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Analysis of greedy perimeter stateless routing protocol network simulation using bird flocking algorithm

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Abstract — This study aims to simulate the GPSR protocol network on NS3 using the bird flocking algorithm and analyze the comparison of performance measurements obtained from the simulation results. The Greedy Perimeter Stateless Routing network was simulated using NS-3 in this simulation. The simulation area is created in length width. The distance between nodes is 50 meters and is simulated in an area of 1000m x 300m for 30 seconds, and 802.11 MAC protocol is used. This simulation was successfully implemented in finding the location of the nearest node using the GPSR protocol with the PSO / BFA algorithm. The number of nodes used in the simulation is 150 nodes and two nodes, so it can be concluded that the performance of Quality of Service (QoS) is greatly affected by the number of nodes and the algorithm used in the simulation.

Keywords – MANET, GPSR, BFA, Position-based routing.

I. INTRODUCTION

GPSR is a routing protocol whose purpose is to use the closest node to the node [1]. However, GPSR can find a suitable route to carry packets. Mobile Ad-Hoc Network (MANET) is a network technology composed of a collection of ad-hoc nodes of the same or different kinds that are connected using a wireless connection. In the MANET protocol, devices can go to various destinations to affect path changes with other devices in a network. [2], [3]. A new suitable routing algorithm was simulated with Network Simulator-3 (NS-3) by modifying the Greedy Perimeter Stateless Routing (GPSR) and Bird Flocking Algorithm (BFA) [4]–[6]. GPSR is used as a position-based algorithm the Mobile Ad Hoc Network (MANET). Because it does not determine the path to the destination [7], [8], thus knowing the position of neighbouring nodes, this algorithm is used to find a more valid routing according to the actual distance [9].

AODV is a routing protocol algorithm in a network. The AODV protocol [10] is a routing protocol that passes data from a wireless network. This routing provides a route according to the desired destination by building a route between nodes [11]. All nodes in the AODV protocol provide a routing table to store data about active routes to the destination node [12]. An efficient routing protocol in knowing the distance in the nearest jump is AODV [13]. GPSR is simple, and GPSR with BFA can be compared based on throughput, delay, and jitter with nodes represented in rectangular form.

II. RESEARCH METHODS

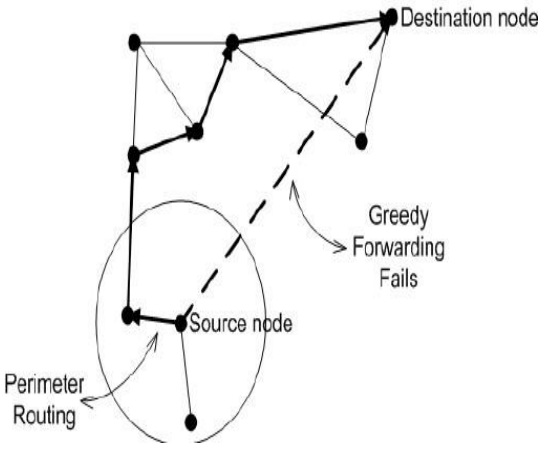

Fig. 1. GPSR [14]

The GPSR protocol uses nodes to determine the position in the header of the packet sent. Each node sends a control message to find out the position to know the direction of the destination position [15]. So that for the node approach, by calculating the distance

so that the nearest node is the jump point for sending messages, the jump from the initial node to the ladder node is only one jump [16].

In perimeter forwarding, the greedy forwarding algorithm cannot forward packets to the destination so that no next node reaches the destination node except for the node itself [17].

The Greedy Perimeter Stateless Routing network was simulated using NS-3 in this simulation. The simulation area is created in length width. The distance between nodes is 50 meters and is simulated in an area of 1000m x 300m for 30 seconds, and 802.11 MAC protocol is used.

Table 1 Simulation Parameters

Parameters	Nilai
Distance nodes	50 m
Simulation Time	30 s
The scope of the simulation	1000m x 300m
Package Size	1024 Byte
Package Traffic Type	UDP
Protokol Routing	Greedy Perimeter Stateless Routing
Protokol MAC	802.11
Time Interval	1.0 s

Table. 1 showsthe Gauss Markov, Mobility parameter model. This simulation also requires source code to run the simulation that will be generated. The step of running the program is:

1. Download and copy the source code from GitHub and make minor modifications if needed.
2. The source code files are copied to the ns-3.25/scratch folder.
3. Open the Terminal.
4. Type the following command in Terminal: cd ns-alone-3.25/ns-3.25 and ./waf --run scratch/GPSR+FB
5. Simulation QoS will be obtained from the running results, such as Packet Loss, Throughput, Packets Delivery Ratio, Jitter, and Delay.
6. Go to the NetAnim directory to see the simulation animation by typing in Terminal: cd. netanim-3.107 cd ./NetAnim
7. The NetAnim window will open, and we are required to open the .xml file generated by the GPSR+FB.cc file to view the animation in the simulation.
8. Click the "Run" button when the .xml file has been opened.

III. RESULT

From the measurement results in the image above, we can see that the simulation results with two nodes are obtained:

Table 2. Measurement Result

Quality of Services (QoS)	Value
Total packet lost	0
Throughput	8.52315 Kbps
Packet Delivery Ratio	100%
Jitter	0.00503966
Delay	0.003448 s

In calculating the QoS routing between nodes, we can get an effective route to get to the next node so that we can consider the following related aspects [18]:

- Postpone
- Jitter
- Throughput
- Package loss
- Packet delay ratio wherein getting this value with a percentage of 100% of the packets that have arrived [19].

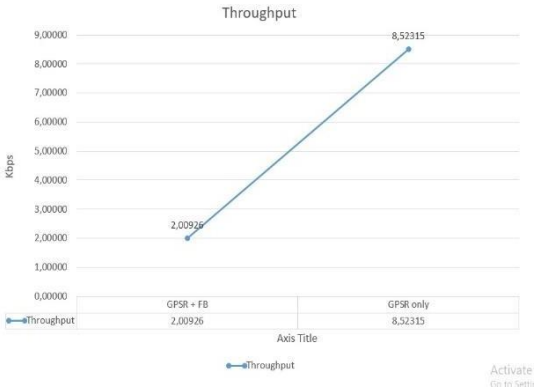

Fig. 7. Throughput

From the measurement results in the image above, we can see that the simulation results throughput as nodes decrease.

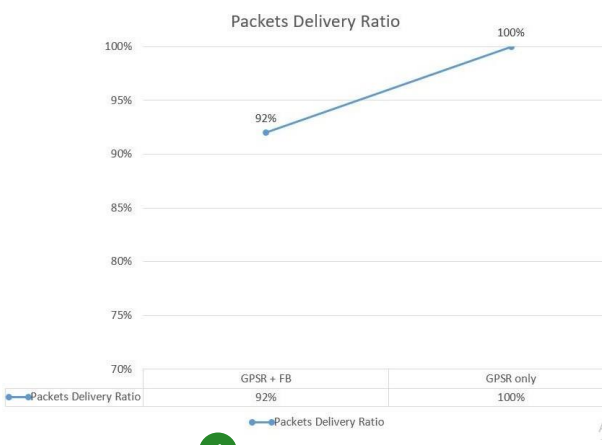

Fig. 8. Packet Delivery Ratio

In the packet delivery ratio based on the results of measurements on NS3, there was a very significant increase in packet delivery from nodes up to 100%.

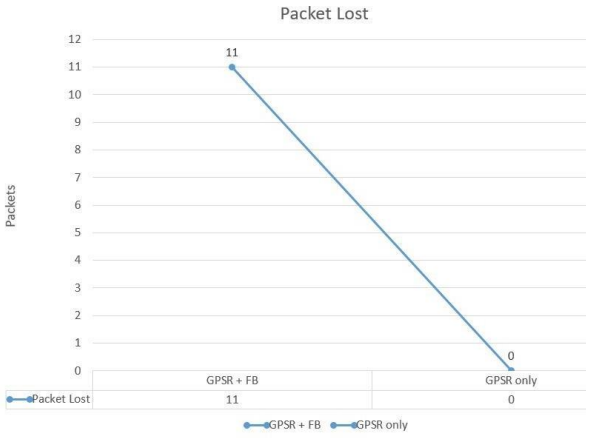

Fig. 9. Packet Loss

In lost packets, there is a decrease in the number of lost packets between GPSR + FB and GPSR Only.

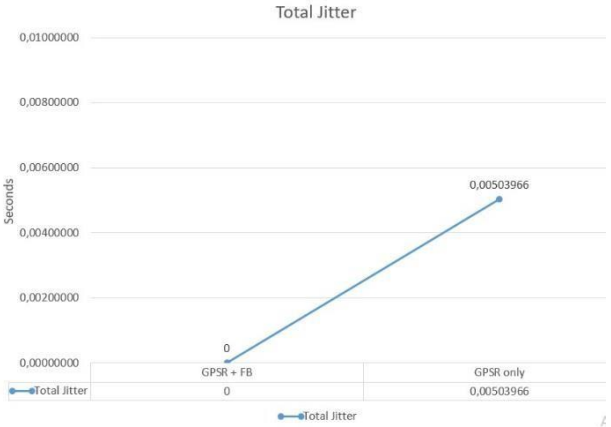

Fig. 10. Total Jitter

This condition means that the GPSR + FB ping is more stable at 0 ms.

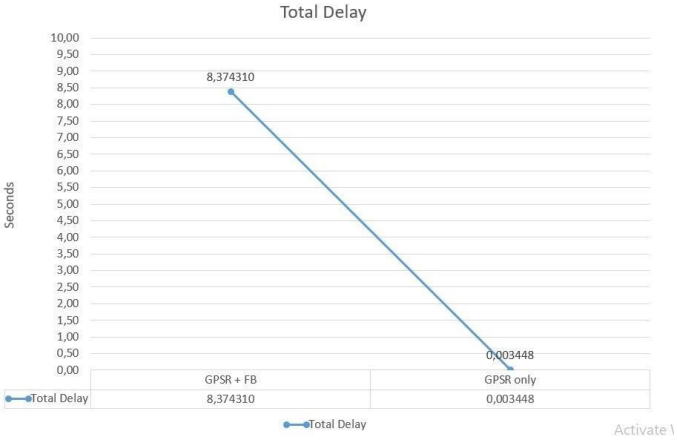

Fig.11. Total Delay

When compared between GPSR only with GPSR + FA, the graph shows that the Total Delay on GPSR + FA is higher than GPSR alone.

IV. DISCUSSION

The nodes that have a number run each other in various directions that have been determined by the birds flocking algorithm with predetermined parameter limits so that they can move around, as shown below. It can be seen that nodes number and algorithm used in the simulation affect the QoS performance. By looking at the measurement result of the increase in throughput as the nodes number decreases, the increase of packet delivery ratio, the decrease of packet loss and delay between GPRS only with GPRS + FA.

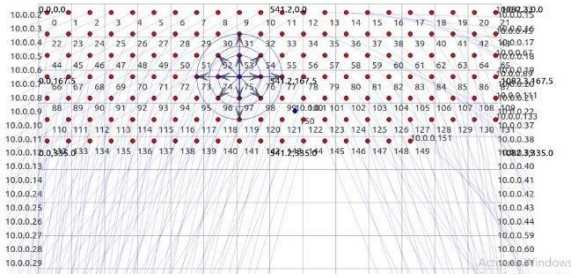

Fig. 12. Simulation

Fig 12 shows that we use 150 nodes and the total simulation time is 100 seconds. It can be seen that the nodes with a number run each other in various directions.

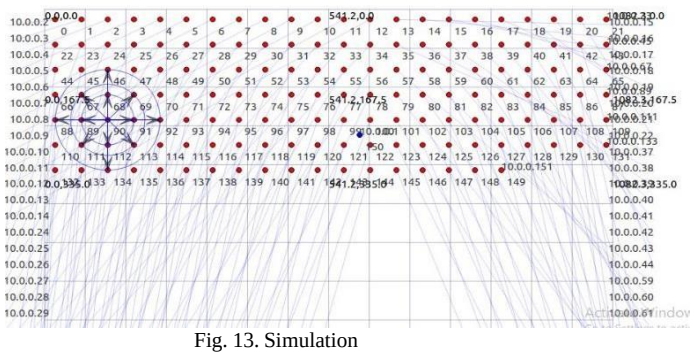

Fig. 13. Simulation

Fig 13 shows that we get the first QoS (GPSR+FB) simulation running for 10 seconds as follows:

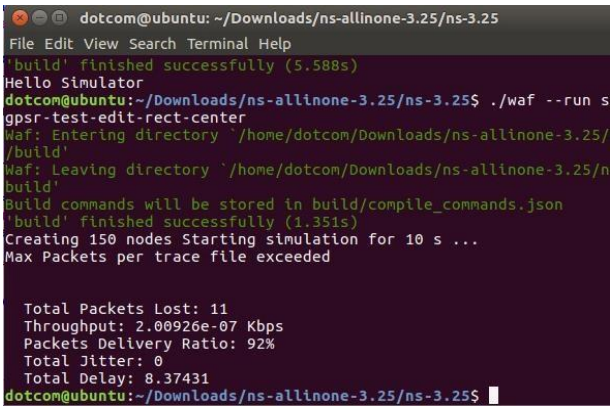

Fig. 14. Simulation

Fig 14 shows that the simulation results with 150 nodes are obtained:

Table 3
measurement result value

Point	Value
Total packet lost	11
Throughput	2.00926e-07 Kbps
Packet Delivery Ratio	92%
Jitter	0
Delay	8.37431 s

From the simulation results above, we get a second QoS (GPSR Only) simulation running for 10 seconds as follows:

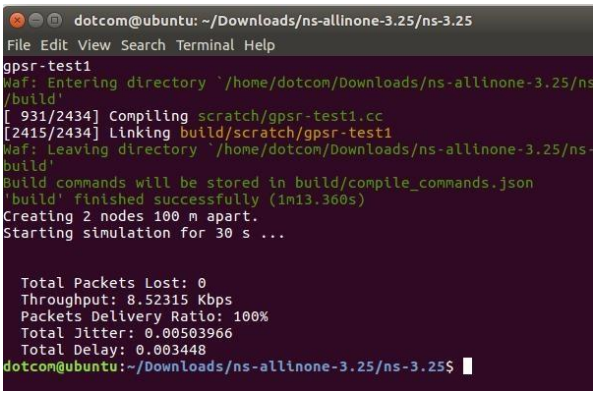

Fig. 15. Simulation

V. CONCLUSION

This simulation has been successfully implemented in finding the nearest node location using the PSO Algorithm. The number of nodes and the algorithm used in the simulation with the nodes used is 150 nodes and two nodes so that it can be concluded that QoS performance is very influential on the number of nodes used in the simulation [20], [21].

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