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Simulation and Automatic Tuning of OLSR Routing Protocol for VANETs

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Abstract— This paper presents a class of routing protocols for vehicular ad hoc networks (VANETs) called the Optimized link state routing protocol (OLSR). OLSR protocol performs well in networks having changing topology of nodes, as it can adapt in such environments easily and updated routing table is maintained by all nodes all the time. Wide range of improvement is possible by changing only the configuration parameters of OLSR protocol.

Modification to the OLSR protocol is needed to increase the performance of the OLSR protocol in a VANET scenario. This can be done by implementing Genetic Algorithm on OLSR protocol and this result in fine auto-tuned OLSR configuration. Performance gets improved in terms of increased PDR and Throughput and reduced End to End Delay with optimized-OLSR (OLSR-GA) protocol.

Keywords— Genetic Algorithm, Metaheuristic Algorithm, OLSR, Vehicular ad hoc network

I. INTRODUCTION

VANETS are considered to be self-configured networks that are made up of a group of vehicles and components of roadside infrastructure that connected with each other without requiring the underlying infrastructure. These kinds of networks send and receive information and warnings about the current situation of traffic. Development of cooperative applications that are able to collect, process and distribute information about road traffic information is possible with such kinds of networks. Due to limited coverage, high mobility of the nodes, and the presence of obstacles results in continuous link failures among VANET nodes. In VANETs, degradation in network performance is possible due to the movement of nodes that can cause the network topology to change frequently, and can introduce congestion in the communication channel [9]. These limitations of the topology-based protocols make them unsuitable for VANETs and in order to face these problems, a great deal of efforts is made to design efficient routing protocols. Some VANET routing methods have been defined based on prior ad hoc network architectures by targeting the specific needs of vehicular environments.

To provide efficient communications in VANET, an optimal routing strategy is needed that makes use of resources efficiently and offers the best quality-of-service (QoS). Network performance can be improved by proper parameterization of these protocols. Thus, in the present scenario, the main aim is to solve an off-line optimization problem to efficiently and automatically tune OLSR, it has used in VANETs research as it offers a large number of features that make it suitable for VANETs: it exhibits short transmission delays, it adapts well to continuous and frequent topology changes, and allows a simple operation and easy integration into different kinds of devices. Excessive routing load can cause network congestion and can limit the data packets exchange. However an extensive improvement is possible by changing the configuration parameters. The method consists in exploring the search space for all possible feasible OLSR configurations using the genetic algorithm to find optimized parameter settings of OLSR protocol. In this situation, choosing an efficient OLSR configuration should maximize the packet delivery ratio and minimize the packet delivery delays. As a result, this configuration should minimize the routing workload to mitigate network congestion problems. The analysis of the solutions is carried out by calculating the communications in VANET scenarios by using the NS-2 network simulator and analysing the best OLSR configuration is found and the OLSR RFC 3626 settings in different VANET scenarios to validate the results.

Genetic Algorithms are one of the most popular metaheuristic algorithms. A Genetic algorithm iterates a process, and with a given selection criterion selects the two parents from the entire population, they are then recombined, the resulting offspring’s are mutated, and at the end they are evaluated and inserted back into the population following a given criterion

II. RELATED STUDY

•In [1] authors presented a series of metaheuristic algorithms (PSO, DE, GA, and SA) is studied in order for finding optimal configurations of OLSR routing protocol. Also a set of realistic VANET scenarios (based in the city of M´alaga) have been defined to accurately evaluate the performance of the network under automatically optimized OLSR. The results obtained states that tuned OLSR configurations results better QoS and then several human experts, realizing it is important for utilization in VANETs configurations.

•In [2] authors describe about the Vehicular ad hoc networks (VANETs) As these are the infrastructure-less and self-organized networks deployed In this study, they implemented a multi-objective optimization metaheuristic, to find efficient OLSR parameterizations that will improve the QoS of the OLSR RFC and a previous optimized configurations. The configuration that is optimized significantly reduces OLSR scalability problems keeping competitive packet delivery rates. In this study there finding is that the OLSR routing overhead is reduced between 47% and 76% and the delivery times are between 32% and 38% shorter when using optimized settings.

•In [11] authors evaluate the performance of OLSR in vehicular ad hoc network (VANETs). The OLSR is best suitable for larger mobile networks and factors affecting OLSR are configuration and multipoint relays (MPR). The automatic selection of optimal configuration of OLSR offers more enhanced performance and the routing protocol used replaces the standard greedy approach with necessity first algorithm. Using the protocol the network traffic load of administrative packet gets reduced. The suggested routing protocols are best suitable for Vehicular network which are highly dynamic in nature.

III. PROPOSED WORK

The Optimised Link State Routing Protocol (OLSR) sends HELLO messages in the neighbourhood periodically for detection of neighbour changes, and topology information is also exchanged among all the nodes of the network to discover available routes in case of node disconnection and mobility of node. Each node generates and maintains a map of the network based on which nodes are connected to other nodes and with related cost to each link this is the case of link state routing protocol and is optimized by OLSR protocol by broadcasting topology information through multipoint relays (MPRs). Flooding of control messages in the network every node generates and maintains a map of the network based on which nodes are connected to other nodes and with related cost to each link. In Link or node failure scenario, OLSR protocol takes some time to detect the failure and re-establish a stable view of the new topology and within this short period, the data traffic forwarded will be dropped along a path with a failed link or node. In the Worst scenario, routing loops may form which results in periodic exchange of different messages so that topology information of the entire network can be maintained in case of mobility and failures.

Functionality of OLSR is basically performed by using different types of messages that are: HELLO, topology control, and multiple interface declaration messages.

• HELLO messages are exchanged between neighbours' nodes. They are used for link sensing and neighbourhood detection. These messages are generated periodically and containing information about the neighbour nodes

• TC messages are generated periodically by MPRs (Multi Point Relays) to indicate which other nodes have selected it as their MPR (Multi Point Relay) and this information is required for routing table calculations and is stored in the topology information base of each network node and these messages are forwarded to the other nodes. To differentiate between recent and old TC messages a sequence number is used.

• MID messages are sent by the nodes to inform about their network interfaces that are actively participating in the network. This information is necessary as the nodes may have multiple interfaces with distinct addresses participating in the communications.

The OLSR protocol mechanism is regulated by a set of parameters defined in the OLSR.

TABLE 1: MAIN OLSR PARAMETERS

Parameter	**Standard Configuration**	**Range**
HELLO INTERVAL	2.0 s	R€ [1.0, 30.0]
TC INTERVAL	5.0 s	R€ [1.0, 30.0]
MPR ALGORITHM	1	R€ [1.0, 30.0]
ROUTING ALGORITHM	1	R€ [1 , 2]
WILLINGNESS	3	R € [0, 7]
LINK QUALITY	1	R € [1, 3]
TC REDUNDANCY	1	R € [0, 3]
C ALPHA	0.6	R € [0, 1]

The optimization strategy is used to obtain automatically efficient OLSR parameter configurations are carried out by two different stages: an optimization procedure and a simulation stage.

1. The optimization block is carried out by the Genetic Algorithm to find optimal solutions in continuous search spaces.
2. Simulation procedure is used for assigning a quantitative quality value (fitness) to the OLSR performance of computed configurations.

Figure 1 illustrates, when the used metaheuristic i.e. genetic algorithm requires the evaluation of a solution; it invokes the simulation procedure of the tentative OLSR configuration over the defined VANET scenario.
For evaluation of quality or fitness of the different OLSR configurations (tentative solutions), Communication cost function has been defined in terms of the most commonly used QoS metrics in this area:
1. *The Packet Delivery Ratio (PDR)*: It is the fraction of the data packets originated by an application that are completely and correctly delivered.
2. *The End-to-End Delay (E2ED)*: It is the difference between the time a data packet is originated by an application and the time this packet is received at its destination.
3. *Throughput*: It is calculated as the amount of data transferred (in bytes) divided by the simulated data transfer time (the time interval from sending the first CBR packet to receiving the last CBR packet The communication cost function represents the fitness function of the optimization problem addressed.

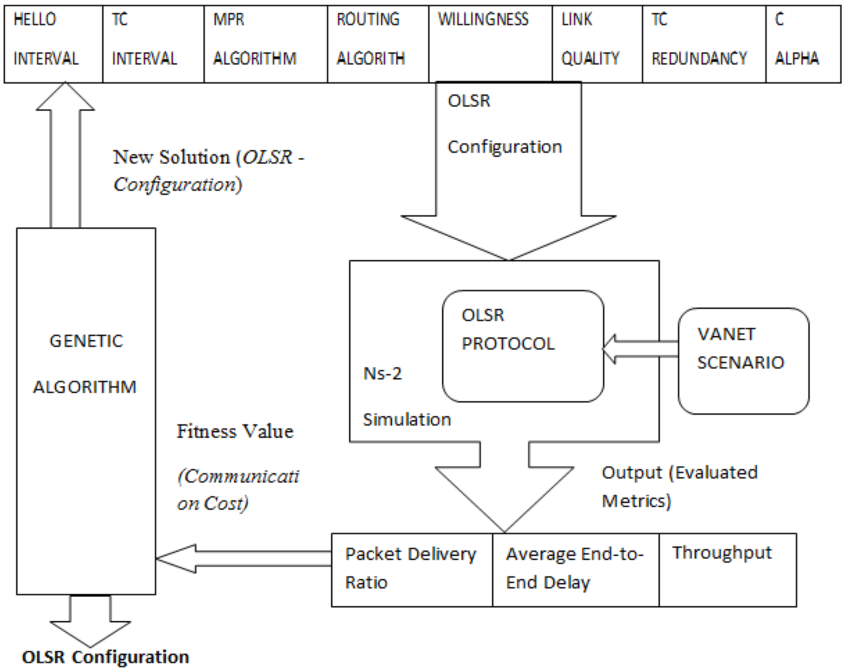

Figure 1: Optimization framework for the automatic OLSR configuration in VANETs

IV. RESULTS

We have used NS-2 Simulator to carry out our investigation. Figure 2, 3, 4 represents the graph comparison of OLSR with default configuration and optimized OLSR with Genetic algorithm in terms of maximized Packet Delivery Ratio, minimized End to End Delay and Maximized Throughput at various simulation instances.

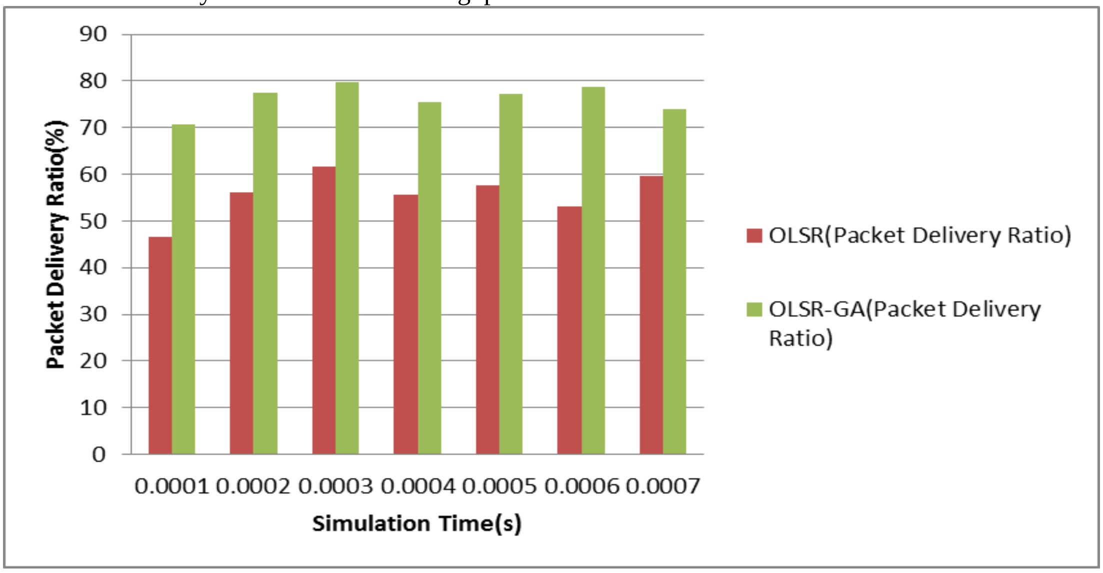

Figure 2: Packet Delivery Ratio of Simple OLSR protocol and Optimized OLSR protocol

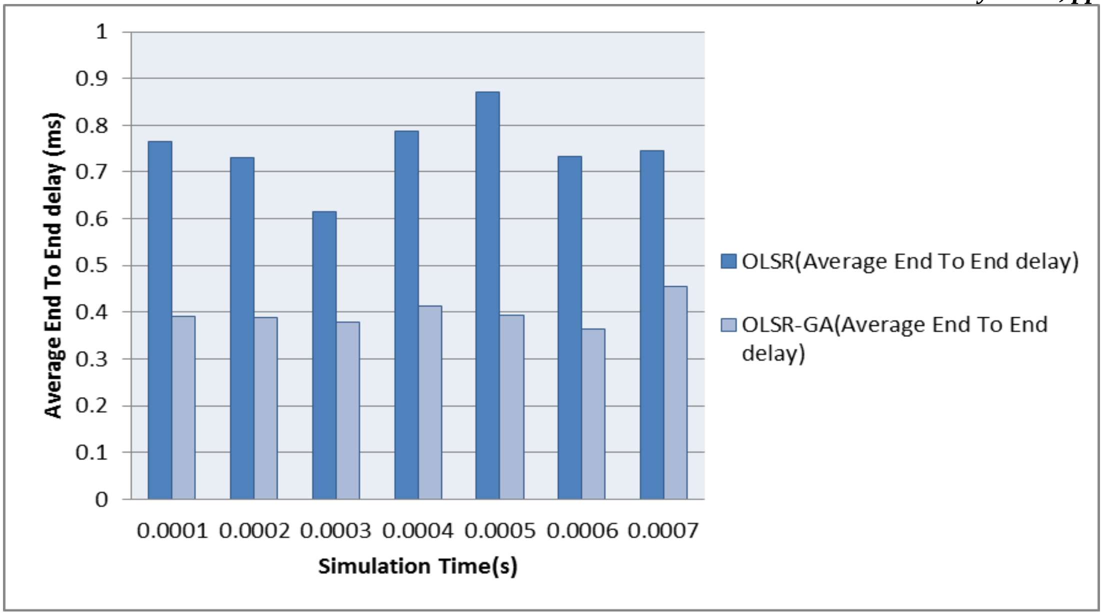

Figure 3: Average End to End Delay of Simple OLSR protocol and Optimized OLSR protocol

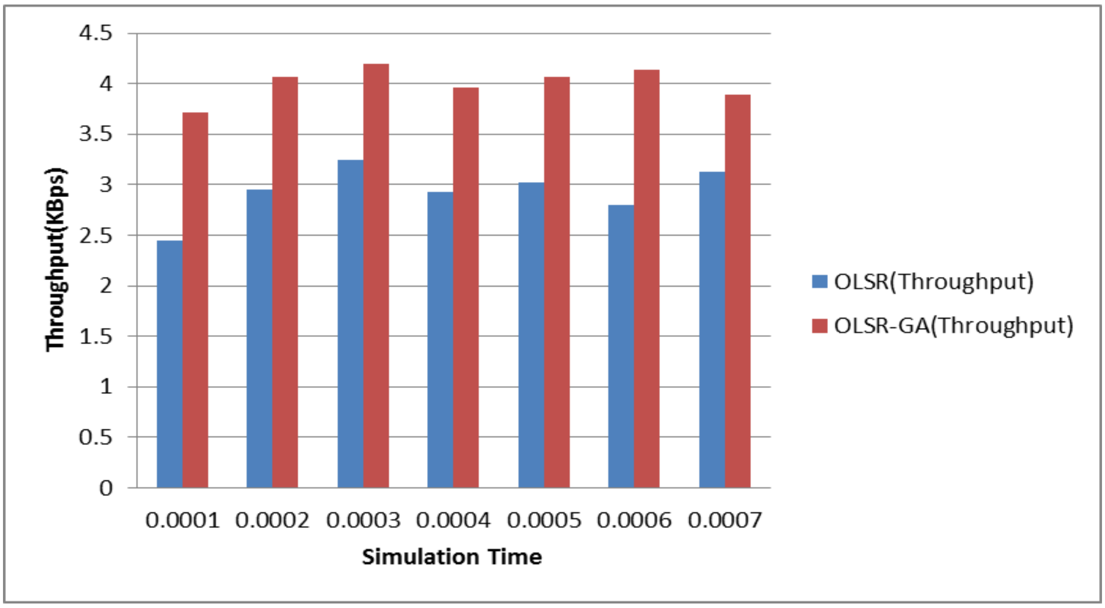

Figure 4: Throughput of Simple OLSR protocol and Optimized OLSR protocol

V. CONCLUSIONS

In this research, Optimization of OLSR protocol is done using genetic algorithm and simulation of traffic is done using NS-2 Simulator. Results of Traditional OLSR and optimized OLSR (OLSR-GA) protocol are compared and evaluated which indicate that performance gets improved in optimized OLSR (OLSR-GA) protocol at various simulation instances. Optimized-OLSR protocol performs better than traditional OLSR protocol in terms of maximized Packet delivery ratio and Throughput and minimized End to End Delay.

REFERENCES

[1] Jamal Toutouh, Jos´e Garc´ıa-Nieto, and Enrique Alba, "Intelligent OLSR Routing Protocol Optimization for VANETs" IEEE TRANSACTIONS ON VEHICULAR TECHNOLOGY, IN PRESS (2012).

[2] Omar Abdel Wahab, Hadi Otrok, Azzam Mourad, "VANET QoS-OLSR: QoS-based clustering protocol for Vehicular Ad hoc Networks", Computer Communications 36 (2013) 1422–1435.

[3] A. Laouiti, P. M¨uhlethaler, F. Sayah, and Y. Toor, "Quantitative evaluation of the cost of routing protocol OLSR in a Vehicle Ad Hoc NETwork (VANET)," in VTC Spring. IEEE, 2008, pp. 2986–2990.

[4] Jatin Gupta and Amandeep Verma" Exhaustive Study on the Infulence of Hello Packets in OLSR Routing Protocol",International Journal of Information and Computation Technology ISSN 0974-2239 Volume 3, Number 5 (2013).

[5] M.Gunasekar and S.J.Hinduja, "Automatic Tuning Of OLSR Routing Protocol Using IWD in VANET", International Journal of Innovative Research in Computer and Communication Engineering, Vol. 2, Special Issue 1, March 2014.

[6] Hanan Saleet, Rami Langar, Kshirasagar Naik, Raouf Boutaba, Amiya Nayak and Nishith Goel, "Intersection-Based Geographical Routing Protocol for VANETs: A Proposal and Analysis" IEEE TRANSACTIONS ON VEHICULAR TECHNOLOGY, VOL. 60, NO. 9, NOVEMBER 2011.

[7] Kuldeep Vats, Monika Sachdeva, Dr. Krishan Saluja and Amit Rathee, " Simulation and Performance Analysis of OLSR Routing Protocol Using OPNET", International Journal of Advanced Research in Computer Science and Software Engineering,Volume 2, Issue 2, February 2012.

[8] Jamal Toutouh and Enrique Alba, "Optimizing OLSR in VANETS with Differential Evolution: A Comprehensive Study", in Proceedings of the first ACM international symposium on Design and analysis of intelligent vehicular networks and applications; 01/2011.

[9] Jamal Toutouh, Enrique Alba, "Multi-objective OLSR optimization for VANETs", Second International workshop on Vehicular communications and networking, 2012.

[10] J. Garc´ıa-Nieto, J. Toutouh, and E. Alba, "Automatic tuning of communication protocols for vehicular ad hoc networks using metaheuristics" Engineering Applications of Artificial Intelligence, vol. 23, no. 5, 2010.

[11] Kunal V. Patil, M. R. Dhage ,"The Enhanced Optimized Routing Protocol for Vehicular Ad hoc Network", International Journal of Advanced Research in Computer and Communication Engineering Vol. 2, Issue 10, October 2013.

[12] C. G´omez, D. Garc´ıa, and J. Paradells, "Improving performance of a real ad hoc network by tuning OLSR parameters," in ISCC '05: Proceedings of the 10th IEEE Symposium on Computers and Communications.Washington, DC, USA: IEEE Computer Society, 2005.

[13] Y. Huang, S. Bhatti, and D. Parker, "Tuning OLSR," in Proceedings of the IEEE 17th International Symposium on Personal, Indoor and Mobile Radio Communications, PIMRC, Helsiniki, Finland, 2006, pp. 1–5.

[14] Rashmi, Vaibhav Jain, Pawan kumar., " Improved OLSR Protocol in MANET", International Journal of Advanced Research in Computer Science and Software Engineering 3(8),August - 2013, pp. 174-178.

[15] Clausen, T., Jacquet, P.Optimized Link State Routing Protocol. IETF RFC, [online].Available in http://www.ietf.org/rfc/rfc3626.txt (2003).

[16] Sabih ur Rehman, M. Arif Khan, Tanveer A. Zia, Lihong Zheng "Vehicular Ad-Hoc Networks (VANETs) - An Overview and Challenges", Journal of Wireless Networking and Communications 2013, 3(3): 29-38.

[17] Ying Ge, Thomas Kunz and Louise Lamont "Quality of Service Routing in Ad-Hoc Networks Using OLSR", Proceeding of the 36th Hawaii International Conference (2003).

[18] The Network Simulator Project-Ns-2. [Online] Available in URL http://www.isi.edu/nsnam/ns/.

