Lab Report

Course Title: Computer Networks Lab

Autumn 2024
Section:7BF

Lab No: 2

Name of Labwork: Hosts in the network have limit for forwarding. Limits and the node to generate the message will be configured in the ini file. Use two configs to run the simulation.

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Marks

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1. Introduction:

This experiment simulates a circular network consisting of four hosts (nodes), where each node forwards messages to the next in sequence. A key element of this simulation is the forwarding limit assigned to each node, which determines how many times a message can be forwarded before it is discarded. These forwarding limits, along with the node responsible for generating the initial message, are defined in the simulation's configuration file (.ini). The objective of the experiment is to analyze how these forwarding limits influence message propagation and the overall behavior of the network. By adjusting the limits and the message initiator, we can explore how message transmission dynamics change within the network

2. Constructing Network(NED):

The network description (NED) file defines the structure of the network. Each node in the network is represented by a module. The modules are interconnected to form a circular topology, where each node has a direct link to its neighbor. The NED file is structured as follows :

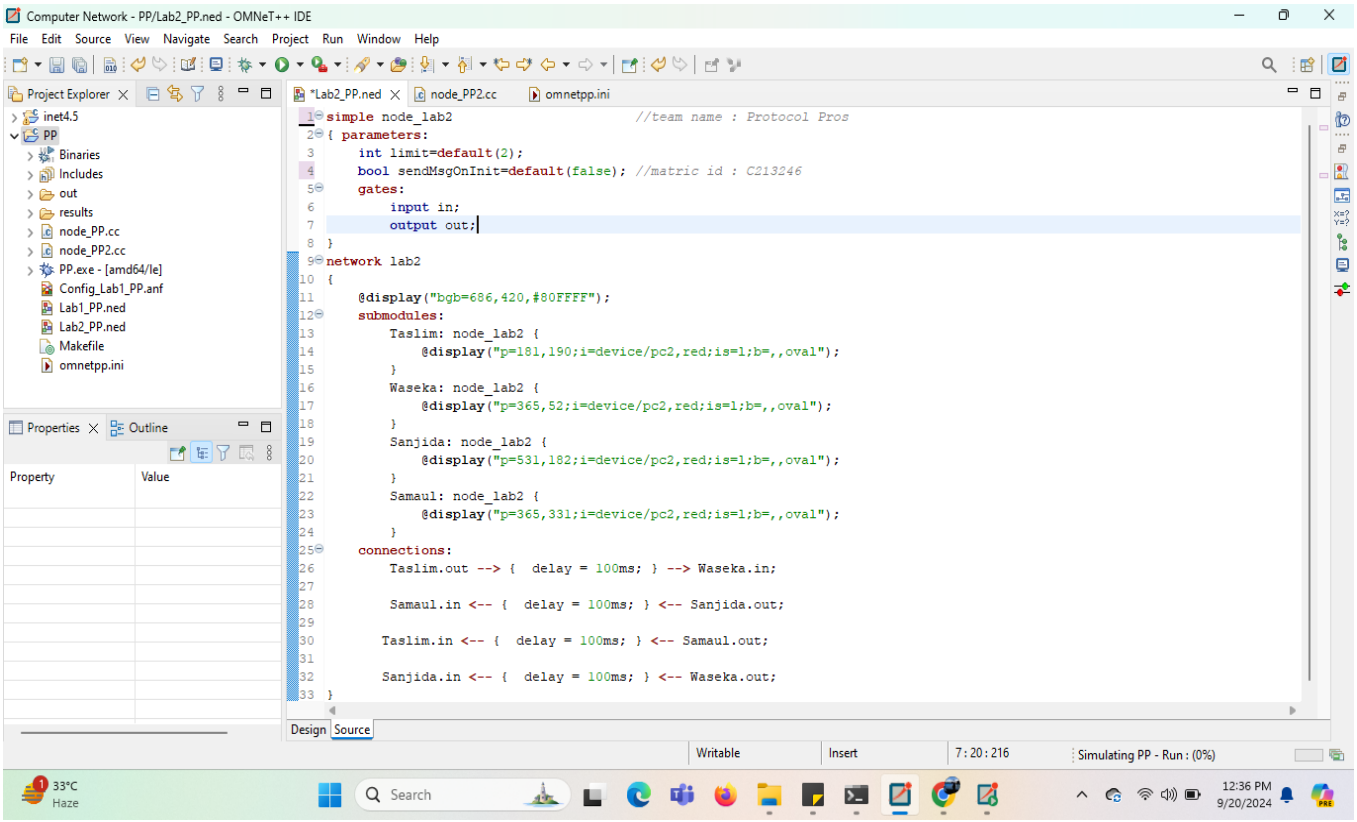

Figure 1: Laptop view of NED file

3. Building Module(C++ file):

I have to write the source file to build the logic. Each node receives a message, checks its forwarding limit, and decides whether to forward the message. If the forwarding limit has not been reached, the message is forwarded to the next node in the loop.

The message-handling logic is based on the message count stored in the `.ini` file, which specifies how many times a node can forward a message.

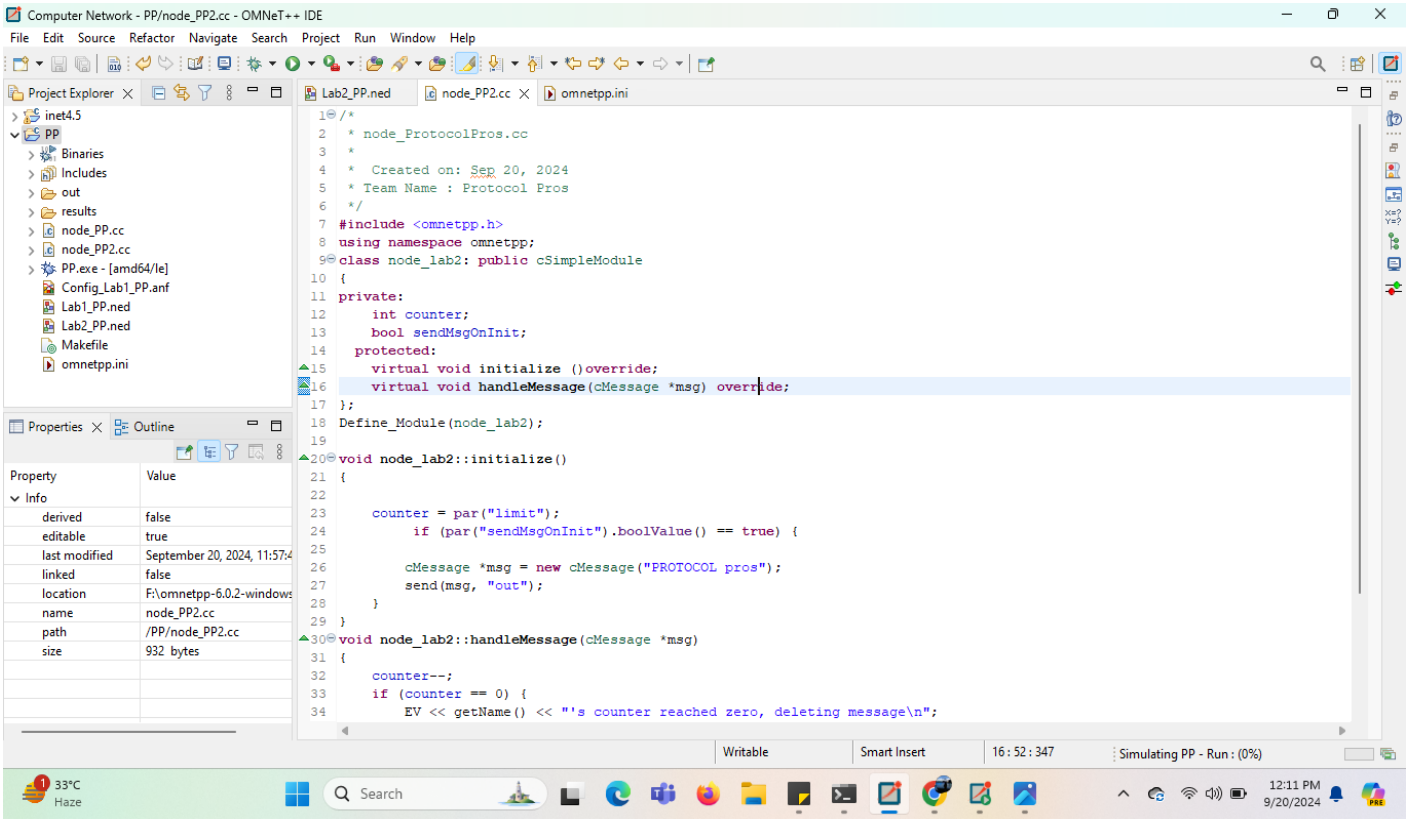

Figure 2.1: Laptop view of cc file

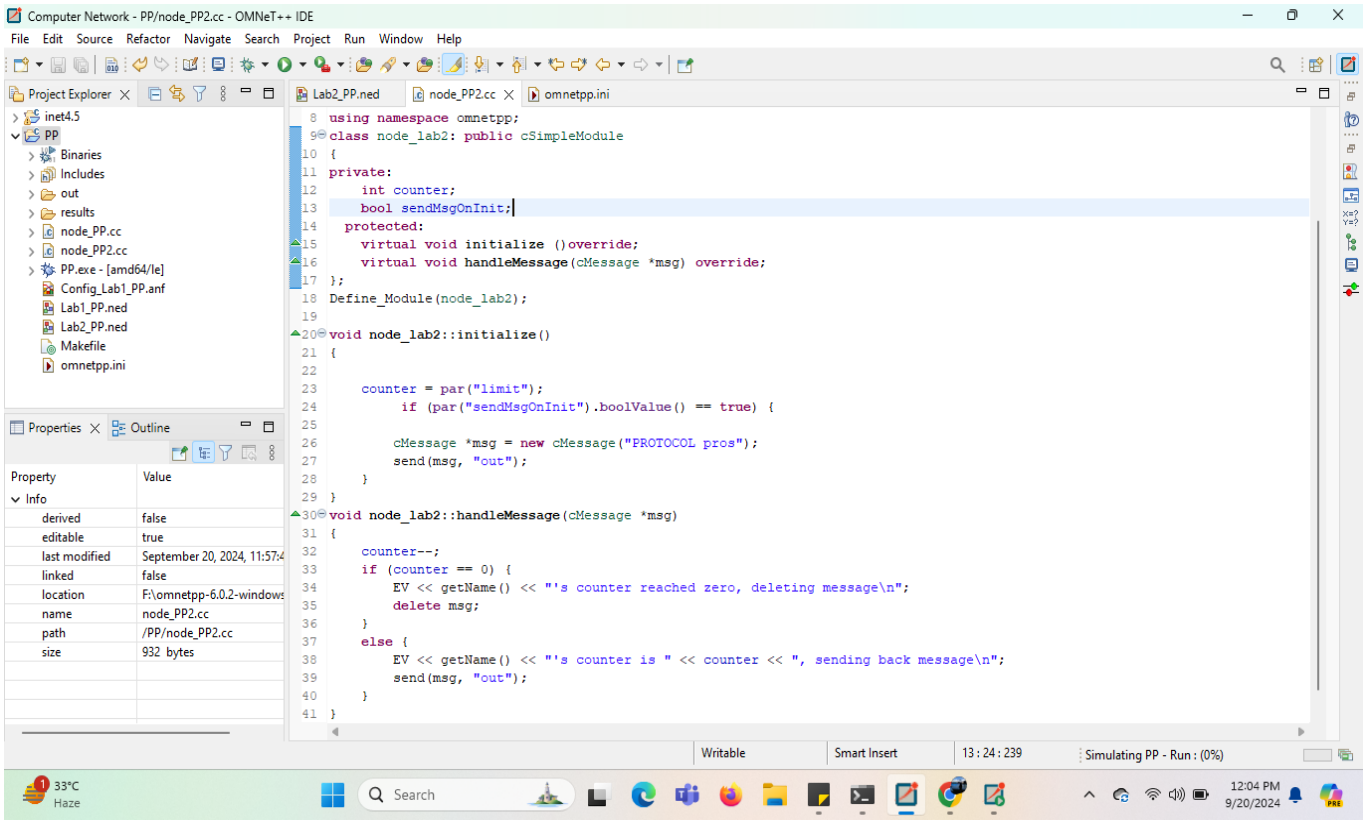

Figure 2.2: Laptop view of cc file

4. Initializing simulation(ini file):

The .ini file configures the simulation parameters, such as the initial node that generates the message, the forwarding limits for each node, and the thre different configurations to be tested.

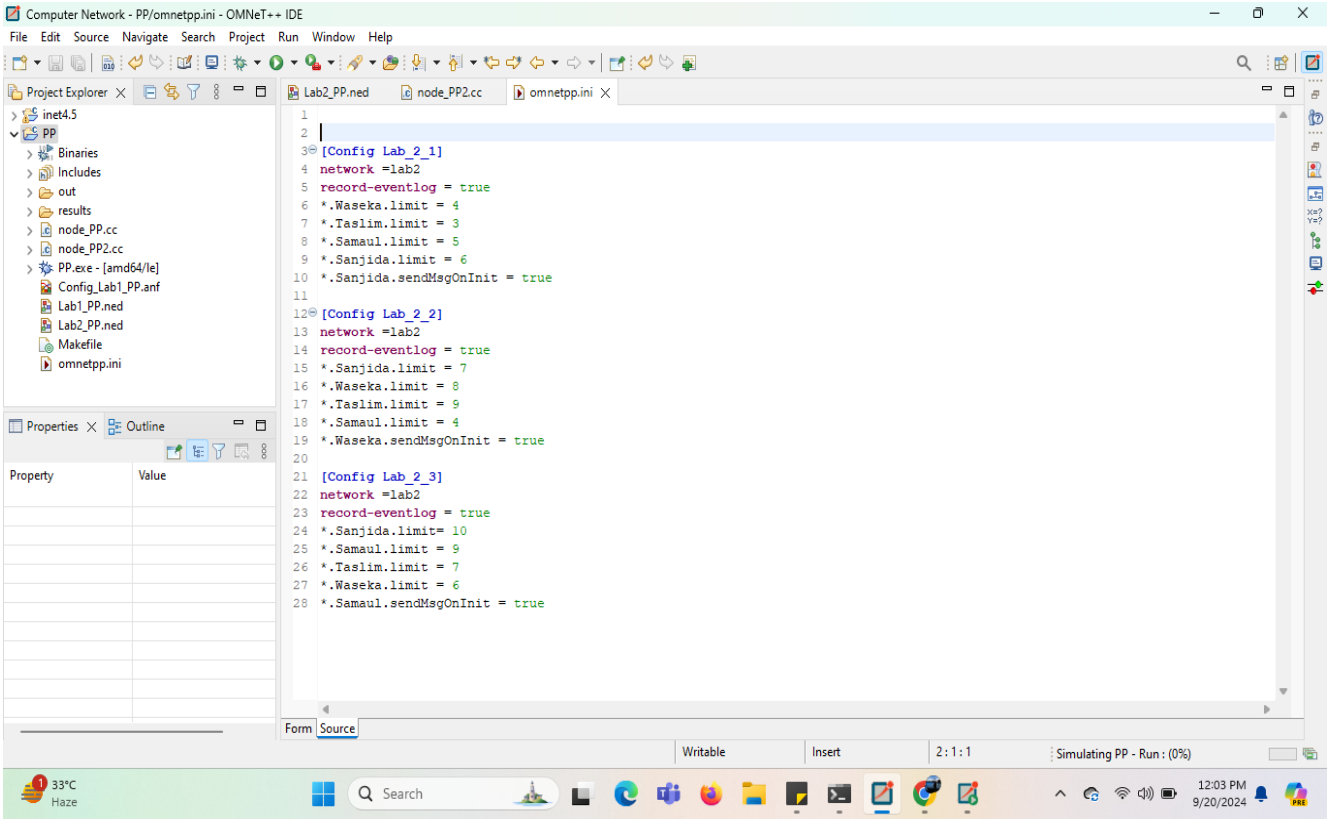

Figure 3: Laptop view of ini file

5. Experiment:

The experiment was conducted using OMNeT++, simulating a network of four nodes arranged in a circular topology. Each node was assigned a forwarding limit, which restricts the number of times it can forward a message. The nodes in the network were named *Waseka*, *Taslim*, *Samaul*, and *Sanjida*. For each configuration, one node was designated to generate and send an initial message to the next node in the sequence.

Three different configurations were tested:

1. **Config Lab_2_1**:
    - *Sanjida* initiates the message with a forwarding limit of 6.
    - The other nodes have varying limits: *Waseka* (4), *Taslim* (3), *Samaul* (5).
2. **Config Lab_2_2**:
    - *Waseka* initiates the message with a limit of 8.
    - The forwarding limits of the other nodes: *Sanjida* (7), *Taslim* (9), *Samaul* (4).
3. **Config Lab_2_3**:
    - *Samaul* generates the message with a limit of 9.
    - The other nodes: *Sanjida* (10), *Taslim* (7), *Waseka* (6).

For each configuration, the simulation was run to observe the flow of messages and how the forwarding limits affected message transmission. The simulation event log and graphical output provided insights into how long the message circulated before reaching a node with no forwarding capacity left.

6. Result and Analysis:

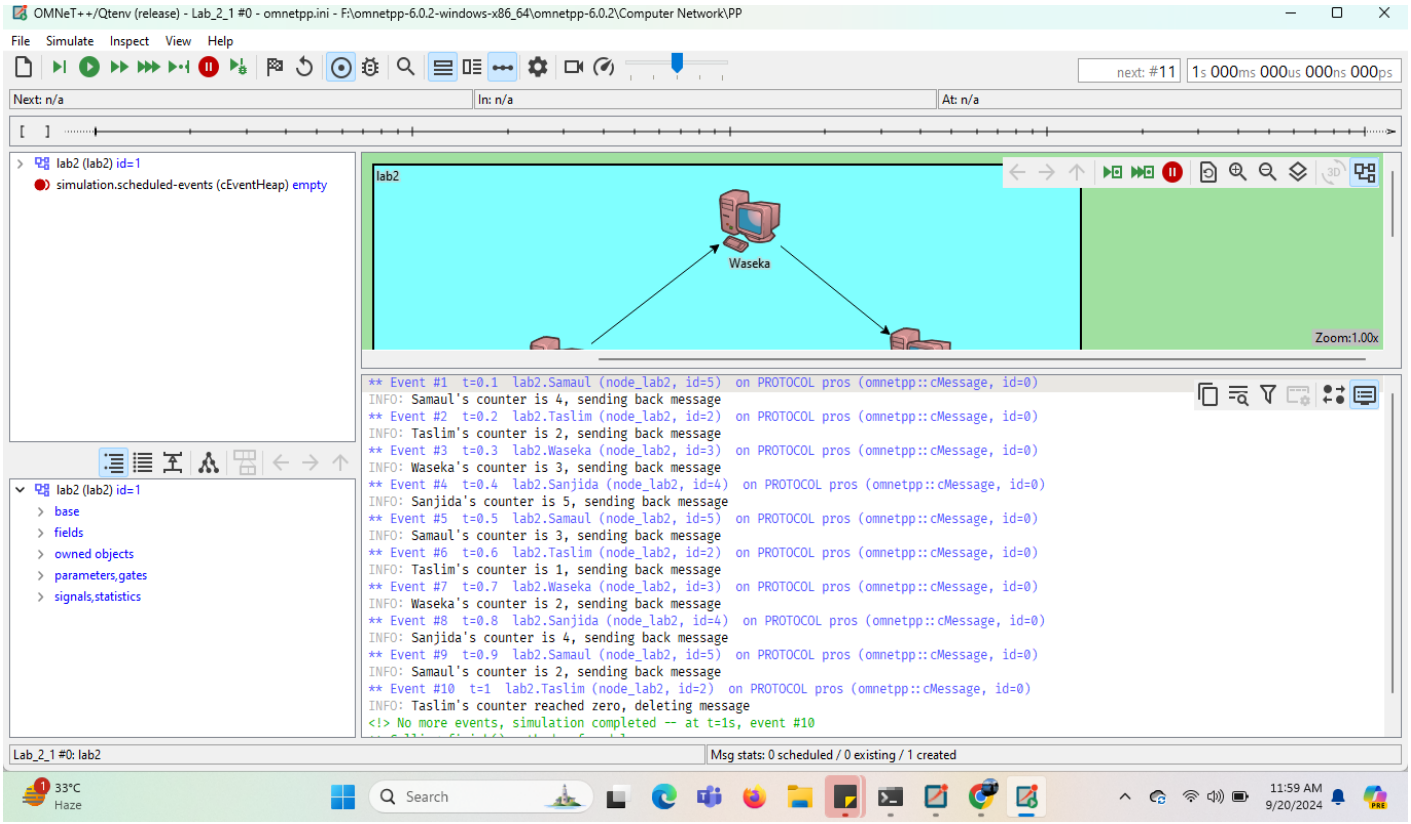

Figure 3.1: Laptop view of result

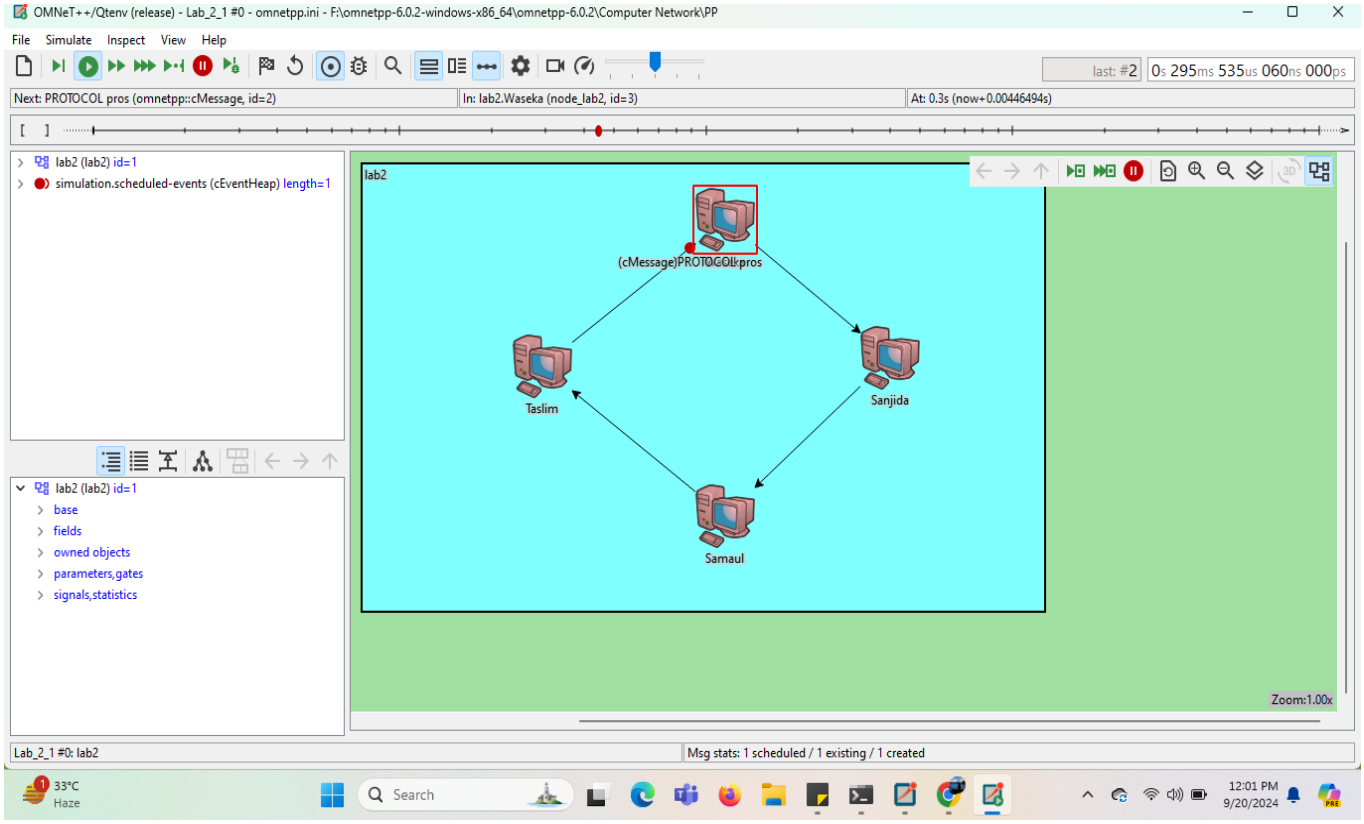

Figure 3.2: Laptop view of result

Result:

The experiment results provided valuable insights into how message propagation within a circular network is influenced by forwarding limits. The behavior of each node, as well as the message flow, is highlighted below for each configuration:.

Config Lab_2_1:

- *Sanjida* initiated the message with a forwarding limit of 6.
- As the event log shows, the message was passed multiple times between nodes. However, when *Taslim*'s limit reached 0, the message was still forwarded until *Samaul* hit its limit of 5, stopping the message propagation.
- This configuration demonstrated that, even with varying limits, the message can circulate for a considerable time before halting at a node that reaches its limit.

Config Lab_2_2:

- In this configuration, *Waseka* initiated the message with a higher forwarding limit of 8.
- Due to *Waseka*'s higher limit, the message was forwarded through multiple nodes before reaching *Samaul*. *Samaul*'s forwarding limit of 4 caused the message to halt after circulating for a shorter time compared to the previous configuration.
- This shows how having a lower forwarding limit on a critical node can significantly affect the message lifetime within the network.

Config Lab_2_3:

- In this setup, *Samaul* was the initiating node with a limit of 9, the highest among the nodes.
- As *Samaul* had the highest limit, the message circulated through the nodes for an extended period, only halting when *Waseka* reached its limit of 6.
- This configuration revealed that starting the message from a node with a high forwarding limit allows the message to travel further, but eventually, the network configuration bottlenecked at *Waseka*.

Analysis:

Impact of Forwarding Limits: Each node in the network had a different forwarding limit, which directly affected how long a message could circulate in the system. Nodes with lower limits acted as critical stopping points, causing the message to halt sooner, while nodes with higher limits allowed the message to propagate for longer.

- In *Config Lab_2_1*, the message initiated by *Sanjida* was able to circulate longer due to the higher forwarding limits set for *Samaul* and *Sanjida*. The message only stopped when *Samaul*'s forwarding limit was reached.
- In *Config Lab_2_2*, *Waseka* initiated the message, and the lower forwarding limit of *Samaul* acted as a bottleneck. Although other nodes had higher limits, *Samaul*'s limit constrained the message's circulation.
- In *Config Lab_2_3*, *Samaul* initiated the message with the highest limit in the network, which allowed the message to circulate more freely among the nodes until *Waseka* hit its lower limit.

Node Initiation and Propagation:

- The node responsible for initiating the message plays a significant role in determining the propagation behavior of the message. When a node with a higher forwarding limit initiates the message, it travels further before hitting nodes with lower limits.
- In *Config Lab_2_3*, where *Samaul* initiated the message, the message was able to circulate the longest due to *Samaul*'s higher forwarding capacity. On the other hand, in *Config Lab_2_2*, *Samaul*'s lower forwarding limit restricted the message propagation early.

Message Termination:

- The experiment demonstrated that when a node's forwarding limit reaches zero, the message is terminated at that point. This behavior helps to prevent infinite loops in message forwarding but also limits the overall message reach.
- Nodes that reach their forwarding limit prematurely, as seen in *Config Lab_2_2*, result in faster

7. Conclusion:

These configurations demonstrate how different forwarding limits impact the propagation of messages in a network simulation. By adjusting these limits, we can control how long and how far the messages travel within the network. These results show that OMNeT++ successfully simulates the message forwarding behavior based on predefined node limits, effectively modeling message propagation and termination within the network.