

## **PERFORMANCE ANALYSIS OF GREEDY PERIMETER STATELESS ROUTING (GPSR) IN MANET ENVIRONMENT USING OMNET++ FOR MULTIMEDIA DATA COMMUNICATION**

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**ABSTRACT** - MANET has become one of the staple structures of wireless communications and multimedia in the modern era with increasing demand for its services and infrastructure-less nature that make every day work a whole lot easier and it uses its well-known and well-used routing protocol such as GPSR. However, throughout the years, there is a lack of thorough research made on the basic aspects and performance of GPSR. Even though there are a handful of research papers that has GPSR as the focus of research, however, the testing and experimentation were not too diverse in terms of network performance metrics measured and also the simulation scenarios. This problem leads to limited understanding of the GPSR protocol, thus also limiting the scientific study contribution of the protocol. This research simulated the performance analysis of GPSR in MANET environments, using a network simulator tool called OMNeT++. Simulation results of the GPSR protocol indicate that GPSR has remarkable performance in terms of its average jitter, average end-to-end delay, average throughput, which indicates a good performance when GPSR is routing multimedia data. Besides that, Packet Delivery Fraction (PDF) and also Normalized Routing Load (NRL) is also at optimal results when simulated in various MANET scenarios. For the future work, simulation of GPSR with additional MANET scenarios and network performance parameters can be carried out and different network simulator tool such as Ns-3 can be used in order to gain deeper understanding of the GPSR protocol and to validate or verify the findings of this research.

**Keywords:** MANET routing protocol, GPSR, OMNeT++

### **1. INTRODUCTION**

The aim of this research is to reflect the GPSR routing capabilities in a MANET environment by using OMNeT++ network simulator tool and then compare the results of GPSR performance under various different scenarios that reflect the real-time implementation of the protocol in MANET. The scope of this research focused on the performance of GPSR protocol in MANET environment, and the simulation is carried out in OMNeT++. This research is also using the INET framework in OMNeT++ that allows for simulation of the GPSR protocol.

### **2. METHODOLOGY**

The method that was used to carry out this research is a simulation model that represents an ad-hoc network with GPSR implementation approach. The simulation model is presented in the form of a network topology that consists of beacon frames to represent MANET devices. There is one source node, one destination node and 12 intermediary nodes that are wirelessly linked together in order to simulate wireless communication in MANET environments. The whole simulation of the GPSR protocol is carried out under several different simulation scenarios such as increasing packet size, transmission rate, transmission power and also simulation time. The results obtained from the simulation is then analysed in order to understand GPSR performances.

### **3. RESULTS AND DISCUSSION**

Based on the results and analysis of the simulations of GPSR, as the packet size, transmission rate, transmission power and simulation time increases, performance of GPSR in terms of average throughput and Packet Delivery Fraction (PDF) increases except when simulated with 8192 bytes of packet size. Besides that, the average end-to-end delay and average network jitter also increases as the packet size increases, but decreases and optimal when transmission rate,

transmission power and simulation time increased gradually. Lastly, the Normalized Routing Load (NRL) remained optimal as packet size and transmission rate increases, and decreased when transmission power and simulation time are increased. Overall, results of the analysis indicate that GPSR has optimal performance as the packet size, transmission rate, transmission power and simulation time increases.

#### **4. NOVELTY OF RESEARCH / PRODUCT**

Throughout the years, there have been several research that conducted performance analysis on GPSR using OMNeT++, Ns-3 and Ns-2, measuring the PDF, NRL and throughput as number of nodes increases, such as (Abdulleh & Yussof, 2019; Chhabra & Barwar, 2022). There is also previous research on the performance of GPSR that measures the performance of the protocol in terms of PDF, NRL, throughput and packet loss rate using OMNeT++ as the transmission rate and Hello packet interval increases (Amaya et al, 2021). Last but not least, there is also research that analysed the performance of GPSR in terms of PDF, NRL throughput and jitter with distance between nodes and map size varied (Laanaoui & Raghav, 2021).

#### **5. CONCLUSION**

To conclude the project entirely, it can be said that GPSR has remarkable performance when routing data in a MANET environment, especially in terms of average network jitter, throughput and end-to-end delay as the packet size, transmission rate, transmission power and also simulation time increases.

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