Lab Report

Course Title: Computer Networks Lab

Autumn 2024
Section:7BF

Lab No: 3

Name of Labwork: A network consists of 10 nodes with forwarding limits. Nodes forward a message randomly. i.e. random routing protocol. Source node, destination node and limits are to be configures in the ini file.

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Date of Performance	: 25.09.2024
Date of Submission	: 29.09.2024
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Marks

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1. Introduction:

This experiment simulates a random routing protocol in a network composed of 10 nodes. Each node has a specific forwarding limit, which restricts the number of times a message can be forwarded before it is dropped. The routing protocol is random, meaning each node forwards the message to any of its neighbors. The objective of the experiment is to observe how the message propagates through the network and analyze how forwarding limits impact overall network efficiency. The configuration file (.ini) defines the source node, destination node, and forwarding limits for each node.

2. Constructing Network(NED):

The network description (NED) file defines the structure of the network. The NED file defines the topology of the network, which consists of 10 nodes connected in a random fashion. The NED file is structured as follows :

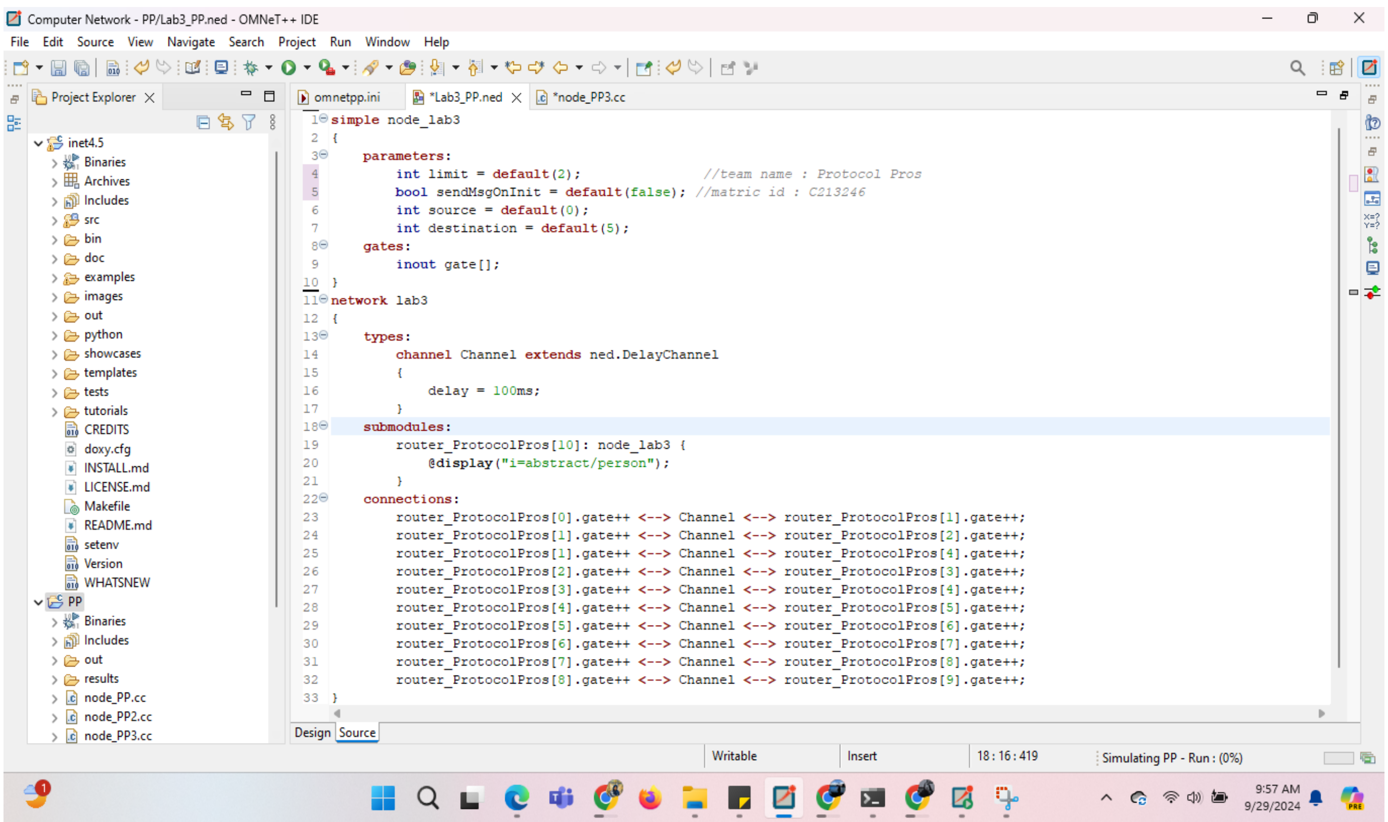

Figure 1: Laptop view of NED file

3. Building Module(C++ file) :

The C++ file implements the core behavior of each node, including message handling and random forwarding decisions based on the limits. Each node has a limit that dictates how many messages it can forward. When a node receives a message, it forwards it to a randomly selected neighbor if its forwarding limit hasn't been reached. When a node receives a message, it decreases its forwarding limit and either forwards the message or drops it.

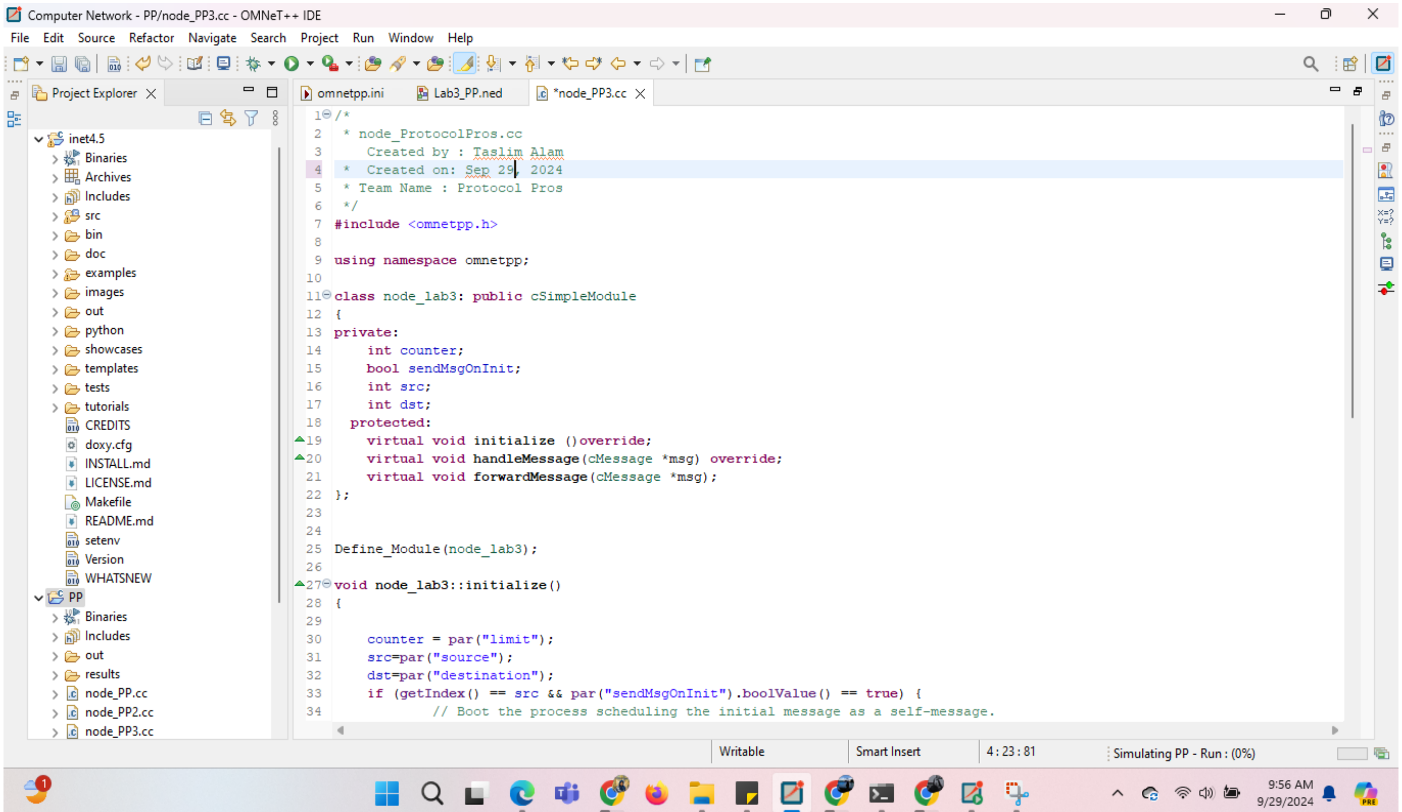

Figure 2.1: Laptop view of cc file

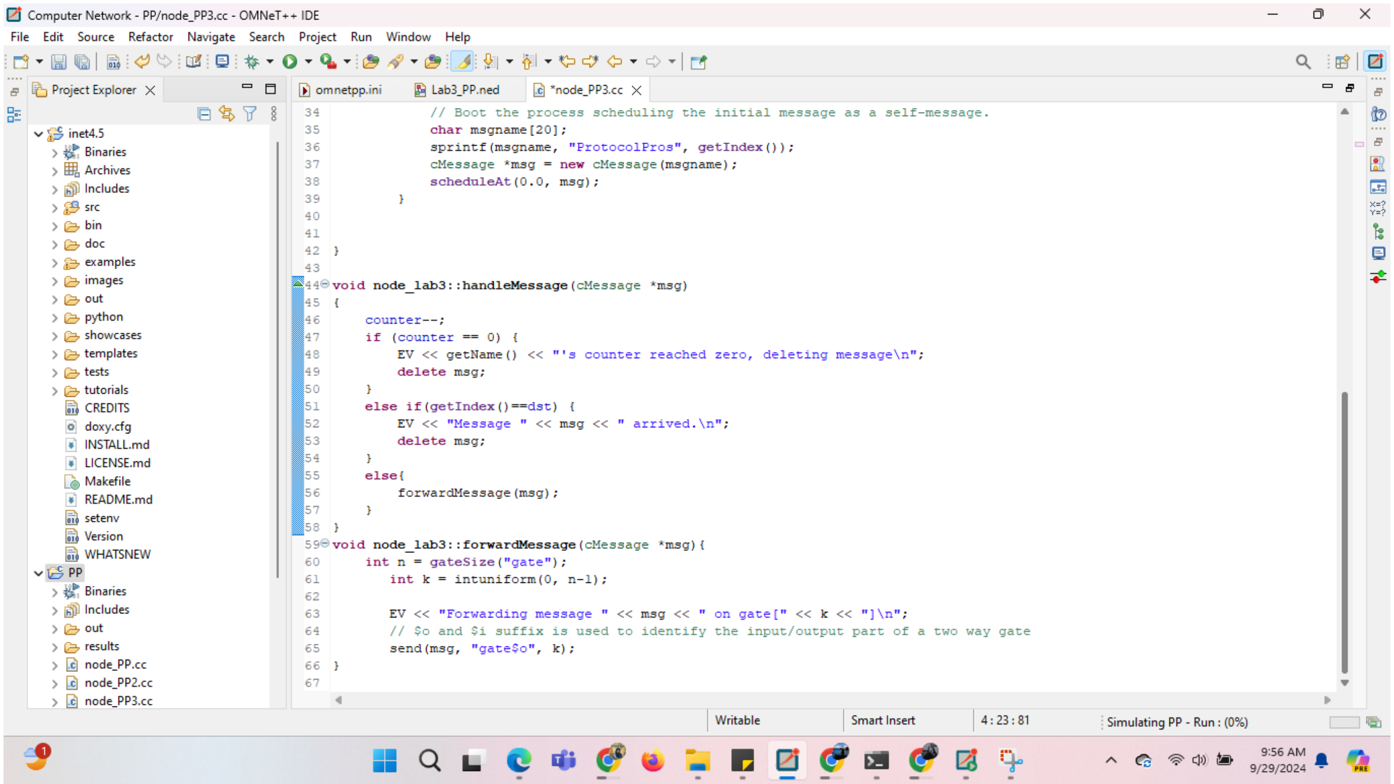

Figure 2.2: Laptop view of cc file

4. Initializing simulation(ini file):

The .ini file is used to configure simulation parameters such as the forwarding limits of nodes, the source node that generates the initial message, and the destination node.

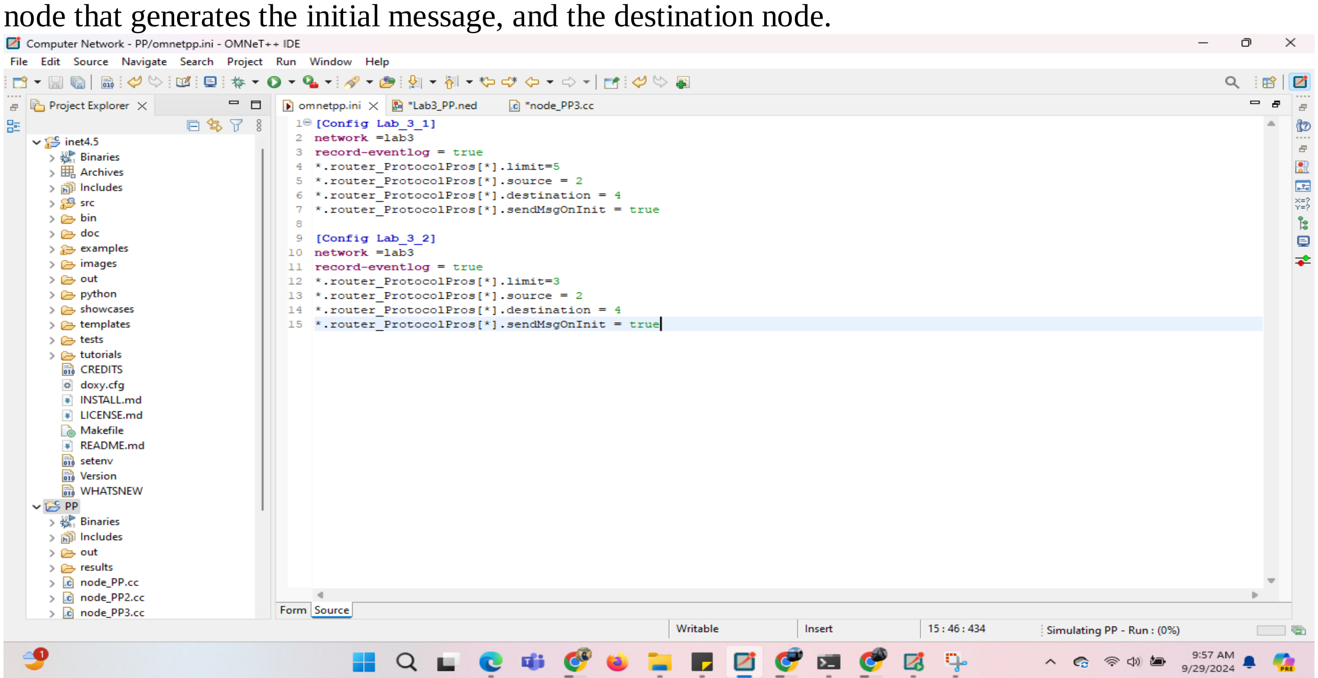

Figure 3: Laptop view of ini file

5. Experiment:

The simulation experiment visualizes a network of nodes where each node forwards messages based on a random routing protocol. The forwarding limits set in the configuration file restrict how many times a node can forward a message. The objective is to observe how these limits affect message propagation and termination within the network.

In the provided experiment setup (as shown in the simulation screenshots):

- A set of nodes (e.g., ProtocolPros[0] to ProtocolPros[9]) are configured to forward messages.
- The visual output shows how the message travels from one node to another.
- The event log tracks the message flow and logs each forwarding instance in real time.

6. Result and Analysis:

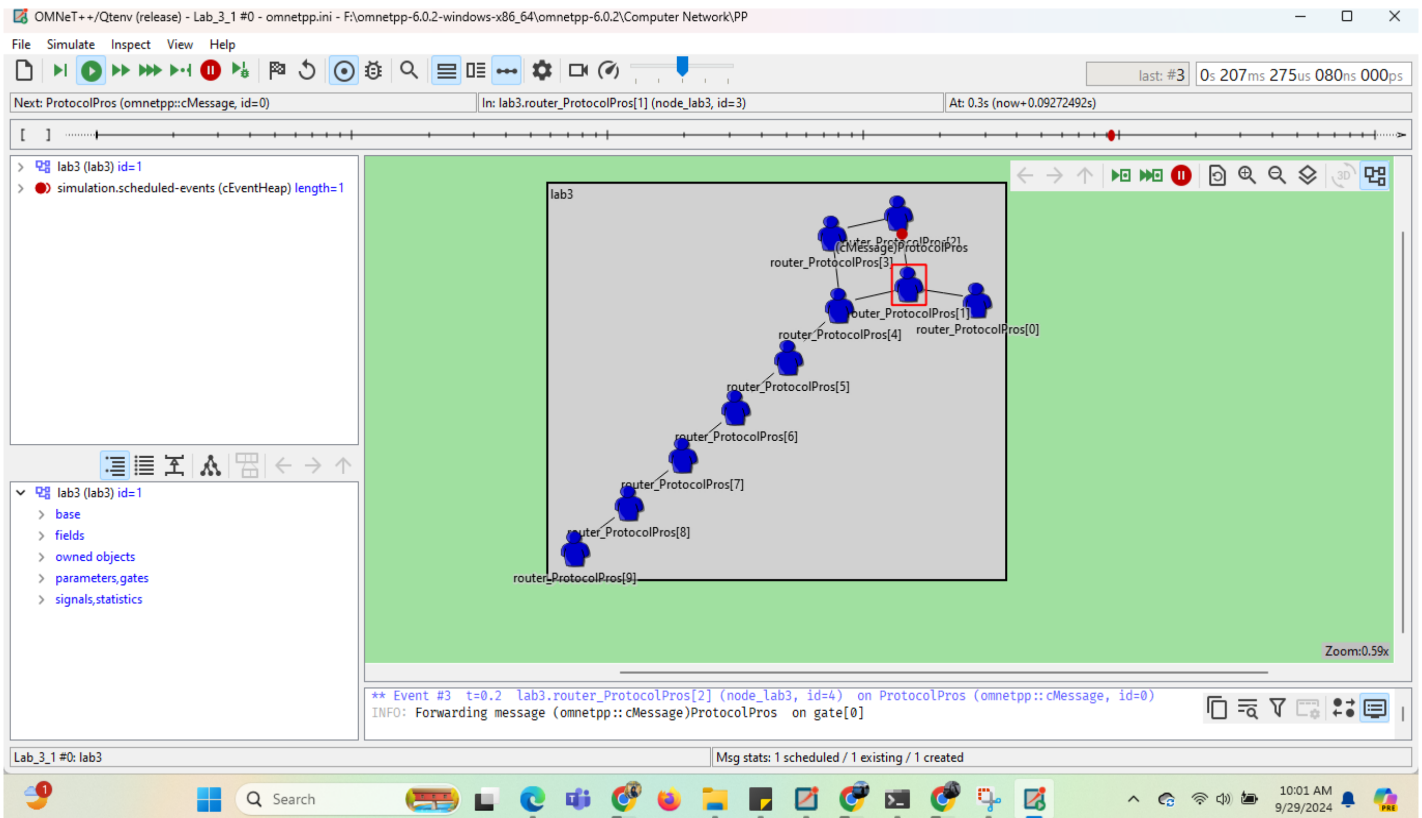

Figure 3.1: Laptop view of result

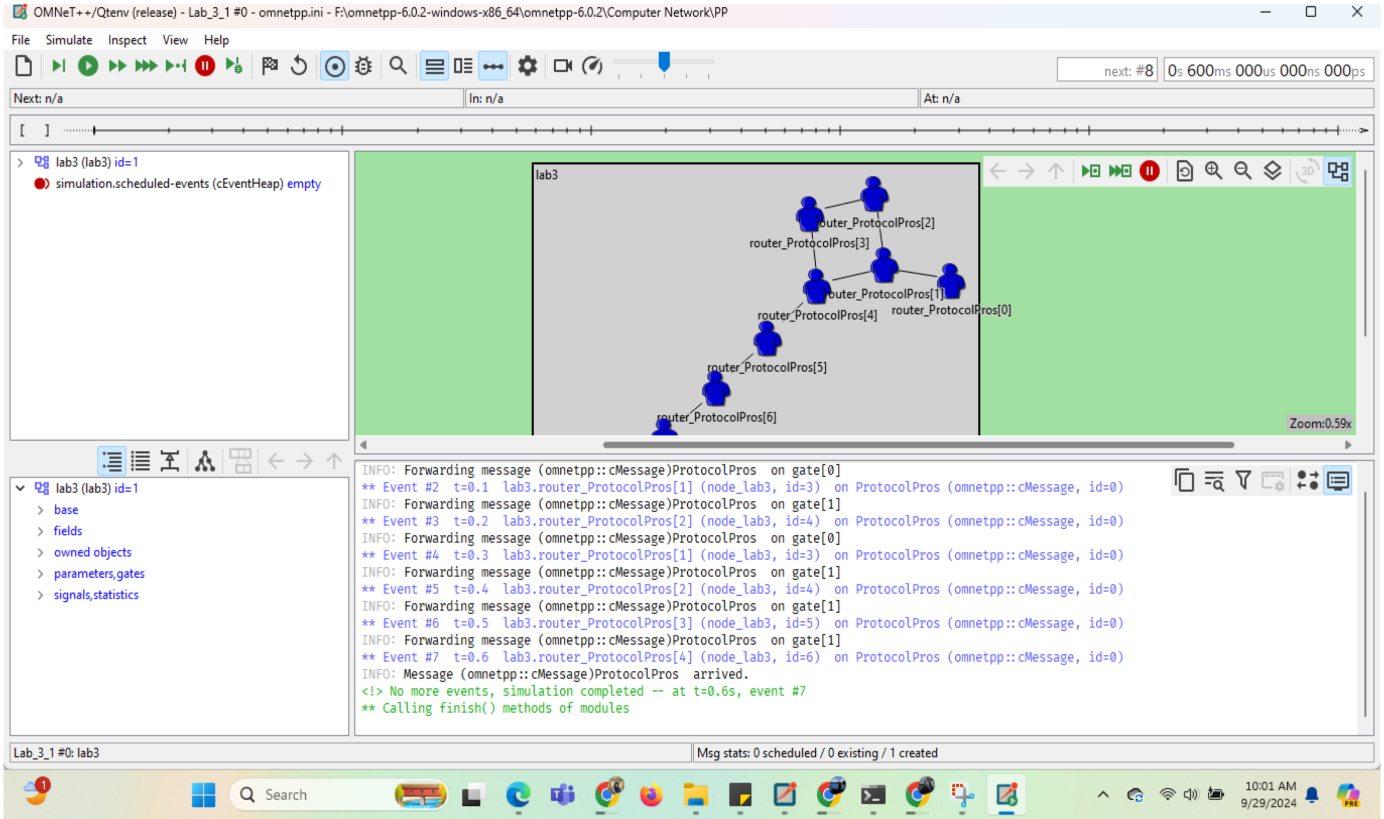

Figure 3.2: Laptop view of result

Result:

The simulation event log records the following key observations:

1. The initial node (ProtocolPros[0]) sends a message.
2. The message is forwarded through various nodes, including ProtocolPros[1], ProtocolPros[2], etc., until it reaches a node that hits its forwarding limit or another termination condition occurs.
3. For example, the event log shows message forwarding between nodes, detailing when the message arrives at a node and when it leaves (e.g., "Forwarding message on gate[0]").
4. The graphical output confirms the message's journey through the nodes, illustrating real-time message propagation across the network.

From the simulation:

5. In **Config 1**, the message reaches certain nodes and halts early due to their lower forwarding limits.
6. In **Config 2**, messages circulate longer due to higher forwarding limits, allowing them to pass through more nodes before halting.
7. The differences in message lifespan highlight how forwarding limits significantly impact the overall message propagation across the network.

Analysis:

 Impact of Random Forwarding: The random routing protocol adds an element of unpredictability in message paths, which can be both an advantage (in terms of balancing load across the network) and a disadvantage (in terms of potential looping or inefficient paths).

 Forwarding Limits: Nodes with lower forwarding limits act as bottlenecks, effectively constraining message propagation and reducing the overall reach of the message.

 Node Connectivity: The random connectivity of nodes (defined in the NED file) influences how well messages propagate. A densely connected network improves message propagation, while a sparsely connected network with nodes that reach their limits early may result in many dropped messages.

7. Conclusion:

This experiment demonstrates the importance of forwarding limits in controlling message propagation within a network. By configuring the limits in the simulation, it is clear that nodes with lower forwarding limits restrict the message's travel across the network, leading to quicker termination. Conversely, nodes with higher forwarding limits allow the message to propagate further, increasing its chances of reaching more nodes.