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Performance optimization of manet

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Abstract

Mobile networking refers to the technology utilized to transmit speech and data between specific mobile network nodes across wireless channels. In general, "mobile" refers to the purposeful, lightweight, and portable technologies that moviegoers may carry. A Mobile Ad Hoc Network (MANET) protocol requires proper settings to perform data transmission optimally. To overcome this problem, it is necessary to select the correct routing protocol and use the routing protocol's default parameter values.. The performance metrics used for measuring performance were Packet Delivery Ratio (PDR), throughput, delay, packet loss, energy consumption, and routing overhead. This paper combines the Ant Colony Optimization (ACO) algorithm and the Particle Swarm Optimization (PSO) algorithm to provide the optimum routing and to improve the QoS resource utilization efficiency. The metrics include all nodes throughput, bandwidth, and load balance, routing and control overhead improvement with reduction. They also comprise of RSSI, end to end delay, Packet Delivery Ratio, network capacity, packet loss probability, as well as power consumption in all wireless nodes and energy consumption from wireless domain to wired domain.

Keywords: MANET; AODV; ACO; PSO; QoS

1. Introduction

A MANET consists of a number of mobile devices that come together to form a network as needed, without any support from any existing internet infrastructure or any other kind of fixed stations. A MANET can be defined as an autonomous system of nodes or MSs(also serving as routers) connected by wireless links, the union of which forms a communication network modeled in the form of an arbitrary communication graph.This is in contrast to the well-known single hop cellular network model that supports the needs of wireless communication between two mobile nodes relies on the wired backbone and fixed base stations. In a MANET, no such infrastructure exists and network topology may be changed dynamically in an unpredictable manner since nodes are free to move and each node has limiting transmitting power, restricting access to the node only in the neighboring range. MANETs are basically peer-to-peer, multi-hop wireless networks in which information packets are transmitted in a store and forward manner from a source to an arbitrary destination, via intermediate nodes as given in the figure:

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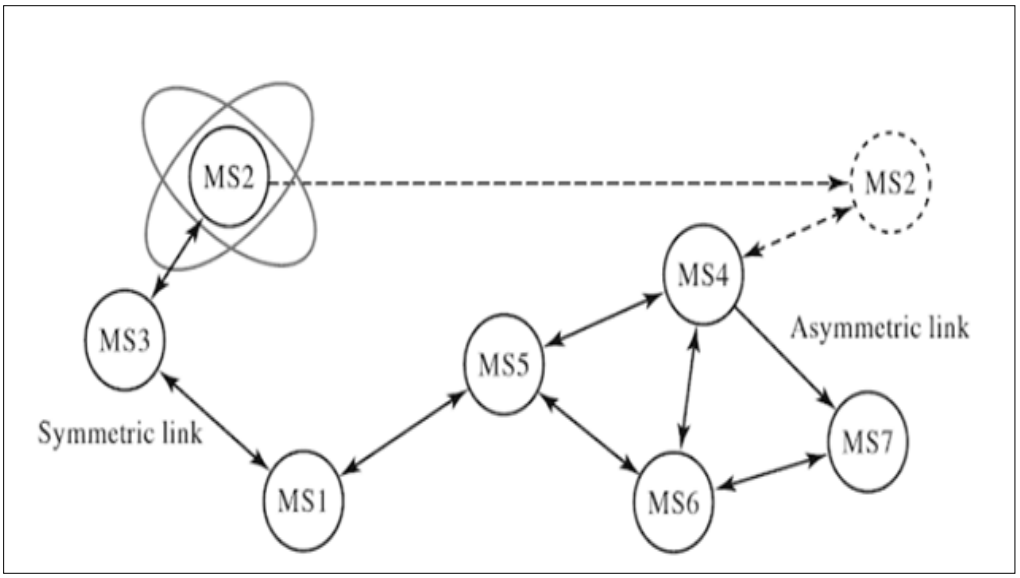

Figure 1 Nodes of Mobile Adhoc Network

Before implementing a MANET, it is essential to properly investigate the routing and security implications. Because of routing methods, nodes in a MANET are able to interact with one another in a dependable manner. Routing is the process through which packets are transferred from one network to another. Routing solutions in MANET must be able to adapt when the network topology changes, which means they must be flexible. A low-overhead routing protocol is thus required to manage the MANET, as shown by improvements in Quality of Service (QoS) metrics like as packet loss, throughput, and latency as a result of the low-overhead routing protocol.

Several approaches have been used to investigate MANET reactive and proactive routing systems. A study has discovered that, on average, the Ad Hoc On-demand Distance Vector (AODV) protocol has excellent throughput and end-to-end latency, as well as low energy consumption. It is also well suited for application to moving nodes, and it has strong performance with enhanced speed for average end-to-end metrics when applied to moving nodes. However, the Optimized Link State Routing (OLSR) protocol is a proactive routing protocol that is based on the link state routing algorithm. It is an excellent approach for obtaining network topology information since it is a proactive protocol. Since OLSR is a routing table, latency is kept to a bare minimum. The long-term performance of OLSR should beat the performance of AODV in terms of throughput, packet loss, and latency. Some of the benefits of OLSR include average end-to-end delays that are less than those of other protocols, a dense and dynamic topology, and the fact that it is well suited for delay-sensitive applications.

AODV protocol studies conducted in the past did not examine the effect of altering performance parameters. However, in an ad hoc network such as MANET, the route discovery and maintenance process is the most important concept to understand when dealing with topology changes. The values of routing parameters such as Active Route Timeout (ART) are also crucial in ensuring reliable routing when the network topology is continually and quickly changing, as occurs in a dynamic environment. The default settings have been subjected to extensive testing to determine their effectiveness. There have been research conducted to see what the effects of route maintenance and HELLO message settings are. HELLO INTERVAL and ALLOWED HELLO LOST are the two types of Hello Lost messages that are permitted. The Active Route Timeouts (ARTs) and deletion period constants are the parameters that control route maintenance (n). As shown in these two experiments, using the AODV protocol's default parameters does not always result in the best outcomes, regardless of the circumstances. In both experiments, decreasing parameter values, such as ART to 2.5 (the default value is 2.5) and HELLO INTERVAL to 0.5, resulted in the best results (default value: 1). Depending on the value of these elements, routing overhead and PDR may increase or decrease, respectively. Strange things happen when the parameter value is changed significantly from its default value.

2. Literature review

Hadi, Ahmed &Vahab, Seyed&Makki (2022) Mobile networking refers to the process of transmitting data across wireless media and the radio spectrum between mobile network nodes. The word "mobile" refers, for the most part, to gadgets that are compact and lightweight enough to be carried by people when they go to the movies. In this study, a suggestion

was made to improve MANET routing protocols by using a hybrid model that is based on the swarm optimization model. According to the authors, the recommended optimization approach can determine what the optimal parameters are for MANET networks. In the technique that has been proposed, swarm optimization for cats and pstudy swarm optimization (PSO) have been integrated (CSO). You might make use of this research to find out how the MANT networks or mobile sensor networks that were used in this study could be modified to minimise degraded routing challenges and improve their overall performance.

Krauß, Jonathan (2022) Machine learning (ML) may be used for the training of data-driven models, which enables the information to be extracted directly from the data itself. As a consequence of expanded networking and more digitalization, the manufacturing industry is increasingly making use of machine learning (ML). Integration of data, preparation of data, modelling, and deployment are all activities that contribute to the development of ML models. Before beginning execution, the hyperparameters of any machine learning technique, regardless of whether they were developed by a data scientist or an AutoML system, need to be properly chosen.

Danilchenko, Kiril&Azoulay, Rina&Reches (2022) When it comes to latency, ad hoc networks in 5G present their own set of issues, which are particularly difficult to overcome for real-time applications and multimedia. The primary emphasis of this study is on mobile ad-hoc networks (MANETs), which may support a wide variety of traffic flows. In this study, we discuss the difficulties associated with regulating these networks by using multi-hop time-slotted time-division multiple access (TDMA). When the weights are set based on the priority of the requests, one of the most challenging tasks in TDMA is to reduce the overall weighted end-to-end packet delay as much as possible.

Sengan, Sudhakar&Nithya (2021) 5G demos in a corporation play a vital part in the technology of today, which moves at a breakneck rate. Manet operates a wireless system in 5G that is expected to have a very high data rate, a low energy consumption, a low latency, and an affordable price. As a direct result of this, the routing protocols used in MANETs could be fundamentally flexible, high-performance, and energy efficient. The objectives of 5G communication are to achieve a higher data throughput and a much reduced Over-The-Air latency. MANETs have been used as the basis for the development of a security-aware, fuzzy improved ant colony routing optimization protocol. This protocol was inspired by extra ACO routing algorithms.

Mirmozaffari, Mirpouya&Golilarz (2020) In the first part of this study, a novel optimization model that makes use of an innovative approach to machine learning is suggested with the goal of achieving the most favourable results in financial institutions as is practically achievable. This study provides a scientific evaluation in the section on optimization and makes a novel suggestion for a model that combines parametric and non-parametric approaches.

Bright, Selorm&Anibrika (2020) A wireless network architecture known as a Mobile Ad Hoc Network (MAN) is one that does not need any help from a preexisting network infrastructure to function properly. MANs are made up of several different routing channels. Because of this, the nodes may transmit packets to other nodes in the network. MANETs are superior to other kinds of network designs or topologies in several respects, including their ability to self-organize and their dynamic topology.

Kumar, Sumit & Saini, Madan & Kumar, Sandeep (2019) New swarm intelligence member The Spider Monkey optimization method considers the manner in which spider monkeys behave. There is a possibility that the algorithmic programme used by SMO is a meta-heuristic population-based algorithm. Exploration and exploitation may both continue forever under the SMO algorithmic programme, which strikes a healthy balance in most circumstances.

3. Methodology

In MANET, the routing issue is solved by the nodes themselves, thus reducing computational and resource costs. The particle swarm optimization algorithm (PSO) is utilized in the research work, to choose the propitious value of parameters for ad hoc on-demand distance vector routing protocol to improve the quality of service (QoS) in MANET. The routing problem is solved where PSO uses agents like entities from insect communities as a metaphor. Swarm agents based on routing explain a collection of rules for the participating nodes to pursue. Swarm agents interchange information about their behavior adaptively and efficiently for the successful completion of their assigned tasks. PSO algorithm uses the maximum flow objective to prefer the best locations of the swarm agents during each step of network operation. MATLAB language is used for implementation of PSO, and the results of it are used for simulation of routing protocol AODV in QUALNET software. PSO is used for majoring the performance of AODV with the help of QoS parameters: jitter, throughput, and average delay.

Ant Colony Optimization (ACO) ACO, or Ant Colony Optimization, is a meta-heuristic approach that draws inspiration from the foraging behavior exhibited by ants. This optimization method was introduced by Dorgio and Dicario in 1999. The framework consists of three primary functions: Ant Solution Construction: In this phase, artificial ants navigate through neighbouring states of the problem.

- Pheromone Update: After a complete solution is constructed, the pheromone trails are revised.
- Daemon Actions: In this step, additional pheromone is applied to enhance the best solution found.
- B. Particle Swarm Optimization (PSO) Introduced by Kennedy and Eberhart in 1995, Particle Swarm Optimization (PSO) is a stochastic optimization technique that relies on population-based strategies. This approach is inspired by the social behaviors exhibited by flocks of birds and schools of fish. In PSO, each individual is represented as a particle, which possesses both a velocity and a position. The best position for each particle is identified based on the highest fitness value achieved. The PSO algorithm consists of several essential steps:

Initialize particles within a designated search space.

- Evaluate the performance metrics of each particle.
- Compare each particle's fitness value with its personal best (pbest). If a particle's value exceeds its pbest, this value is updated 0as pbest. Update the particles' positions and velocities accordingly.
- C. Genetic algorithms (GA) This methodology was introduced by Holland in 1975. The genetic algorithm represents a category of computational models grounded in the principles of natural selection. Among various optimization techniques, it stands out as the most potent. These algorithms draw inspiration from the process of human evolution. Genetic algorithms excel in optimization tasks and are commonly referred to as function optimizers. Within this framework, a population of solutions, termed chromosomes, is initialized for the algorithm. The fitness of each chromosome is assessed using a suitable fitness function. Subsequently, the most fit chromosomes are chosen to undergo crossover and mutation, resulting in improved offspring. Genetic algorithms prove to be beneficial and effective under the following circumstances:

When the search space is extensive, complex, or poorly understood.

- No mathematical analysis is available.
- When domain knowledge is limited, making it difficult to refine the search space.
- For problems that are complex or vaguely defined, as they operate based on their internal mechanisms.
- When traditional search methods are inadequate

4. Conclusion

In earlier works, MANET routing and satisfying QoS performance metrics are challenging task need to be drawn. In the first stage, the ACO algorithm is used to find the possible paths between the source and destination based on the metrics energy and bandwidth. The results from the initial population for PSO algorithm using good pheromone values. In the second stage, the PSO algorithm finds the better path using fitness function computation values which considers the metrics such as end to end delay and hop count between the source and destination nodes. In future work, the authors plan to increase the number of nodes in the MANET network. In addition, they plan to mitigate the Byzantine Attack and Wormhole attack in the MANET routing.

Compliance with ethical standards

Disclosure of conflict of interest

I declare that I have disclosed all associations required for disclosure under Conflict of Interest; and that, except as declared, I do not consider that any of the associations present a conflict of interest. I declare that there is no conflict of interest regarding the publication of this paper.

References

[1] Chalmtac, M. Conti, and J. J. Liu. Mobile ad hoc networking: Imperatives and challenges. Ad Hoc Networks, 1(1):13–64, 2003. Cited By (since 1996):376.

[2] S. Corson, J. Macker., "Mobile Ad hoc Networking (MANET): Routing Protocol Performance Issues and Evaluation Considerations," IETF RFC2501, 1999.

[3] David B. Johnson, David A. Maltz, Yih-Chun Hu and Jorjeta G. Jetcheva, "The Dynamic Source Routing for Mobile Ad Hoc Wireless Networks, " July 2004.

[4] Al-Ghazal M, El-Sayed A, Kelash A, "Routing Optimlzation using Genetic Algorithm in Ad Hoc Networks" International Symposium on Signal Processing and Information Technology IEEE, 2007.

[5] Karthikeyan, D. and "Ant based intelligent routing protocol for MANET" International Conference on Pattern Recognition, Informatics and Mobile Engineering (PRIME), IEEE, 2013.

[6] Alireza SajediNasab, ValiDerhamia, Leyli Mohammad Khanli, "Energy-aware multicast routing in manet based on particle swarm optimization" Procedia Technology, ELSEVIER, 2011.

[7] Nancharaiah, B. and Mohan, B.C., "MANET link performance using Ant Colony Optimization and Particle Swarm Optimization algorithms" International Conference on Communications and Signal Processing (ICCSP) , IEEE, 2013

[8] Anuj K. Gupta, Harsh Sadawarti, and Anil K. Verma, "MANET Routing Protocols Based on Ant Colony Optimization" International Journal of Modeling and Optimization, Vol. 2, No. 1, February 2012.

[9] Amanpreet K, Gurpreet S, Rohan G 2018 Limiting excess broadcast in multipath routing International Journal of Engineering & Technology, 7 (3.1) 770-74

[10] Khan N. R, Sharma S, Patheja P. S 2018 Energy-Aware Multipath Routing Scheme Based on Particle Swarm Optimization (EMPSO) International Research Journal of Engineering and Technology, 5(1) 1189-1197.