ENSC 894 SPECIAL TOPICS II: Communication Networks

Final Project Presentation

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Performance Analysis of Wi-Fi using ns-2

Web page: http://www.sfu.ca/~csa96/894

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Overview

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- Wi-Fi Topology Implementation in Ns-2
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Introduction

- ## Project Idea:

To analyze the performance of Wi-Fi during VoIP (Voice Over Internet Protocol) using Network Simulator (ns-2.35).

- ## Scope:

- Long distance voice calls by exchanging voice data between two user nodes belonging to two different server branches.

- The movement of a mobile node during the voice call.

- Group chat between the user nodes connected to different access points.

- Related Work:
- Simulation of a wireless network using ns-2 in which five mobile nodes are connected to two access points and certain number of packets are transferred to analyze the efficiency of Wi-Fi network [1].
- Observed the performance of Wi-Fi network when a mobile user was utilizing video stream using Riverbed Modeler [2].
- Designed and simulated a wireless network using ns-2 and analyzed the Quality of Service (QoS) parameters [3].
- Evaluated VoIP performance of City-Wide Wi-Fi and Long Term Evolution (LTE) and analyzed QoS parameters [4].

- # (Wireless Fidelity) Wi-Fi:
  - One of the popular wireless technology.
  - Based on IEEE 802.11 Standard.
  - Requires high frequency radio waves to transmit data from one place to another.
  - Operating speed is 54Mbps.
  - Operating range is few hundred feet (100-300).
  - It is mainly implemented in office and home networks.
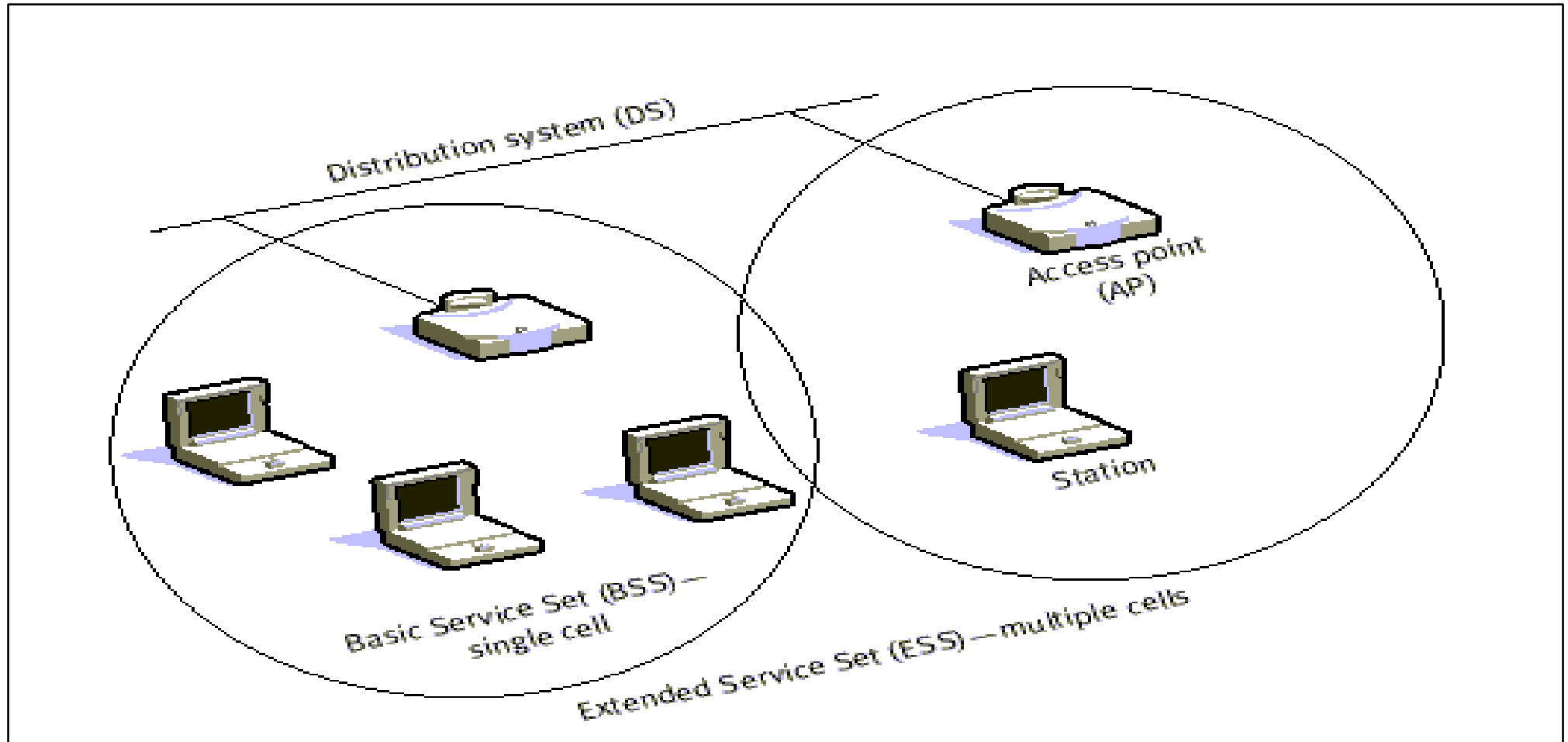
- # Wi-Fi Network Layout:

Figure 1: Wi-Fi Network Layout [6]

- ## Basic Service Set (BSS):

When two or more stations come together to communicate with each other, they form a Basic Service Set (BSS).

- ## Access points:

The devices that create the Wi-Fi microwaves for mobile devices to detect and connect to, for the purpose of sending data to servers.

- ## Distribution System (DS):

 Two or more BSS's are interconnected by a Distribution System.

- ## Extended Service Set (ESS):

A set of two or more BSSs that form a single sub network.

- ## Servers:

Provide services for a network and allow the users to access the internet.

- ## Routers:

Make up the path for the data to travel in order access the servers.

- # Voice Over Internet Protocol (VoIP):
  - Used for the delivery of long distance voice communications over the Internet.
  - Convert analog audio signals into digital data that can be transmitted over the Internet.
  - Advantages:
  - ➢ Low cost of phone calls
  - ➢ Multifunctionality
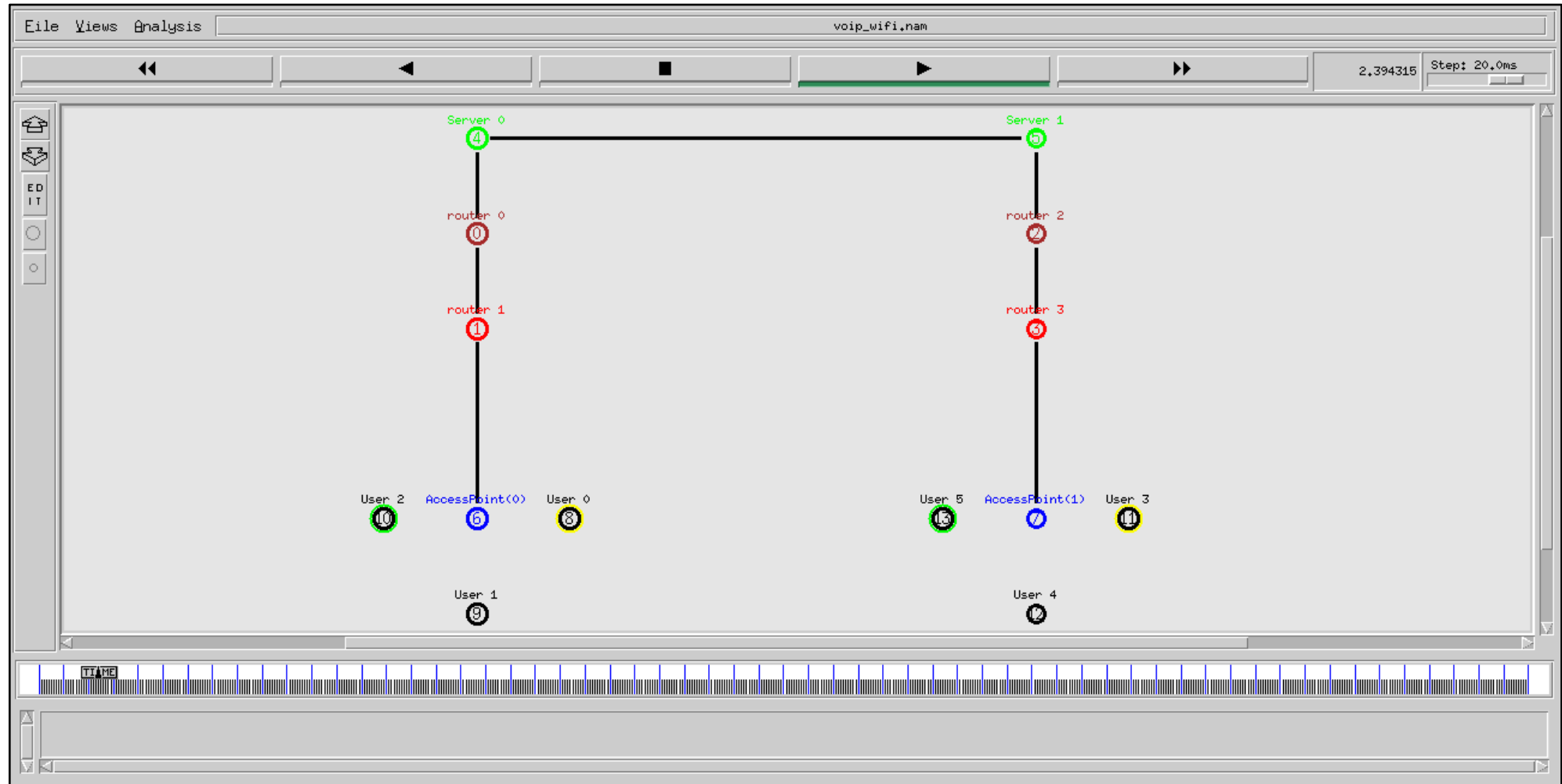 - ➢ Portability
  - ➢ Scalability

Figure 2. Wi-Fi Topology Implementation in Ns-2

Simulation Details:

- Implementation of VoIP with UDP (User Datagram Protocol) protocol.

- Attachment of UDP agents and sinks to the user devices to send and receive voice data between users.

- CBR (Constant Bit Rate) traffic is attached to the UDP agents to simulate voice data between the users.

- One to one voice calls are initiated from 1 minute to 20 minutes between user0 to user3 and user2 and user5 that are connected to different access points.

- User0 is moving between 5 to 8 minutes while the other users are fixed throughout the simulation.

- Group chat simulations between user0, user1, user3, and user4 start at 10 minutes and end at 15 minutes.

- Simulation data is collected using the LossMonitor class.

Performance Parameters

- Throughput
- Packet Loss Rate
- End-to-end delay
- Jitter

Results

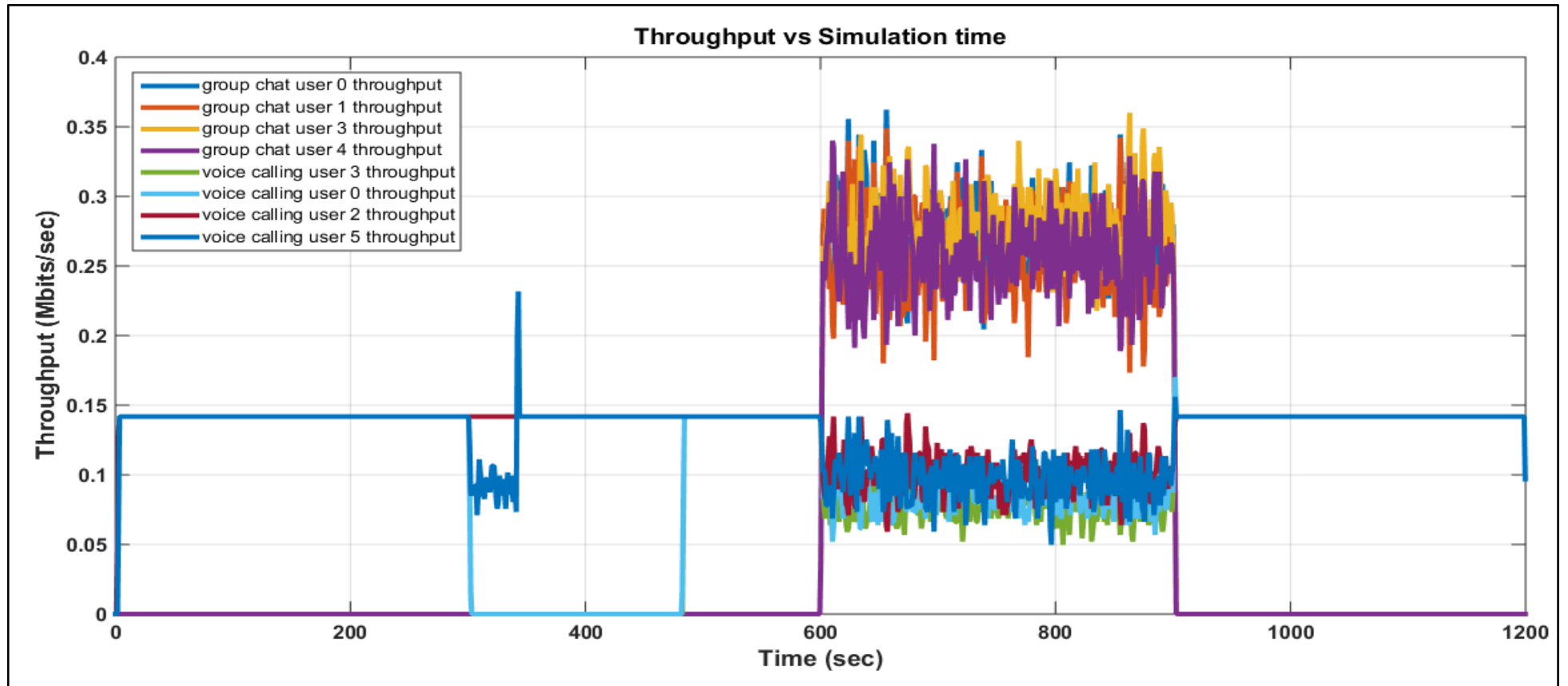- ## Throughput:

It is the rate of successful packet delivery.

Figure 3. Throughput

- ## Packet Loss Rate:

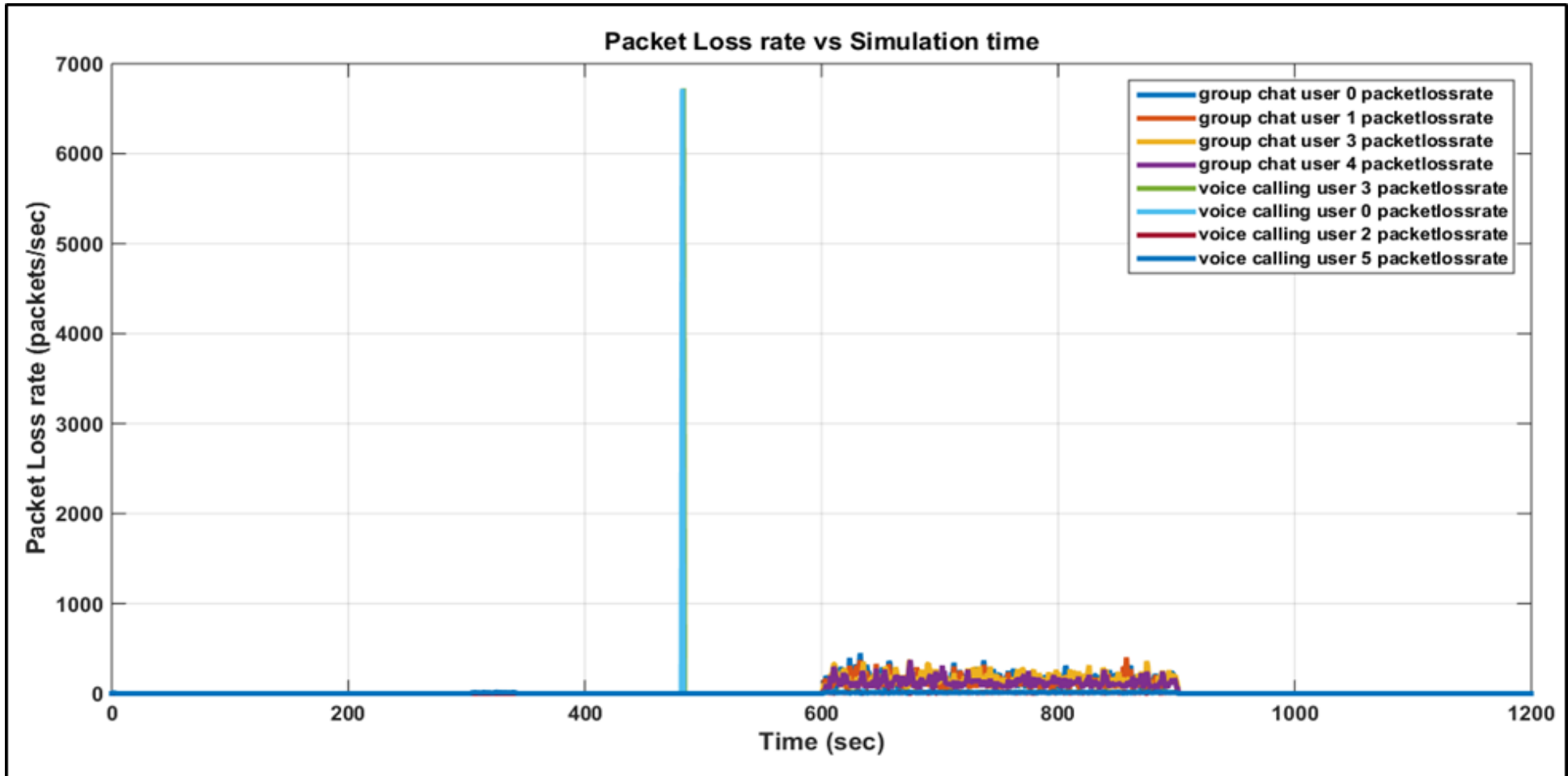When the data from one node fails to reach the destination node.

Figure 4. Packet Loss Rate

- # End-to-end Delay:

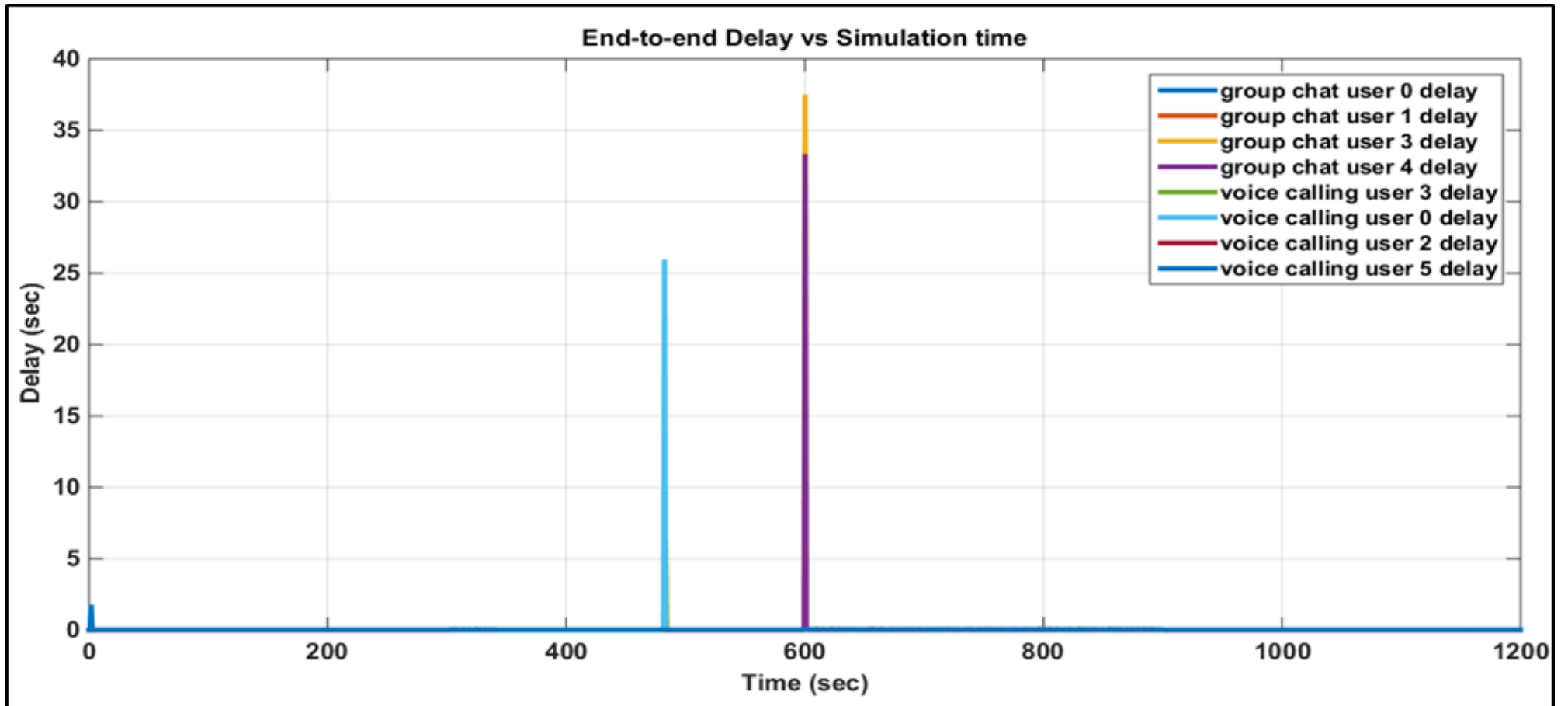The time taken by a packet to travel from source to destination in a network.

Figure 5. End-to-end Delay

- ## Jitter:

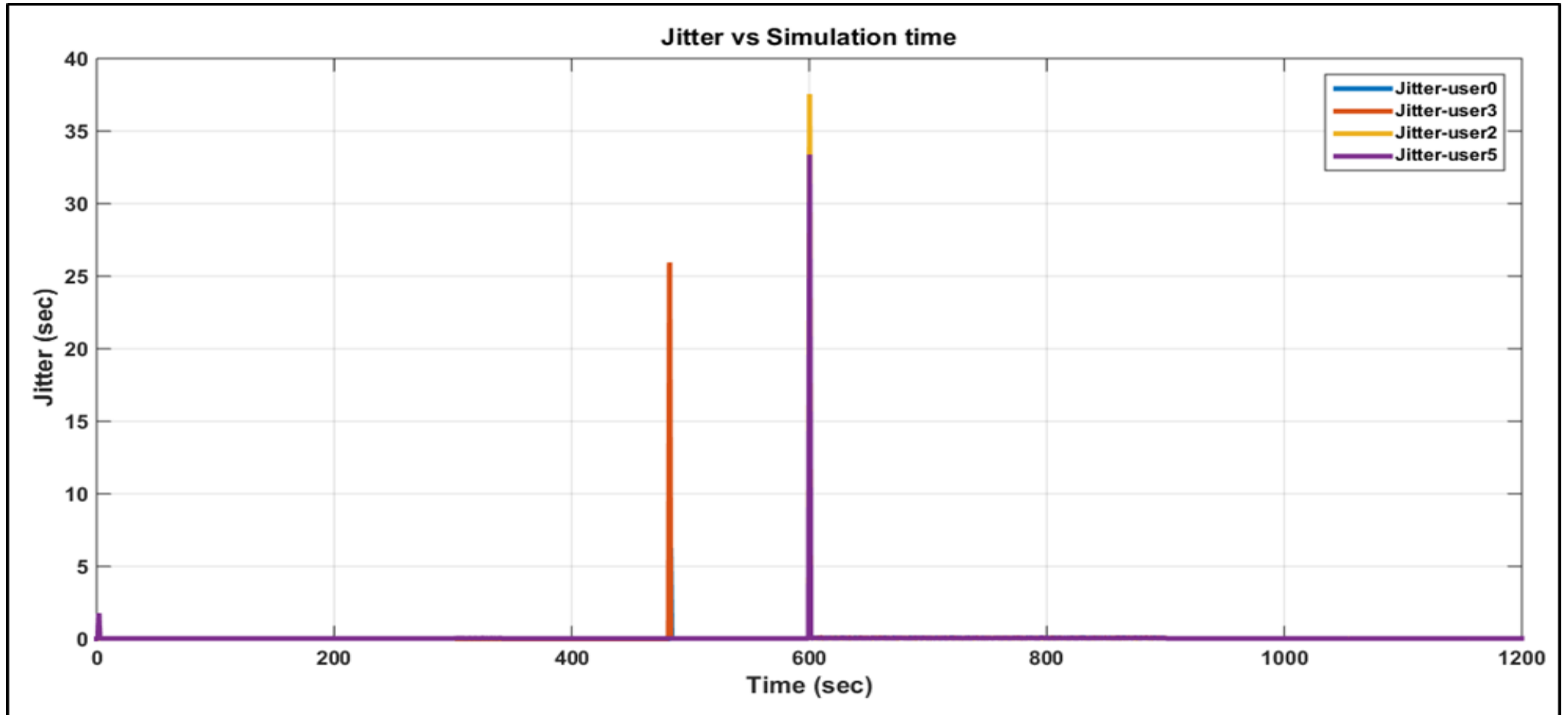The variation in the delay of received packets.

Figure 6. Jitter

Discussion

- ## Difficulties:
  - Installing and learning ns-2 as we were new to this simulator.
  - Understanding and implementing the Wi-Fi topology with multiple mobile nodes.
- ## Alternative Approaches:
  - Use other modeling software such as Riverbed Modeler or ns-3.
- ## Future Work:
  - To evaluate the performance by increasing the complexity of the network i.e. by adding more routers and mobile nodes.
  - To use VoIP for video calling by using Real-time Transport Protocol (RTP).

Conclusion

- Successful implementation of VoIP in Wi-Fi using ns-2.

- Wi-Fi provides better performance and Quality of Service (QoS) for small area networks.

- Wi-Fi is the most widely used method for connecting to the Internet when lingering in a small network.

- Installation is cheaper as compared to other technologies.

References

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[3] A. Ezreik and A. Gheryani, "Design and simulation of wireless networks using ns-2," in Proc. International Conference on Computer Science and Information Technology, Singapore, pp.1–5, April 2012.

[4] Cheng Jie Ou, Tian Lin Yang, Yawen Chen, "VoIP Performance of City-Wide Wi-Fi and LTE," School of Engineering Science, Simon Fraser University, 2014.

[5] IEEE 802.11 Architecture. Available Online:

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[8]   CISCO, "Voice Over IP - Per Call Bandwidth Consumption," Available Online:

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