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The Enhanced Optimized Routing Protocol for Vehicular Ad hoc Network

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Abstract— The vehicular ad hoc network (VANET) is a superior new technology. Vehicular ad hoc network (VANET) is a subclass of MANET that is mobile ad hoc networks. Vehicular ad hoc network provides wireless communication among vehicles and vehicles to roadside equipments. The communication between vehicles is more important for safety and more probably for entertainment as well. The performance of communication depends on how better the routing takes place in the network. Routing of data depends on routing protocols being used in network. The performance of routing protocols in vehicular ad hoc network (VANET) depends on different scenarios that are the city and highway. Position based routing protocols are best suited for vehicular environment. Furthermore, it also provides robustness in highly dynamic wireless ad hoc networks such as for VANET.

The OLSR is best suitable for larger mobile network. It is having affecting factors like configuration, multipoint relays. The new automatic selection of optimal configuration can offer more enhanced performance. In proposed routing protocol the standard greedy approach is replaced with necessity first algorithm. Using proposed protocol the network traffic load of administrative packet is reduced. The proposed routing protocols are best suitable for vehicular network which are highly dynamic in nature.

Keywords - OLSR, MPR, VANET.

I. INTRODUCTION

Recent technologies in communication domain gave rise to the gradual beginning of vehicular ad-hoc networks (VANETs). There are some limitations of the wireless technologies used in such networks, so routing protocols development for VANETs is more important task. For getting new routing protocols best way is to revise existing mobile ad hoc network protocol to get adapt to vehicular environments. It is also important to evaluate these new protocols perfectly before using them to deploy VANETs and one way to do this is through simulation. Assessment of OLSR considered with different urban areas sizes, traffic densities, and workloads. The QoS has been measured using four metrics: PDR, NRL, and E2ED. In order to develop a VANET every participating vehicle must be capable of transmitting and receiving wireless signals within range. The main service provided through VANET is GPS navigation system, electronic payment of toll tax, authenticity of vehicle without human intervention, traffic message, Internet access, broadcasting of traffic scenario and multimedia streaming. Various user group among VANET are getting popular, mostly it is used in traffic management agencies, highway safety agencies, law enforcement agencies and emergency services. Concepts of VANET are briefly analyzes and compares some different kinds of existing routing protocols in VANET. The vehicular ad hoc network has routing protocols such as namely Ad hoc On-Demand Distance Vector Routing (AODV), Destination Sequenced Distance Vector (DSDV) and Dynamic Source Routing (DSR). In the case of cluster overlapping Traffic Infrastructure Based Cluster Routing Protocol with Handoff is preferred. The efficient routing protocol is required in vehicular network with the high throughput, low packet collision, low packet drop and high packet delivery ratio for guaranteed delivery in sparse network.

The remaining organization of paper is as follows. In section II, overall description and details of optimized link state routing protocol is discussed. Section III presents description of necessity first algorithm. Section IV contains the proposed methodology in detail. Conclusion is shown in section V. Acknowledgement is considered in section VI.

II. OPTIMIZED LINK STATE ROUTING PROTOCOL

An optimized link state routing protocol finds optimal effective value or communication cost for the real world scenario with best configuration. It mainly involves two steps, suitable configuration extraction and deployment of it. In the configuration extraction part, the features of the OLSR are extracted. Features are parameters of the optimized link state routing protocol, which is considered to be an important in configuration and generating optimal communication cost. Computing an optimal configuration for the parameters of the protocol is crucial before deploying any VANET, since it could decisively improve the QoS, with a high implication on enlarging the network data rates and reducing the network load. Then, all these features make OLSR a good candidate to

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be optimally tuned. Here, defined an optimization problem to tune the OLSR protocol, obtaining automatically the configuration that best fits the specific characteristics of VANETs. An optimization problem is defined by a search space and a quality or fitness function.

A. Optimized link state routing protocol factor

OLSR periodically exchange different messages to maintain the topology information of the entire network in the presence of mobility and failures. The core functionality is performed mainly by using three different types of messages: HELLO, Topology Control (TC) and multiple interface declaration (MID) messages. HELLO messages are exchanged between neighbor nodes (one-hop distance). They are employed to accommodate link sensing, neighborhood detection, and MPR selection signaling.

OLSR is a type of classical link-state routing protocol that relies on employing an efficient periodic flooding of control information using special nodes that act as multipoint relays (MPRs). The use of MPRs reduces the number of required transmissions.

These messages are generated periodically, containing information about the neighbor nodes and about the links between their network interfaces. TC messages are generated periodically by MPRs to indicate which other nodes have selected it as their MPR. The information is stored in the topology information base of each network node, which is used for routing table calculations. Such messages are forwarded to the other nodes through the entire network. Since TC messages are broadcast periodically, a sequence number is used to distinguish between recent and old ones. MID messages are sent by the nodes to report information about their network interfaces employed to participate in the network. Such information is needed since the nodes may have multiple interfaces with distinct addresses participating in the communications.

B. Fitness value

Parameter tuning To evaluate the quality or fitness of the different OLSR configurations (tentative solutions), it have defined a communication cost function in terms of three of the most commonly used QoS metrics in this area: 1) the packet delivery ratio (PDR), which is the fraction of data packets originated by an application that is completely and correctly delivered; 2) the network routing load (NRL), which is the ratio of administrative routing packet transmissions to data packets delivered, where each hop is counted separately; and finally, 3) the end-to-end delay (E2ED), which is the difference between the time a data packet is originated by an application and the time this packet is received at its destination.

C. OLSR configuration

These parameters have been tuned by different authors without using any automatic tool, and they are the timeouts before resending HELLO, MID, and TC messages (HELLO_INTERVAL, REFRESH_INTERVAL, and TC_INTERVAL, respectively); the "validity time" of the information received via these three message types, which are NEIGHB_HOLD_TIME (HELLO), MID_HOLD_TIME (MID), and TOP_HOLD_TIME (TC); the WILLINGNESS of a node to act as an MPR (to carry and forward traffic to other nodes); and DUP_HOLD_TIME, which represents the time during which the MPRs record information about the forwarded packets[3].

D. Multipoint relay selection

The MPR selection is done by the general Greedy approach in standard optimized link state routing protocol. Let us see what MPR is exactly. In following fig traffic with and without selection of MPR is shown.

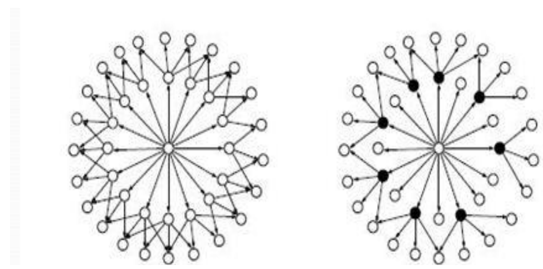

Figure 1. Network without multipoint relays and with multipoint relays.

In first network, packet load is more and hence the network traffic is more. Solution to reduce network traffic load is selecting the multipoint relays. In second network of figure the reduction in load is shown. This is giving coverage to all nodes as same as in first network that is without MPR with minimum load over network. But this load can be reduced more avoiding overlapping of nodes and links.

III. NECESSITY FIRST ALGORITHM

In this algorithm, some notations are described

• N(x): The set of node x's 1 hop symmetric neighbors. It is created by the way of changing HELLO messages between nodes at a certain interval. It can be changed in the course of selecting MPRs.

• N2(x): The set of node x's 2 hop symmetric neighbors excluding any node in N(x). It is also created by the way of changing HELLO messages. It can be changed in the course of selecting MPRs.

• D(x, y): The degree of node x's 1 hop neighbor y. That means the number of nodes in N2(x) that covered by y. It also can be changed in the course of selecting MPRs.

Here Calculate N(x), N2(x), and D(x, y) of all the nodes in N(x). If there are some nodes in N(x) who are the only nodes providing reach ability to some nodes in N2(x), select them as MPRs. Then, delete all the neighbors in 2 hop distance that are covered by these nodes from N2(x). If there are still some nodes remained in N2(x) Recalculate D(x, y) of all the nodes in N(x), choose the nodes with the minimal degree [7].

This reduces the number of multipoint relays but covering same numbers of nodes. This algorithm gives better performance and reduces the number of TC packets.

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No.	Test Case Description	Result
1	Check whether system is running with OLSR- NFA for standard configuration	PASS
2	Check whether system is running with OLSR- NFA for newly selected configuration	PASS

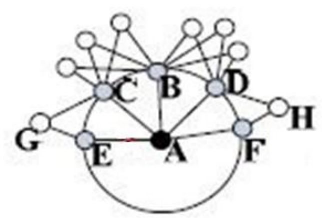

Figure 2. Multipoint relay selection with Greedy approach.

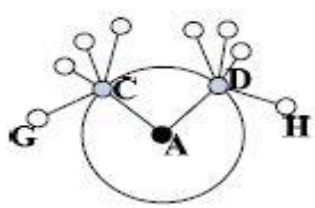

Figure 3. Multipoint relay selection with necessity first algorithm.

IV. NEW OPTIMIIZED LINK STATE ROUTING PROTOCOL WITH NECESSITY FIRST ALGORITHM

The main motivation behind the idea of routing protocols is to more efficient and accuracy in the creating of the communication cost in order to improve throughput and efficiency. It mainly involves two steps, suitable configuration extraction and deployment of it. In the configuration extraction part, the features of the OLSR are extracted. Features are parameters of the optimal link state routing protocol, which is considered to be an important in configuration and generating optimal communication cost. The optimal combination of certain factors may lead to improve the PDR or efficiency or throughput using automatic selection by optimization algorithm like DE, GA, etc.

A. Automatic intelligent selection of configuration with genetic algorithm

The automatic selection of the optimized configuration is main task. It is done with the help of genetic algorithm. The testing phase done with two configurations. One is with standard configuration for OLSR as well other is with newly selected configuration. The test both test are compared in following table

B. Implementing necessity first algorithm

In OLSR by default greedy algorithm is used as a standard algorithm to select multipoint relays (MPRs). So introducing new algorithm in standard OLSR overall performance of OLSR and system should be improve.

C. Selection of parameter values

In an OLSR selection process is required to let know the features of each factor. By this process of the selection of factors like HELLO message or any other, let try to enhance existing protocol.Efficiency enhancement is main task. The idea behind the enhancement is to bring out a best optimal configuration which gives best optimal communication cost.
The configuration can be selected automatically using Generic algorithm.[10]There are various combinations of factors with appropriate value. Changing this combination along with value may give better result than existing standard configuration. So pre processing requires knowing the emphasis of each factor and its contribution in effective value. Thus the proposed system can give better performance and throughput.
Also the reduced traffic node can use available bandwidth. For instance of OLSR, knowledge of topology of whole network which is prior known can resolve link break issues immediately. This can make performance better.
It uses a simulation procedure for assigning a quantitative quality value (fitness) to the OLSR performance of computed configurations in terms of communication cost. This procedure is carried out by means of the $ns-2$ network simulator widely used for simulation purpose in VANETs accurately. For this, $ns-2$ has been modified to interact automatically with the optimization procedure.

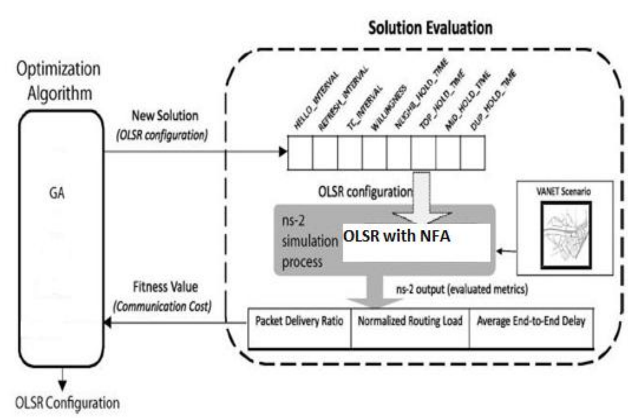

Figure 4. Optimization framework for automatic optimal configuration for vehicular ad hoc network [3].

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As Fig. 1 illustrates, when the used meta heuristic requires the evaluation of a solution, it invokes the simulation procedure. This simulation gives the tentative configuration of OLSR over the defined VANET scenario. Then, *ns* − 2 is started and evaluates the VANET under the circumstances defined by the OLSR routing parameters generated by the optimization algorithm. After the simulation, *ns* − 2 returns global information about the PDR, the NRL, and the E2ED of the whole mobile vehicular network scenario, where there were some independent data transmission between the vehicles. The information is used to calculate the communication cost (comm_cost) function as follows:

$$\text{comm\_cost} = w2 \cdot \text{NRL} + w3 \cdot \text{E2ED} - w1 \cdot \text{PDR}. \quad (1)$$

The communication cost function represents the fitness function of the optimization problem addressed. To improve the QoS, the objective here consists of maximizing the PDR and minimizing both NRL and E2ED. As expressed in, it is used an aggregative minimizing function, and for this reason, PDR was formulated with a negative sign. In this equation, factors $w1$, $w2$, and $w3$ were used to weigh the influence of each metric on the resultant fitness value. These values were set in a previous experimentation, although resulting in poor solutions with low PDR and high NRL. It is observed that in VANETs (highly dynamic environments), the OLSR delivers a great number of administrative packets, which increases the NRL, hence damaging the PDR. Since interested issue is in promoting the PDR for the sake of an efficient communication of packets, it is decided in this approach to use different biased weighs in the fitness function, being $w1 = 0.5$, $w2 = 0.2$, and $w3 = 0.3$. The way, PDR takes priority over NRL and E2ED since first look for the routing effectiveness and second (but also important) for the communication efficiency [3].

V. RESULT

The GUI provides a simple and most understandable. In following figure the functioning, movement and activity of each and every node is shown at certain instance. The out.tr that is trace file is not much easily understandable to the human beings or user. Hence it needs to be explained in animated format. So that it get more visualization. It helps to explain the trace file moments. Trace file has all activity record of each packet and node movements at every moment. It also stores the status information of each packet whether the packet is delivered or dropped or sent in certain status messages stored in message format field.

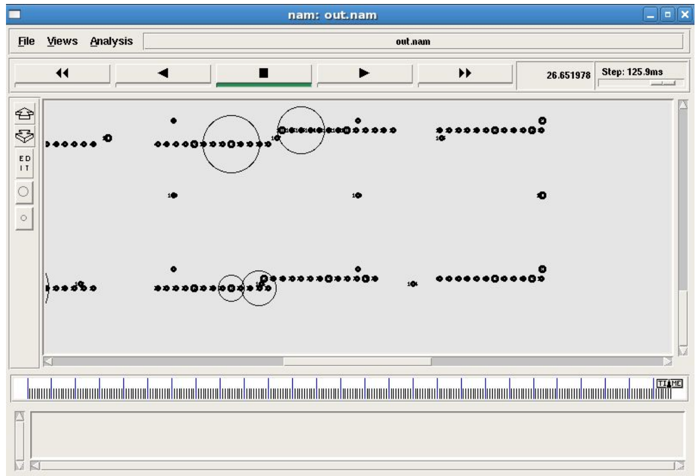

Figure 5 Graphical user interface (GUI)

The graphical user interface also helps to monitor all network scenarios at single view. Here, playing and understanding all network scenario and movement of the assumed vehicles or nodes with a single click.

The network routing load should be less in order to improve the performance of the network.

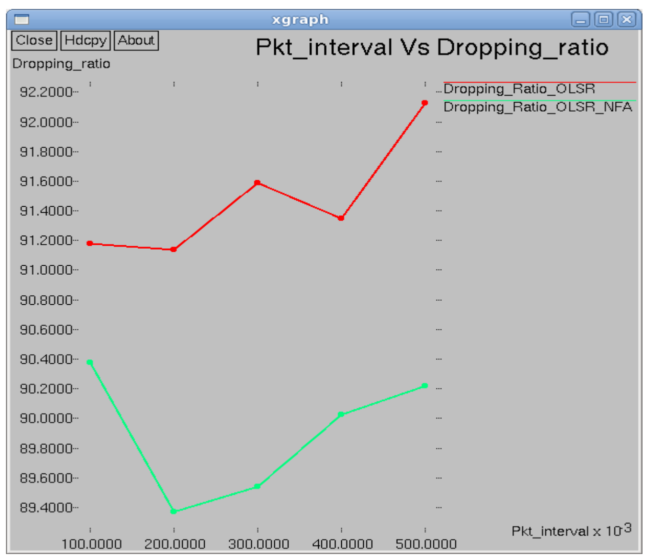

Figure 6 Dropping ratio showing reduction in administrative packet traffic

Figure 6 shows dropping ratio analysis, here as the value of dropping ratio for OLSR with NFA decreases as compared with that of OLSR. The administrative packets like TC packets consume much bandwidth and causes network routing load overhead. These packet numbers is dramatically reduced in necessity first algorithm. The network routing load often leads to more dropping ratio. The optimized link state routing protocol with necessity first algorithm has less dropping ratio due to less number of administrative packets.

VI. CONCLUSION

The available standard protocols are feasible and useful in vehicular ad hoc network. But there is always need of better and better performance. The standard optimized link state routing protocol is revised with new MPR selection. Hence revised OLSR protocol is used to get better performance. Necessity first algorithm is useful in avoiding the traffic load over network. Automatic selection of best configuration available does impact on the fitness value. Fitness value is directly concern with the performance of the OLSR routing protocol.

VII. ACKNOWLEDGMENT

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