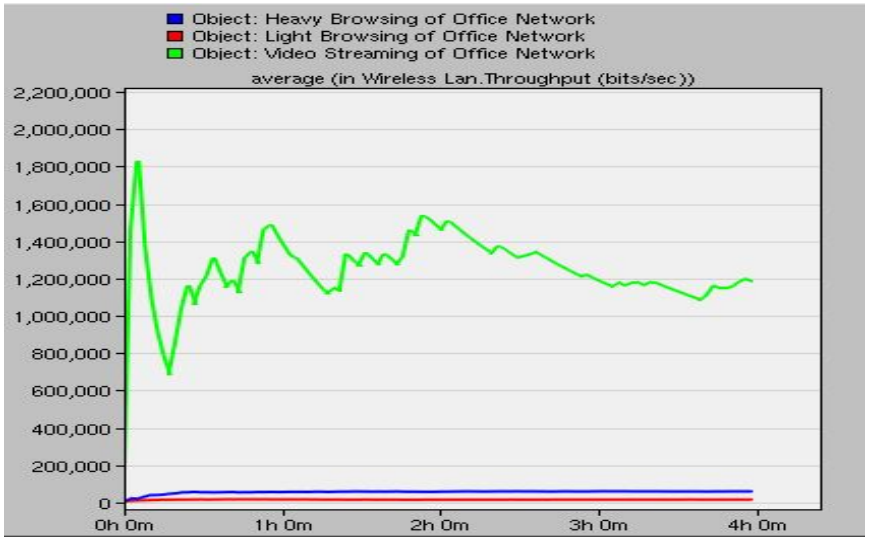
- Video streaming is a user broadcasting media content to multiple viewers or clients.
- Video streaming content is being delivered in real time over the Internet.
- Examples of video streaming services are: Twitch and YouTube.



Heavy and Light Browsing vs Video Streaming

- Streaming videos transmits much larger amount of data than browsing websites.
- Depending on the delivery method of the medium, throughput rate will vary.

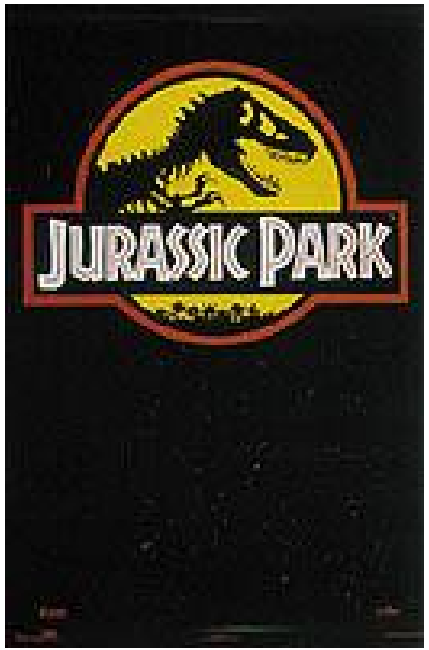




Streaming a Movie

Network-Attached Storage (NAS)

- Jurassic Park - First movie to use large amounts of computer-generated imagery.
- Aladdin - Hand Drawn frames.



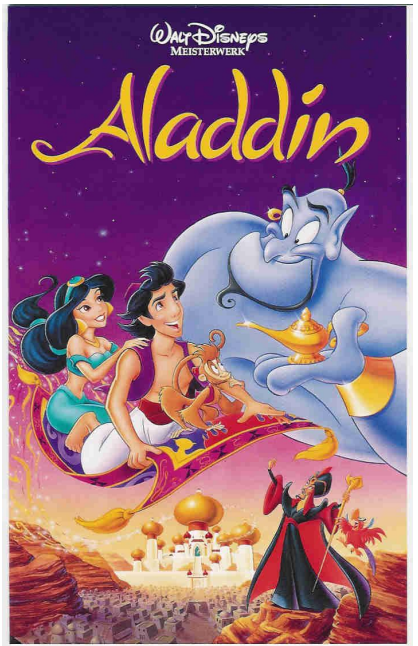
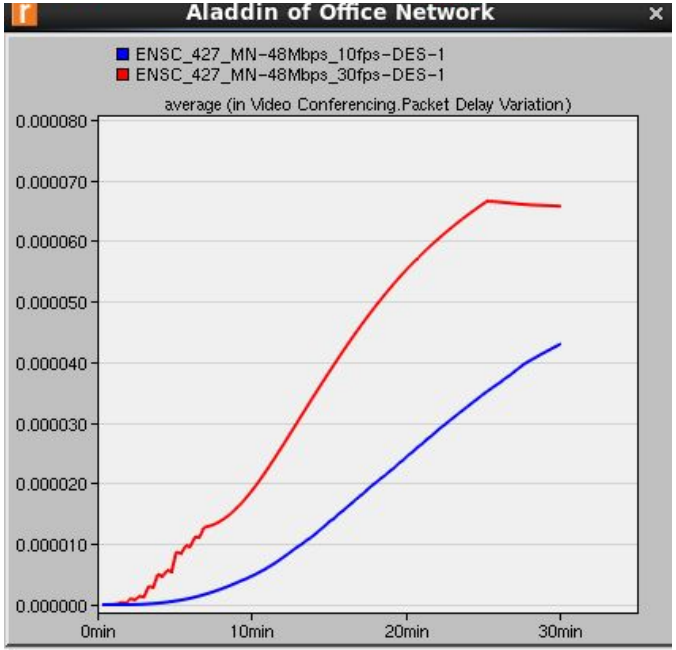
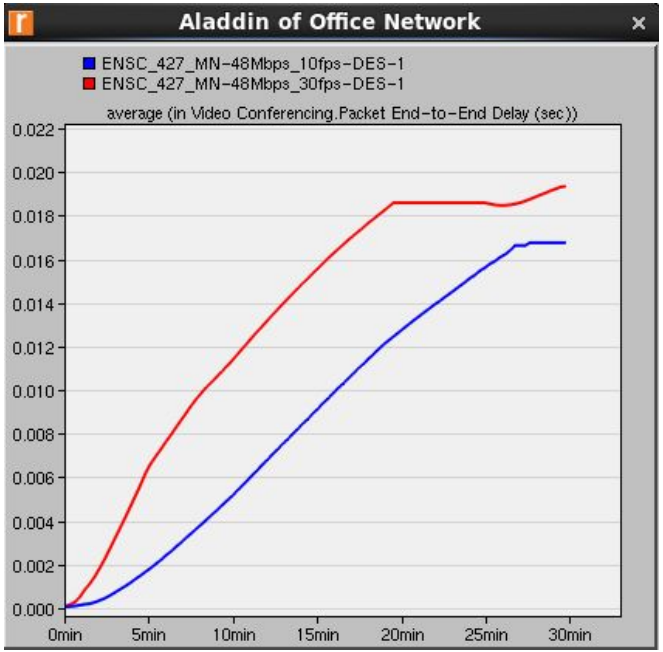


Image Reference: https://www.synology.com, http://www-tkn.ee.tu-berlin.de/research/trace/ltvt.html

Effect of Frame Rate on Delay

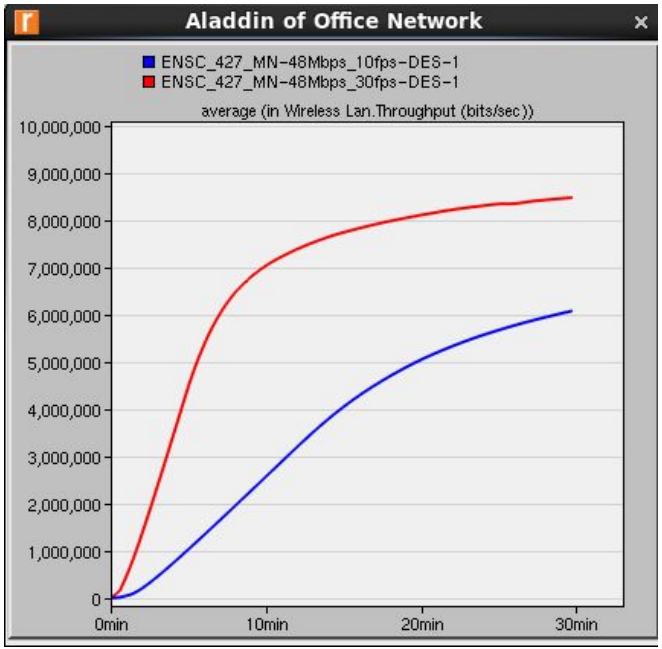
- Choosing 30 FPS and 10 FPS to give more easily comparable options.
- WLAN delay and End-to-End delay are both increased as FPS is increased for Aladdin.

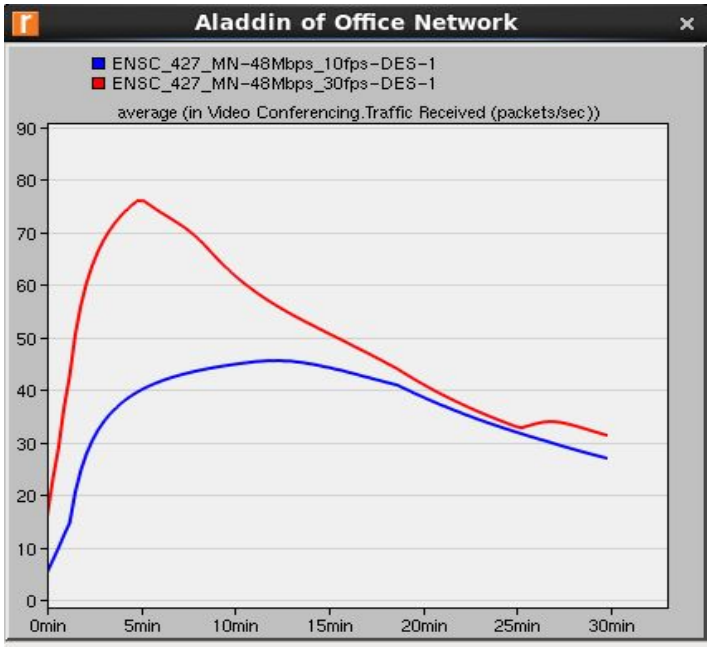




Effect of Frame Rate on Throughput and Traffic

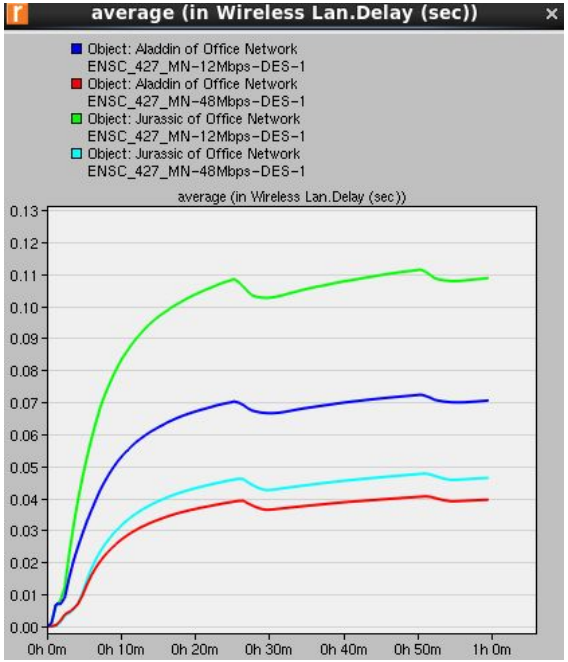
- There is an increase in the throughput rate as well as in the received traffic as frame rate is increased.

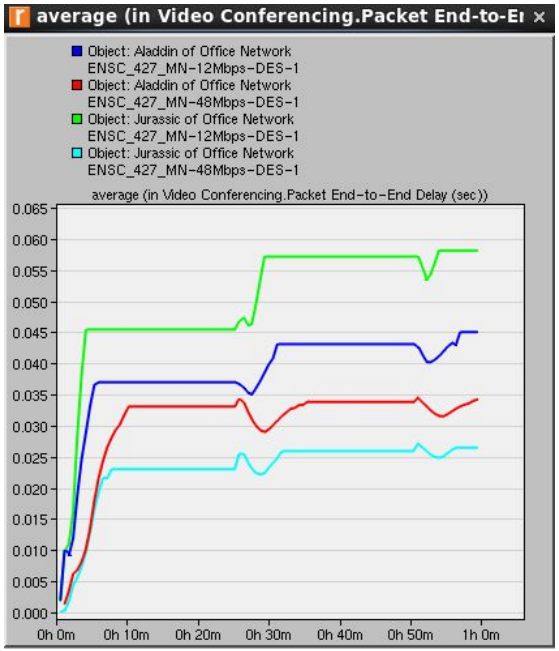




Effect of Data Rate on Delay

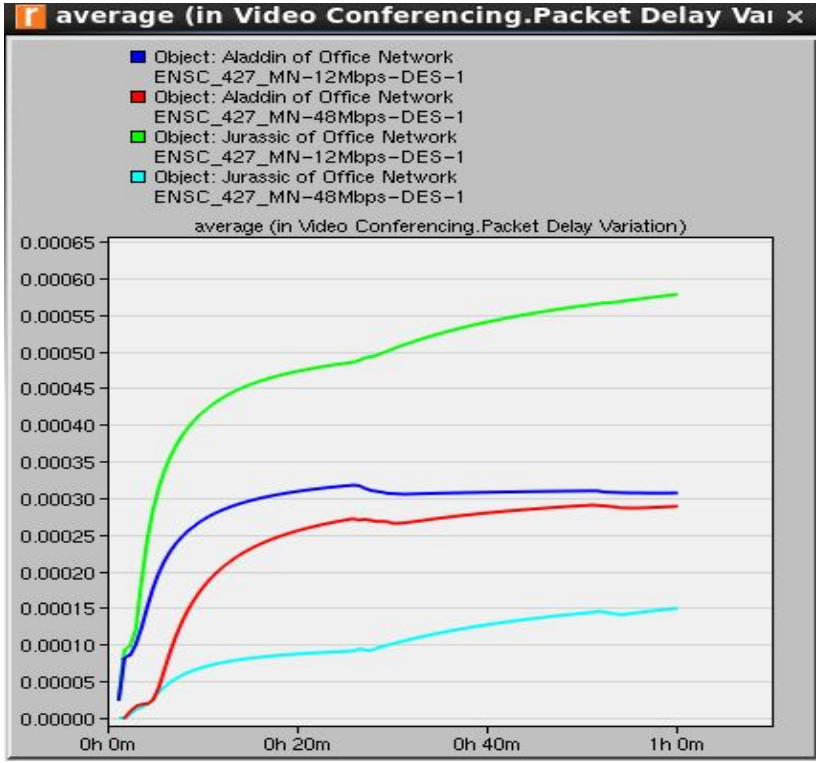
- Data rate of the router can be increased, resulting in a decrease in delay in both movies.





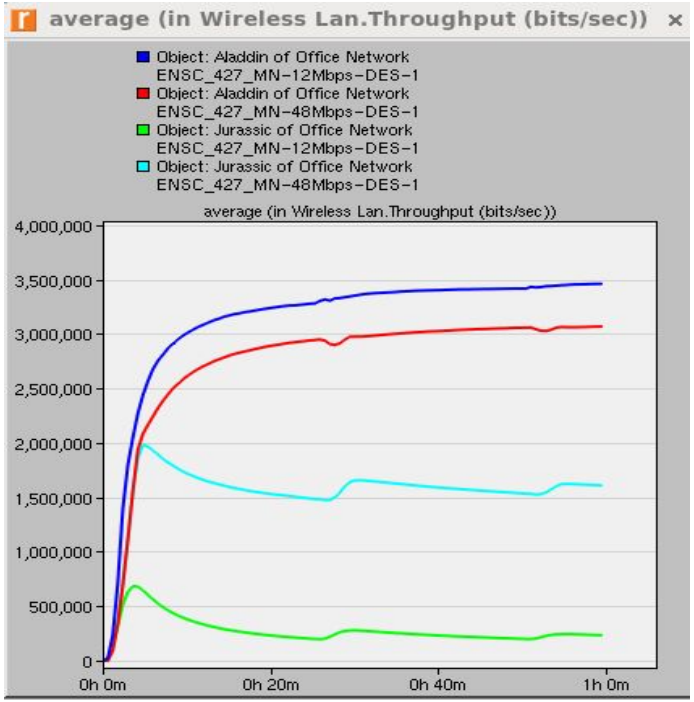
Effect of Data Rate on Jitter

- Packet delay variation is commonly known as jitter.
- Jitter is decreased as the data rate is increased.
- The router at a rate of 48Mbps is less likely to backup compared to a data rate of 12Mbps.



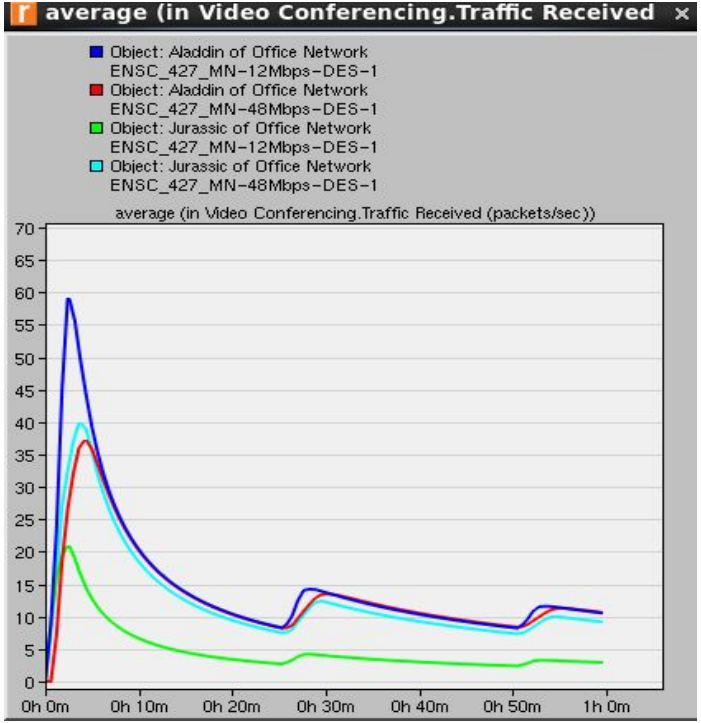
Effect of Data Rate on Throughput

- Throughput for Jurassic Park increases as data rate for the router increases.
- However, Aladdin shows a decrease in throughput, given a data rate increase.
- Aladdin is possibly being buffered by the router, at the lower data rate case which causes an increase in throughput.



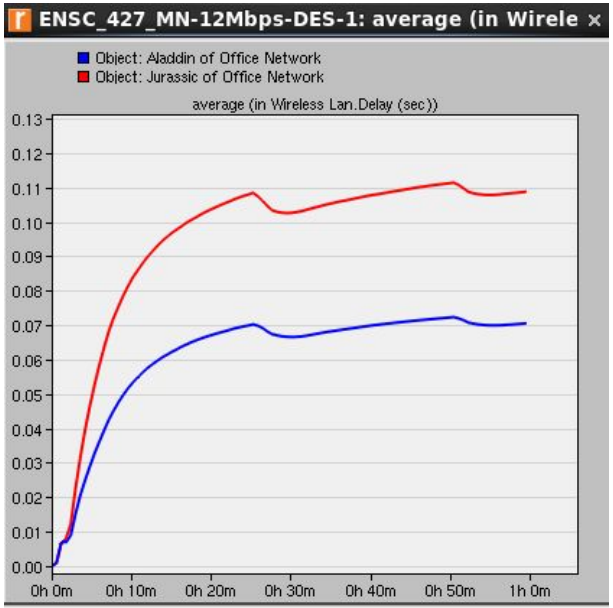
Effect of Data Rate on Traffic Received

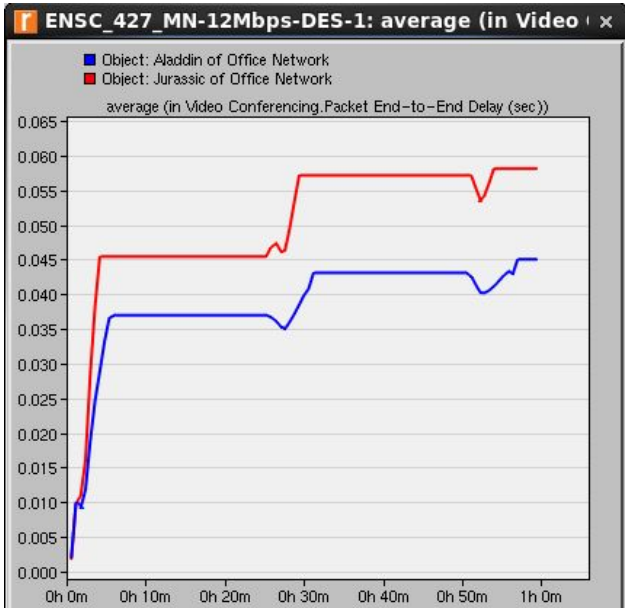
- With Jurassic Park, the received traffic increases as the data rate increases.
- However, Aladdin has a similar amount of traffic received with an exception of a large spike.
- This spike can be attributed to a buffer, which would allow the 12Mbps Aladdin movie to be run smoothly.



Effects of Movie Content on Delay

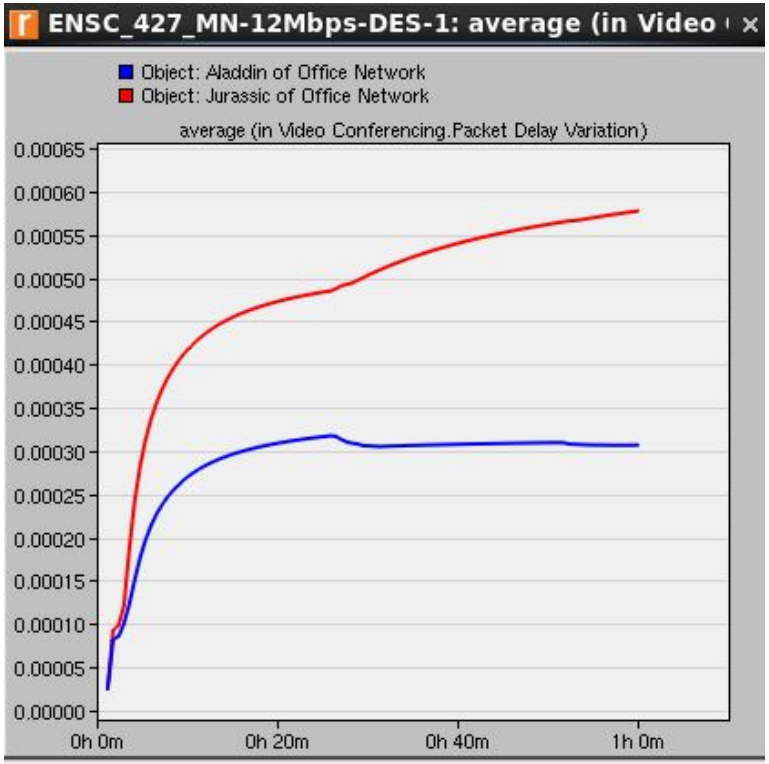
- Jurassic Park contains a lot of heavy computer-generated imagery.
- On the other hand, Aladdin has all of the frames hand-drawn.
- Thus, Aladdin has less information per frame, so it has less delay.





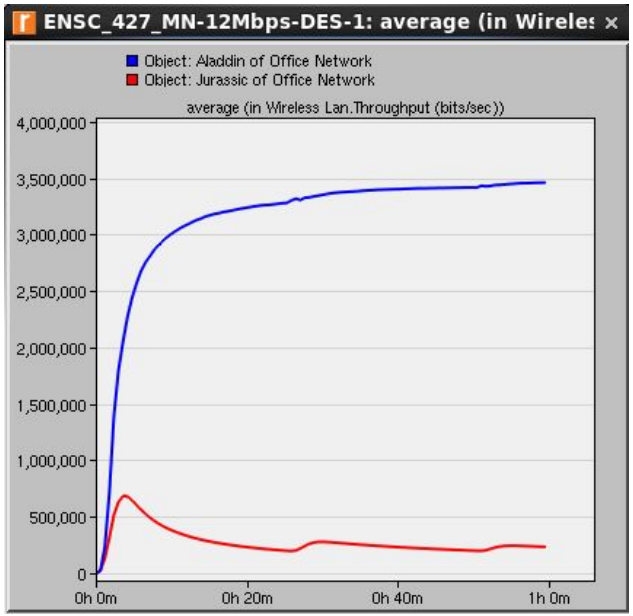
Effects of Movie Content on Jitter

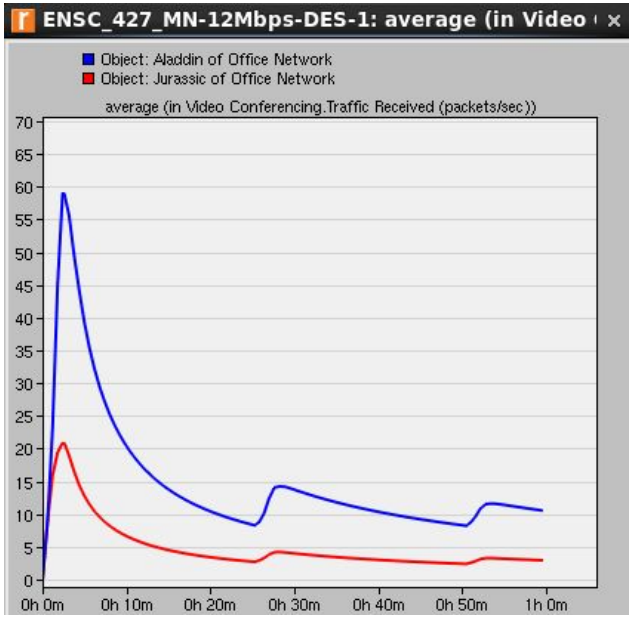
- As a result of Jurassic Park having much more content, it also has an increase in the packet delay variation



Effect of Movie Content on Throughput

- Aladdin has a much higher throughput rate than Jurassic Park.
- The compression ratio for Jurassic Park is smaller than Aladdin's.
- This results in an increased loss of packets for Jurassic Park.





Conclusion

- Our simulations and results show that video streaming has the highest throughput and delay.
- Increasing frame rate has tradeoffs; increasing data rate improves all QoS statistics.
- Streaming Aladdin had increased throughput rates, while having lower delay, End-to-End delay, and jitter, compared to Jurassic Park.
- Algorithm for the compression of Jurassic Park may be inefficient, resulting in packet loss.

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Thank You