Performance of a WiFi Network as a function of Distance and Number of Connections in a School Environment

ENSC 427 Communication Networks

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Group 1

http://www.sfu.ca/~rsa83/

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Overview

- Introduction
- Technology
- Scenarios Simulated
- Simulation and Data Analysis
- Conclusion
- Difficulties and Future Work
- References

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Introduction

What we intend to achieve?

- Simulate and analyze the performance of a typical University Wi-Fi environment to determine the optimal network configuration

- Analyze the following performance metrics throughout various scenarios

  - Throughput

  - Packet Loss

  - Delay

Introduction

- Tools:
  - Network Simulator (ns2)
 - Network Animator (nam)
  - X-Graph
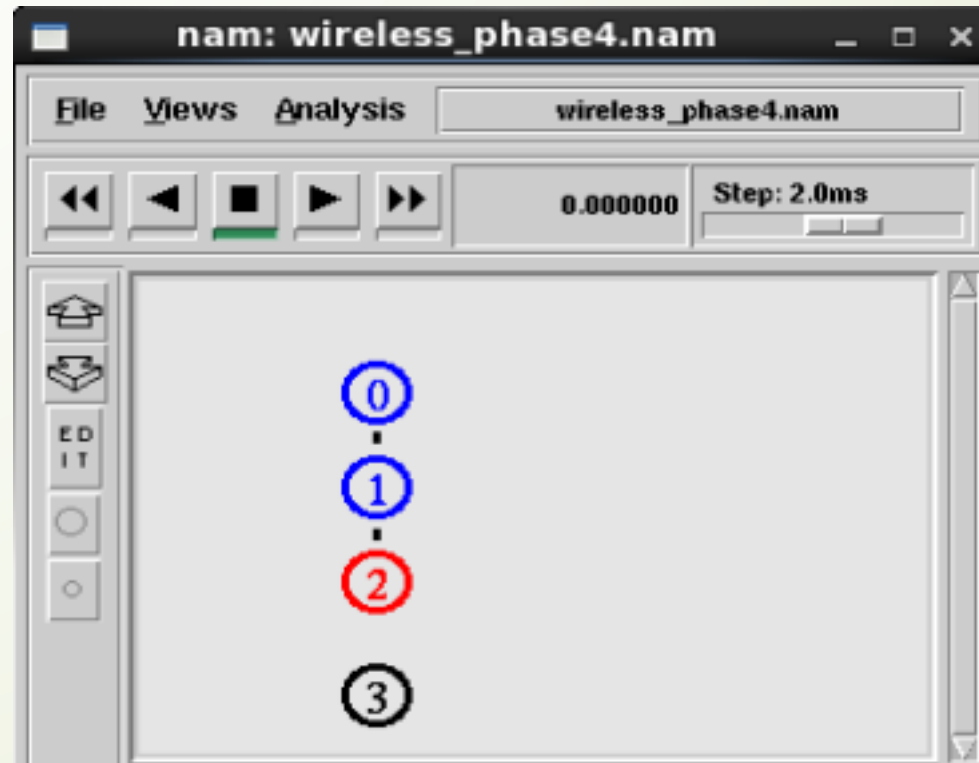
Technology

- 802.11a/b/g/n/ac

Standard	Max Data Rate (Mbps)	Typical Throughput (Mbps)	Channel Bandwidth (MHz)	Operating Frequency Band
802.11b	11	6.5		2.4 GHz
802.11a	54	25	20	5 GHz
802.11g	54	25	20	2.4 GHz
802.11n	600	100	20, 40	2.4 GHz & 5 GHz

- Transmission Control Protocol (**TCP**)
  - Connection-oriented
  - Reliable
- User Datagram Protocol (**UDP**)
  - Connectionless
  - Fast

Technology

- Access Point Transmission Power
  - Omnidirectional 40 metre radius
- Classroom Size
  - 10 metre X 10 metre

Room Size 10M X 10M

Access Point

20M

Hallway
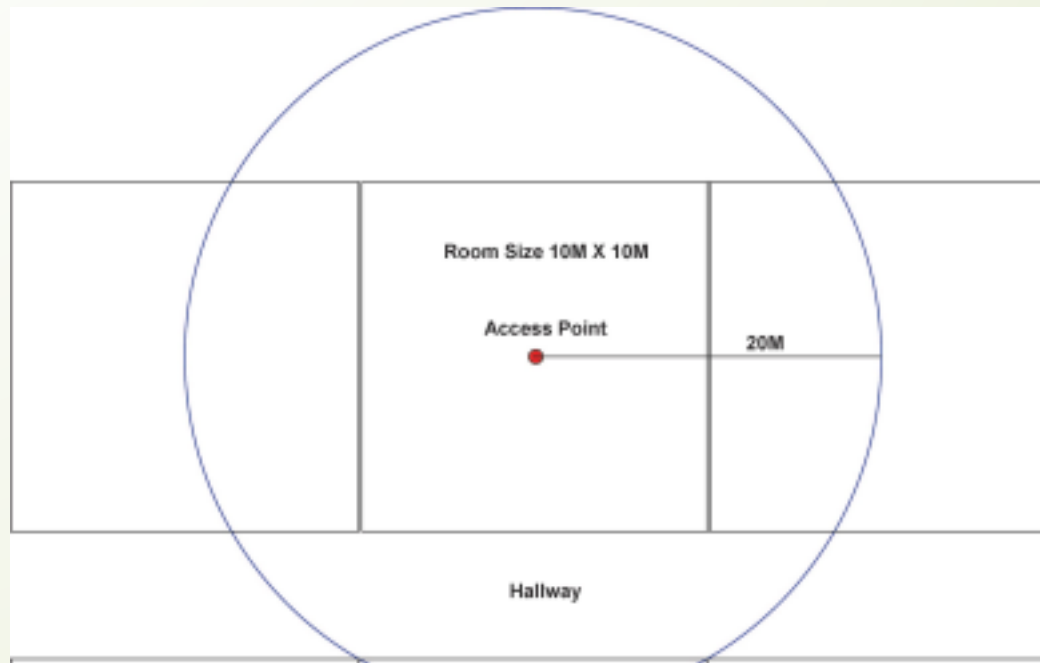
Related Work

- **Video Streaming over WiFi**

  C. Chen, S. Sheng, and J. Yoo, "High Resolution Video Streaming over Wi-Fi, WiMAX and LTE," Accessed: March 28, 2017. Available: http://www.sfu.ca/~cyc19/report.pdf

- **Performance Analysis of a Home WiFi Network**
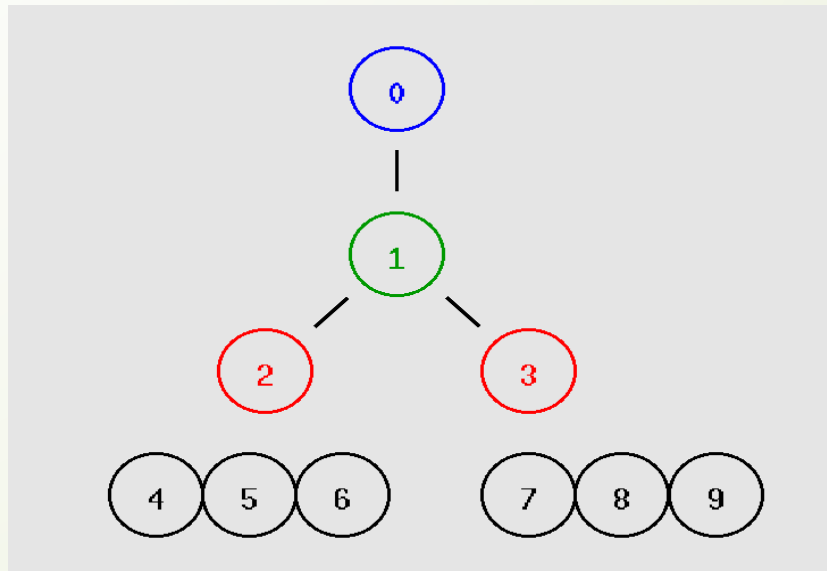
  M. Morales, C. Rietchel, and T. Szajner, "Performance Analysis of a Wireless Home Network" Accessed: March 28, 2017. Available: http://www.sfu.ca/~tszajner/
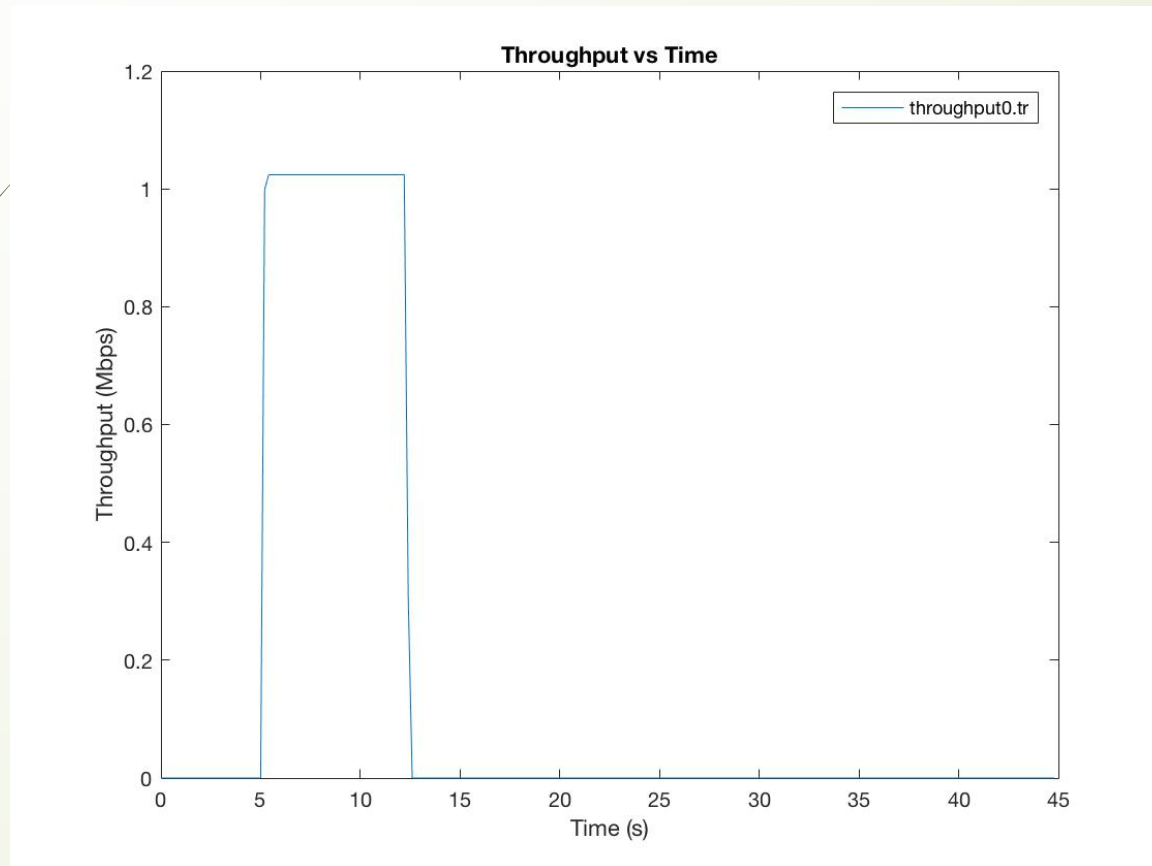
Scenarios Simulated

- **1** Access point serving **1** Node
- **1** Access point serving **n** max Nodes
- **2** Access points serving **n** Nodes

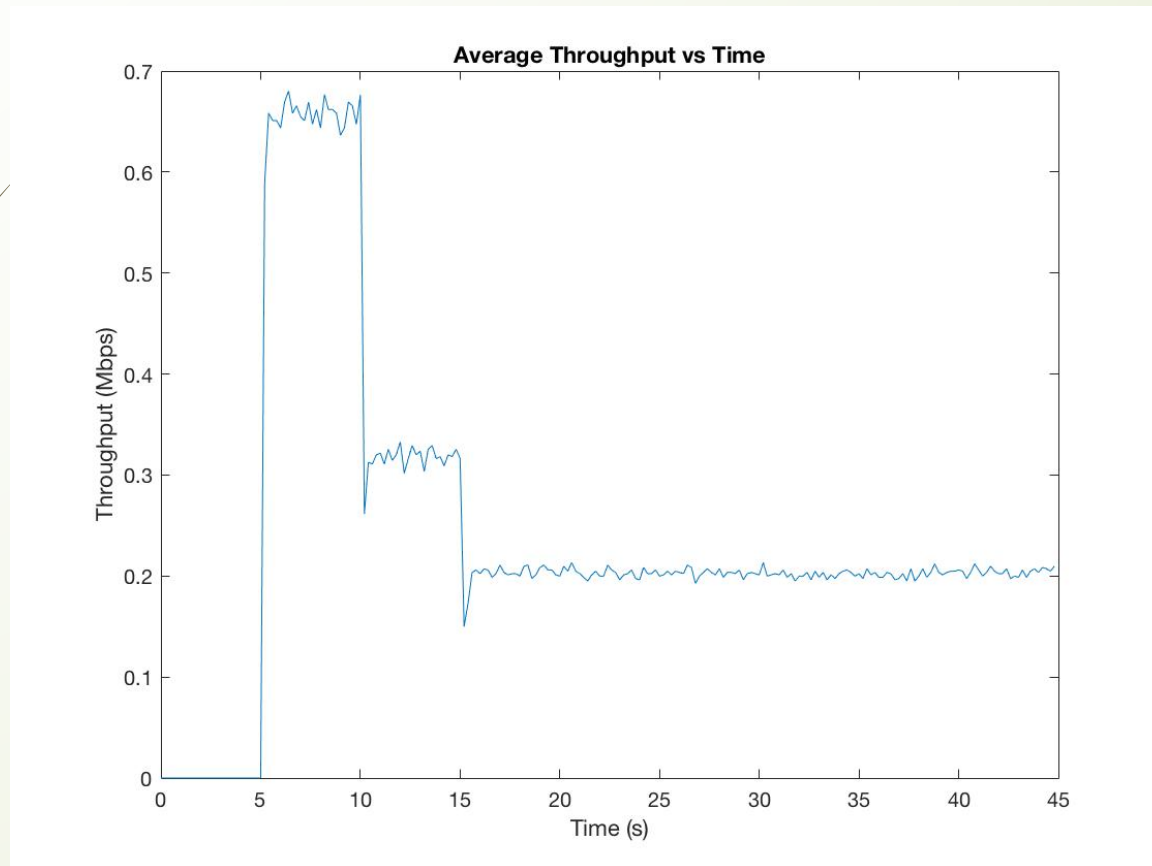# Simulation and Data Analysis - Throughput

- 1 Access point X 1 Node

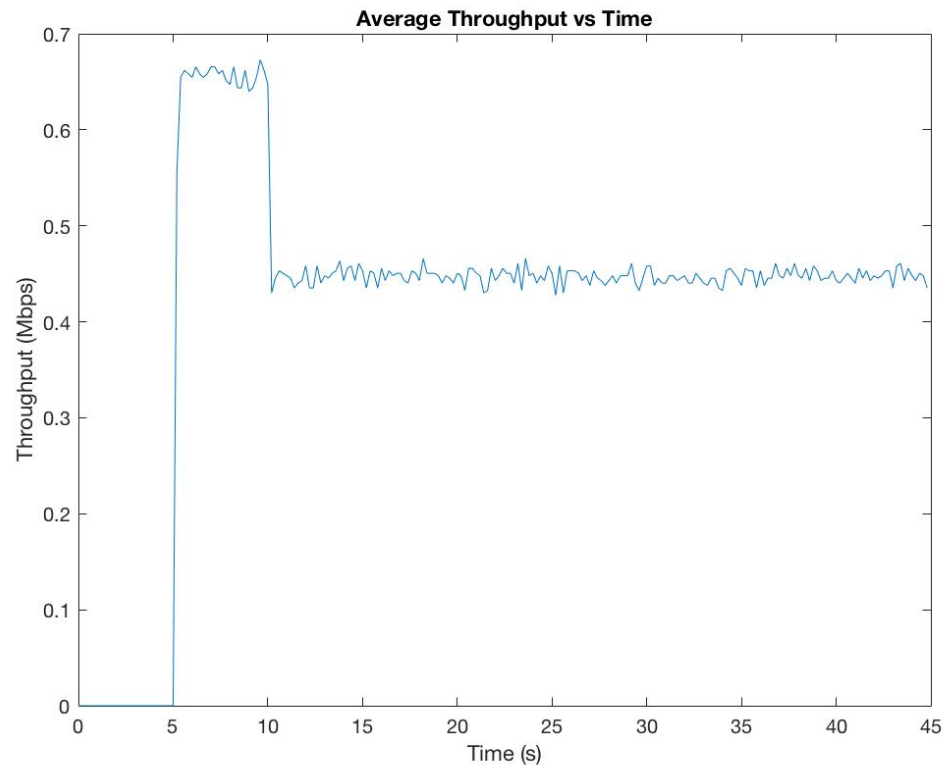# Simulation and Data Analysis - Throughput

- 1 Access point X 20 Nodes

Simulation and Data Analysis - Throughput

- 2 Access points X 20 Nodes

Conclusion

- Throughput

  - The rate is expected to fall in steps as we increase the distance between our node and the access point

  - Throughput does not change during ns-2 simulation as the tool does not account for wireless medium noise

  - After the wireless node reaches outside of the transmission range, throughput drops to zero as the connection is lost

  - As the number of connections to the access point increases, the throughput of each connected node declines as throughput is shared among all connected nodes

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Conclusion

- Packet Loss

  - As more nodes are connected to the access point, packet loss increases for each of the connected nodes

- Average End-to-end Delay

  - The time taken for data to travel across the network from one point to another increases as more nodes are enrolled to the access point

Difficulties and Future Work

- 802.11n/ac for ns2

- Ns2 Syntax

- Complex and Diverse Evaluation Scenarios to simulate realistic traffic

- Further metrics could be monitored

  - Noise and Interference

  - Jitter

References

[1]   J. Kolap, S. Krishnan and N. Shaha, "Frame Aggregation Mechanism for High Throughput 802.11n WLANs," *International Journal of Wireless & Mobile Networks (IJWMN),* vol. 4, no. 3, pp. 141-153, 2012.

[2]   K. Fall and K. Varadhan, "The ns Manual (formerly ns Notes and Documentation)," 5 Novemeber 2011. [Online]. Available: http://www.isi.edu/nsnam/ns/tutorial/. [Accessed 19 3 2017].

[3]   J. Florwick, J. Whiteaker, A. Amrod and J. Woodhams, "Wireless LAN Design Guide for High Density Client Environments in Higher Education," 10 July 2015. [Online]. Available: http://www.cisco.com/c/en/us/products/collateral/wireless/airo net-1250-series/design_guide_c07-693245.html#wp9001157. [Accessed 19 March 2017].

[4]   M. Gast, 802.11n: A Survival Guide, Sebastopol: O'Reilly, 2012.

[5]   P. Gaonkar, D. Tandur and G. Rafig, "Range Performance Evaluation of IEEE 802.11n Devices," in *Industrial Technology (ICIT), 2015 IEEE International Conference,* Sevilla, Spain, 2015.

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Questions?